

Contributions to Management Science

Renata Petrevska Nechkoska

Tactical Management in Complexity

Managerial and Informational Aspects

 Springer

TACTICAL MANAGEMENT

SENSE-AND-RESPOND FRAMEWORK

ENHANCEMENT USING ICT

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Ghent Belgium/Bitola Macedonia, 2017

Renata Petrevska Nechkoska

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SUMMARY (ENGLISH)

This research is about helping the individual manage towards accomplishment of purpose(s). It is inspired in practice (both from researcher's own experience and by interviewing professionals), where managers in the middle are facing tremendous challenges and need tailored support on the socio-technical nature of people, resources and problems they are dealing with. With this motivation, the researcher aims to contemplate overarching managerial guidance and personalized information system structure, throughout time. The Design Science Research methodology has enabled making a relevant, rigorous and applicable research that results with an artifact which is implementable enough to be applied in the appropriate environment and generic enough to contribute to the knowledge base of management and management information systems, in the very least of its core.

The DENICA method guides the person on what to think, consider, observe, configure and reconfigure in order to reach goals in unpredictable and changeable environment, interrelated with others. In its core, this means tactical management and its core characteristic – adaptability. Both in managerial and information system sense. Both towards what is 'given' and what is initiated as desired change in order to improve towards a purpose. In companies, this translates into guidance for the managers on tactics – how to effectively manage with what is given towards what is expected in dynamic context. In private life, this translates into roadmap on what we need to pay attention to and how we should reason and act in pursuing our individual and collective purpose(s).

The artifact development has been carried out through the stages of Action Design Research in four companies with 11 managers in Belgium and Macedonia. The knowledge and practical questions of the nested problem solving guided the researchers throughout the project and the CIMO logic provided the basis for the realist evaluation.

The research attempts to parallel the real world by being multidisciplinary – incorporating complex adaptive systems as subject being managed, complexity theory to describe the current context of living and working, social network analysis as the manner to visualize, describe, communicate and get everyone on board around a purpose, and Sense and Respond framework for providing adaptability that properly responds to the unpredictable environment. This research sheds different light on the management information systems nature as perceived from the side of the manager as user and the nature of work (i.e. information flows) as dynamic, changeable and living matter.

Hopefully, the Denica artifact and the Tactical Management research (as part of management control) will re-introduce the perception of tactics as important managerial function that provides and necessitates adaptability and uncovered source of competitive advantage, and of its information system distinctive profile and needs.

SAMENVATTING (DUTCH)

Het voorliggend doctoraatsonderzoek had als doel een methode te ontwerpen die managers met verantwoordelijkheden op het vlak van tactische besluitvorming zou toelaten om beter hun doelstellingen te halen. De motivatie voor dit onderzoek kwam voort uit praktijkervaringen (zowel van de onderzoeker zelf als van geïnterviewde managers) waaruit een gebrek blijkt aan specifieke ondersteuning voor tactische besluitvorming met betrekking tot hedendaagse complexe socio-technische systemen. Dit gebrek aan ondersteuning betreft zowel een aan de noden van de tactische besluitvorming aangepast managementinformatiesysteem als de organisatie van het managementsysteem zelf. Om dit praktijkrelevant probleem aan te pakken werd gebruik gemaakt van de *Design Science Research* onderzoeksmethodologie dewelke door zijn rigoureuze wetenschappelijke aanpak toelaat een oplossing te ontwerpen die zowel praktisch implementeerbaar is als generiek genoeg is om kennis bij te dragen aan het wetenschapsdomein.

Deze oplossing kreeg vorm als de DENICA-methode. Deze methode stuurt personen met tactische besluitvormingsverantwoordelijkheden aan in hun doelgericht denken, beschouwen, observeren, configureren en her-configureren, rekening houdend met een onvoorspelbare en veranderende omgeving. De kerngedachte van DENICA is het bewaken en realiseren van de aanpasbaarheid van het systeem, zowel het managementsysteem als het managementinformatiesysteem. DENICA biedt zodoende een antwoord op de vraag hoe op doelmatige wijze het te beheren systeem blijvend te laten voldoen aan de verwachtingen met de middelen die voorhanden zijn en onderhevig zijn aan veranderingen in een dynamische omgeving.

Het bedenken en ontwikkelen van de oplossing gebeurde volgens de fasen van de *Action Design Research* methode waarbij 11 managers uit 4 bedrijven in België en Macedonië betrokken waren. Volgens Wieringa's genest probleem-oplossen werden hierbij afwisselend kennisvragen beantwoord en praktische problemen opgelost. De CIMO-logica (*Context-Intervention-Mechanism-Outcome*) werd toegepast voor een realistische evaluatie van de oplossing in de context van de 4 betrokken bedrijven.

Het gerealiseerde doctoraatsonderzoek spiegelt zich aan de 'echte' wereld door zijn multidisciplinariteit: het voorstellen van het te beheren systeem als een complex adaptief systeem, het toepassen van complexiteitstheorie voor het beschrijven van systeemgedrag en -structuur, het gebruik van sociale netwerkanalyse voor het visualiseren van de dynamische netwerkstructuur van het systeem, en het gebruik van Haeckel's *Sense-and-Respond* raamwerk voor het vormgeven van het managementsysteem en het managementinformatiesysteem. De invalshoek voor het bestuderen van managementinformatiesystemen is hierbij fundamenteel verschillend van wat gangbaar is door de focus op de informatiestromen (eerder dan de technologie) vanuit het perspectief van de manager en hun karakterisering als 'levende materie'.

Wij hopen dat met DENICA en het onderzoek naar tactisch besluitvorming in het algemeen (en als onderdeel van de discipline van de managementcontrole) tactisch management terug aan belang kan winnen en erkenning krijgt als essentieel onderdeel van het bedrijfsmanagement voor het blijvend behalen van concurrentievoordeel in de extreem dynamische omgeving van vandaag.

РЕЗИМЕ (MACEDONIAN)

Ова истражување ќе и помогне на индивидуата во управувањето на патот до остварувањето на целта/целите. Инспирацијата ја наоѓа во праксата (како од сопственото искуство на истражувачот, така и преку интервјуирање на професионалци), каде менаџерите, во „средината“, се соочуваат со огромни предизвици и имаат потреба од специјална поддршка за социотехничката природа на луѓето, ресурсите и проблемите со кои се справуваат. Со ваква мотивација, истражувачот имаше за цел да создаде комплетно менаџерско водство и персонализирана структура на информациски систем, со временска димензија. Методологијата на Design Science Research овозможи дизајнирање на релевантно, научно-основано и апликативно истражување кое резултира со артефакт (продукт) што е доволно применлив за користење во соодветно окружување и доволно генерички за да придонесе, во најмала рака, кон теоријата на менаџментот и информациските системи.

Методот ДЕНИЦА за тактички менаџмент ја води личноста на менаџерот/ката во правец на тоа за што треба да размислува, да зема предвид, опсервира, конфигурира и реконфигурира - со цел да ги постигне посакуваните цели во непредвидливото и динамично окружување, во постојаните релации со другите. Во својата суштина, ова го означува тактичкиот менаџмент и неговата основна карактеристика – адаптабилноста, како во менаџерска смисла, така и во поглед на информациските системи. Адаптабилноста подразбира прилагодување кон она што е зададена големина, но, и иницирање на промени - со цел да се постигнат унапредувања и чекори кон целта. Во компаниите, ова се преведува како водство на менаџерите за тактика – како ефективно да управуваат од она што е на располагање - до она што се очекува да се постигне во динамички контекст. Во приватниот живот, ова се преведува во патека на која треба да посветиме внимание и што треба да резонираме и правиме за постигнувањето на посакуваните лични и колективни цели.

Развојот на артефактот се спроведуваше низ фазите на Action Design Research во четири компании со 11 менаџери во Белгија и Македонија. Низ проектот беа одговарани прашања од теоретска и практична природа, според техниката на вгнездено решавање на проблеми, додека СИМО-логиката ја овозможи основата на реалистична евалуација. Ова истражување се обидува да направи отсликување, проекција на реалниот свет преку својата мултидисциплинарност – вклучувајќи комплексни адаптивни системи кои се предмет на менаџирање, теоријата на комплексност за опишување на моментниот контекст на живеење и работа, анализа на графови како начин на визуелизирање, но и комуницирање и синхронизирање на системите и нивните учесници кон определена цел и Sense-and-Respond рамката за обезбедување на адаптабилност која соодветствува на потребите на непредвидливо окружување. Ова истражување дава различно светло на природата на менаџмент информациските системи во однос на тоа што се позиционира во личноста на менаџерот и како тој ги гледа своите информациски потреби и во природата на работата која е динамична, променлива и жива материја. Се надеваме дека артефактот „ДЕНИЦА“ и истражувањето за тактички менаџмент ќе ја реиницира перцепцијата за тактиката како важна менаџерска функција (како дел од менаџерската контрола) што обезбедува и бара адаптабилност и претставува неоткриен извор на компетитивна предност, како и за специфилниот профил и потреби на неговиот информациски систем за тактички менаџмент.

CHAPTER I

INTRODUCTION

INTRODUCTION: MOTIVATION

“The methodology works! The amount of insight it provides is comprehensive, you can easily translate the method into real life actions, the awareness you can create with the method for higher management is game-changing, the amount of control you gain with the method is unexpectedly high, it forces you to think about working in a structured way. It provides you with a method that allows you to see visually what is influencing you. It also gives an insight in not only your own responsibilities but also of the people you are in contact with. The method combines several points of view into a 360° overview of the workspace you are functioning in.”

Marc Van Aerde, Suelto GCV, Belgium

Doing research with the intention of changing the world towards better, is a project characterized with challenges, interventions, synchronizations, trade-offs, collaborations, conflicts, dependencies, motivation and perseverance. The idea lifecycle is also passing maturity stages. It is like few treadmills going in different directions, intersecting and passing by, with the goal to deliver something somewhere under certain conditions. One can't allow many dead-ends and broken strings. But also, one can't influence the world as much as one would like to.

In this journey of a researcher bearing from experience a motivation to assist the tactical manager, the idea to explore for scientific grounds that may be fit for tactical management has been, hopefully, groundbreaking. There have been incredible stages and eventually, personal satisfaction for the deeds. At the same time, the researcher's wish to improve this world significantly by handing over something substantial and worthwhile, persists ...

Our research is motivated to show that tactical management needs adaptability, elaborate why and how it can be addressed and to design a method that supports the manager in the adaptable facilitation of a system towards accomplishment of desired outcomes. Our approach is comprehensive, embodying the managerial and informational aspects of a solution. Tactical management operates in dynamic and complex environment and faces numerous 'givens' in a union of interrelated entities and actors in certain direction. At the same time it needs to initiate changes and enforce them towards improvement. The manager dealing with tactical management issues is not very supported with guidance and solutions on how to manage in an adaptable manner that incorporates the overall big picture of entities but also the necessary information flows and be in position to communicate managerial actions. This research aims to provide the person (the manager) with an artifact that supports managerial adaptability through system design, context capture, effective communication and tactical management information system adaptability through self-design of the information entities and flows.

This chapter outlines the research in brief.

- It starts by clarifying tactical management, intentionally contemporary re-defining it and emphasizing its importance (Section 1 – Research Context: Starting point – Tactical management), wrapping up with the main research questions (Heading 1.1)
- Positioning tactical management in the domains of management and information systems – combining them with complexity theory (Section 2 – Positioning of the Research).
- Presenting the methodology of Design Science Research, upon which foundations, Action Design Research, Nested Problem Solving and CIMO-logic have been used (Section 3 – Research Methodology)
- Outlining the structure of the dissertation (Section 4 – Structure of the Dissertation)
- Listing Publications for the research (Section 5 – Publications)

1. RESEARCH CONTEXT: STARTING POINT – TACTICAL MANAGEMENT

Tactical management is a managerial function aiming to achieve given goals, with given resources, in given circumstances, with respect to given rules, preconditions and strategic guidelines in a dynamic environment. All these **‘givens’** are strikingly numerous and diverse and tactical management faces the necessity to (i) generate change and/or (ii) adapt to change in order to accomplish a purpose, in a dynamic and unpredictable environment. The first very important **source of changes are the ones the manager** needs to initiate and effectuate in order to facilitate improvement and goal accomplishment. The second are the ones we can’t influence. We are adding the **‘dynamic’** aspect because in time everything is subject to changes (resources, goals, context, environment, ...) – so offering only a static view is insufficient. ‘Context’ in this sense denotes the circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood (Oxford English Dictionary 2017b). The **‘unpredictability’** is another very distinctive thread of thought that needs to be incorporated – situating and orienting oneself is very demanding when a system needs to exist and grow in a global information economy, where changes will occur but in unpredictable ways. The starting point of this research was the observation that tactical management is less supported by information system solutions and managerial solutions than strategic management (as “the full set of commitments, decisions, and actions required for a firm to achieve strategic competitiveness and earn above-average returns” (Hitt et al. 2004) and as “the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources” (Anthony 1965)). and operational management (as the systematic design, direction, and control of processes that transform inputs into services and products for internal, as well as external customers (Krajewski et al. 2012)). To specify the specific information needs of tactical managers, a clearer understanding of tactical management and how it differs from strategic and operational management is needed.

If we take for example the human body, where the brain creates, reasons, sets objectives, reacts to circumstances, ... and transmits the information and action via the nerves and muscles, then we would like to focus on the arm. The arm components can be perceived as follows: the shoulder – strategy, the hand – operations and it is the elbow that resembles tactics – the one that provides flexibility and adaptability for the arm to do what it is supposed to do with the hand. Adaptability is perceived as the quality of being able to adjust to new conditions but also as the capacity to be modified for a new use or purpose (Oxford English Dictionary 2017a). In our analogy of strategy, tactics and operations, with the human arm – we could position the strategy in the shoulder for the reasons that it is somewhat movable/changeable but also very much affixed because of being attached to the body (organism, company) and a person can’t move the shoulder freely apart from it without moving the entire body or severing it. The hand is on the opposite end, denoting operations. If someone needs to grasp an object, lift something, push, pull, ... it is the hand and fingers that are doing it. The shoulder and the hand are interconnected with bones, muscle tissue, nerves, veins and arteries – each of which having specific function in the task of maintaining the arm alive and functional. Employees, information systems, communication systems, equipment, knowledge, training and capabilities will find parallel in the before mentioned components of the arm (Figure 1.1).

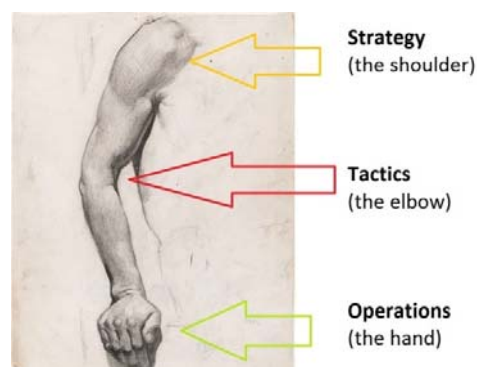


FIGURE 1.1 ANALOGY OF THE HUMAN ARM WITH STRATEGY, TACTICS AND OPERATIONS (DRAWING OF (WAKELIN 1912))

However, when the arm needs to perform an action, it flexes, extends, rotates, stretches (Da Vinci 1478) (Wakelin 1912) (Banbury 2017) (Figure 1.2) at the elbow to adjust its positioning in all dimensions of space and in time. If it needs to push a cart towards a finish line, it flexes, stretches, rotates mainly at the elbow, but also to some extent at the shoulder, in order to maintain course in a dynamic manner in time but also according the road conditions. If there is a bump on the road, it will adjust height, strength of grasp, make a rotation and try to keep the object in hand. If it gets hurt at some place, it may not function properly or at all.



FIGURE 1.2 POSSIBLE MOVEMENTS OF AN ARM – FLEXION, EXTENSION, ADDUCTION, ABDUCTION, MEDIAL (INTERNAL) ROTATION, LATERAL (EXTERNAL) ROTATION AND CIRCUMDUCTION PROVIDED BY THE ADAPTABILITY OF THE ELBOW ALONG WITH THE SHOULDER (DA VINCI 1478) (BANBURY 2017)

It is the utmost adaptability in space and time that is situated in the elbow – and analogously in tactics. If we try to engineer a robotic arm that performs the same functions as a natural human arm, it will either have to be consisted of exactly the same components – joints, connectors, wires for the information and power flows, appropriate materials; or engineer something else that will anyhow have a fixed end – the elbow connected to a body; a micro-adjustable component – mimicking the hand and fingers; and a rotating joint somewhere in the middle or at the body. The robotic arm (as a serial manipulator) presented on Figure 1.3 has a base (resembling the body), joint 1 (resembling the shoulder), end-effector (resembling the hand) and joint 2 and 3 (resembling the elbow(s)). The organizations, the projects and the entire socio-technical systems we are living and working in, have many artificial elements in them – so we should pay particular attention to how we are designing them in order to function purposefully and sustainably. We can't provide an exhaustive set of prescribed actions and movements, because we can't fully plan every future development and contextual change – but generic adaptability – with rounded joints, connection and communication networks and muscle tissue.

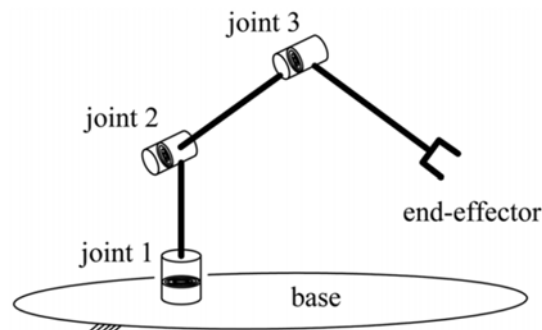


FIGURE 1.3 ROBOTIC ARM (SERIAL MANIPULATOR) WITH COMPONENTS ((GAN ET AL. 2012))

But if we observe the situation in real life today - for example middle managers or project managers having very little support for adaptability and being served with automatized information systems design that feed abundant data with not much context-dependent and/or relevant structure; they are like a robotic arm that doesn't consider an elbow. It has limited maneuvering space and possibility to accomplish purpose(s). The strategic information flows coming through the shoulder are connected directly to the sensors in the hand and fingers; which return data back through the shoulder and somehow omit the elbow (Figure 1.4). What would the performance of that arm mean? If it is supposed to capture an object from a table – the body would have to be placed on specific distance in order for the non-elbow arm to point and grasp it. If the table changes location, so should the entire body, because the arm is rigid to reach a straight line point. The alteration of location of the aimed object is just one of the changes that happen in real life, which the body and arm should be adaptable to. Others come from altitude, weight, size, stability of the ground, ... A non-elbow arm would have very limited set of actions that it can perform without involvement of the entire body. Such a serial manipulator is presented on Figure 1.4. The maneuvering abilities of that robotic arm are limited – horizontal and vertical. If any change occurs, it will take radical changes (energy, costs, time, resources, ...) to the entire arm and body to be able to respond appropriately. What we are witnessing nowadays in management and information systems is some sort of non-elbow arms – organizations, projects having big strategic focus and abundant operational data with little or no 'joints' in the middle. It is even more difficult in reality to move the entire body (the company) to even slightest changes in the environment. For this reason, we should emphasize the adaptability of the elbow as a joint in order to provide as many potential alternatives of action as possible. We ought to do the same with tactical management – for which this research has been conducted and possible solutions and knowledge offered.



FIGURE 1.4 ROBOTIC ARM (SERIAL MANIPULATOR) WITH BODY, SHOULDER AND HAND AND NO ELBOW IN THE MIDDLE – RESEMBLING CURRENT TACTICAL MANAGEMENT SUPPORT WITH ADAPTABILITY AND INFORMATION SYSTEMS

Since there is a prerequisite for tactical management to be adaptable to dynamic and unpredictable changes in each of the 'givens' (strategy, goals and KPIs, processes, resources, competitors, economies, ...) – as a consequence, the 'tactical manager' (the manager dealing with tactics) needs to continuously scan and probe the **(internal and external) context, environment** in order to get the necessary and complete information for successful facilitation and steering towards an effect, the desired effect.

Figure 1.5 – clarifies our approach to this research. We are putting ourselves in the shoes of a tactical manager (prevalently a middle manager of a department, for example). There are numerous projects, events, developments that are going on daily, weekly, monthly and so on. Some are repetitive some occasional, some with only one occurrence. Usually, the core business operations are covered with information systems, various software solutions, dashboards and resolved, somewhat optimized and efficient business processes. The manager needs to have a moderate and diverse understanding of the operations (he/she is managing (the baseline vertical lines at the bottom of the figure), own reasoning of the interconnectivity, interrelatedness and interdependency among things (the rectangles in blue, black, white, gray shade just above the vertical lines) and the positioning of his/her own information sensors (the open-ended vertical lines above the rectangles) regarding the current specific context and situation the manager, his department, organization and environment are in. For instance, if there is a new trainee overtaking regular responsibility, the manager ought to position his/her information sensors to obtain more frequent, somewhat more detailed qualitative and quantitative information on how that trainee is doing, errors, need for trainings, etc. just until the induction is done properly; and then change the frequency of obtaining the information, possibly the details, and so on. On the opposite end – on the top of the figure, the same principle is applied when observing the strategic aims, business plan targets, KPIs, effects, goals. The manager in the middle should have

knowledge of strategy (as an integrated and coordinated set of commitments and actions designed to exploit core competencies and gain a competitive advantage (Hitt et al. 2004)) and the aims and goals expected to be achieved (the baseline vertical lines on the top of the figure), his/her own reasoning (the rectangles in green, white, grey shade) and positioning of the own information sensors depending on his/her own context. There are rather diverse managerial methods and information support for strategic management, ERP systems, scorecards, ... Another group of entities and events that are less frequently taken in the primary consideration of the middle managers are the other departments, suppliers, competitors, clients, legislative, technology, ... that also influence the outcomes of the managerial efforts. For them also the middle manager should have proper understanding (the baseline of horizontal lines far left on the figure), reasoning (the rectangles in red, white, black, grey shade) and position own information sensors depending on the current context. The information for these developments is rarely quantitative and contained in a software platform. Most of the times, this is qualitative information obtained by following news, forums, making phone conversations, attending business gatherings etc. The rest of events, entities and occurrences happening in the world are presented on the figure with the element 'other external factors and events'. The tactical manager's duty is to position the information sensors according to his/her own reasoning, with respect to the prescribed principles, goals, expectations from strategic altitude. The manager should, furthermore, continuously scan and revise the information flows according changes that happen in time in any of these elements. This behavior is shown with the two loops (blue and green) that are surrounding tactical management in the middle of the figure. In other words, the manager should capture the context in all its dimensions, and make proper actions in response accordingly. As we can conclude from this elaboration, it is all mostly 'givens' that are at hand of the tactical manager. Resources, entities, expectations that are given and he/she should find a way to accomplish what is expected by utilizing what is given, considering all factors in the external and internal context. Sometimes the manager will need to adapt to the changes in the 'givens' and even more frequently initiate changes – regardless, changes are the core component the manager needs to be dealing with. To make a parallel with the arm analogy, the 'elbow' needs to make various continuous movements to maneuver towards successful ending. The maneuverability should be given to tactical management too, as it is not a plan that can fit in the middle and automatically converge strategy to operations and vice versa, when things are changing dynamically but adaptability – that can interweave different components in one way or another, and still facilitate towards a good result.

If we place the operations, projects, departments, competitors, legislative and other entities and events on one side, and strategic expectations on the other, we can see that the manager is faced with most diverse and disconnected domains and areas of work (Figure 1.6). These are presented on Figure 1.6 with various polygons in different colors (blue, green and red shade). The current information systems design is providing some support for the manager – through the ERP, core business software platforms and solutions (presented on the figure as Existing Information Systems). There are attempts to make mathematical calculations and directly connect operations and strategy result with information mismatch and content scarcity. By proper structuring of the information flows, broadening the scope of entities and events that the manager is capturing to a much wider view than the usual (where managers see only their internal resources and capabilities) and by continuously setting and repositioning the information flows according the current context, the manager would be able to receive much more appropriate and context-sensitive information to behave accordingly. For tactical management facing so many givens as described before, it is of primary importance.

Throughout the text, on occasions, the expression 'tactical manager' is used. It denotes the person performing the tactical management function – which is a role almost every manager has. We are not referring to the tactical manager in terms of a position in a company, because of the fact the top managers become 'tactical managers' when dealing with tactics, the middle managers shift into the role of tactical manager most frequently, operational ones too. When observing positions – mostly middle managers are dealing with tactics, hence, prevailing in the role of tactical manager. But also projects deploy tactics, as do top managers when organizing how to achieve strategy – each of these actors fill the role of tactical manager in those instances.

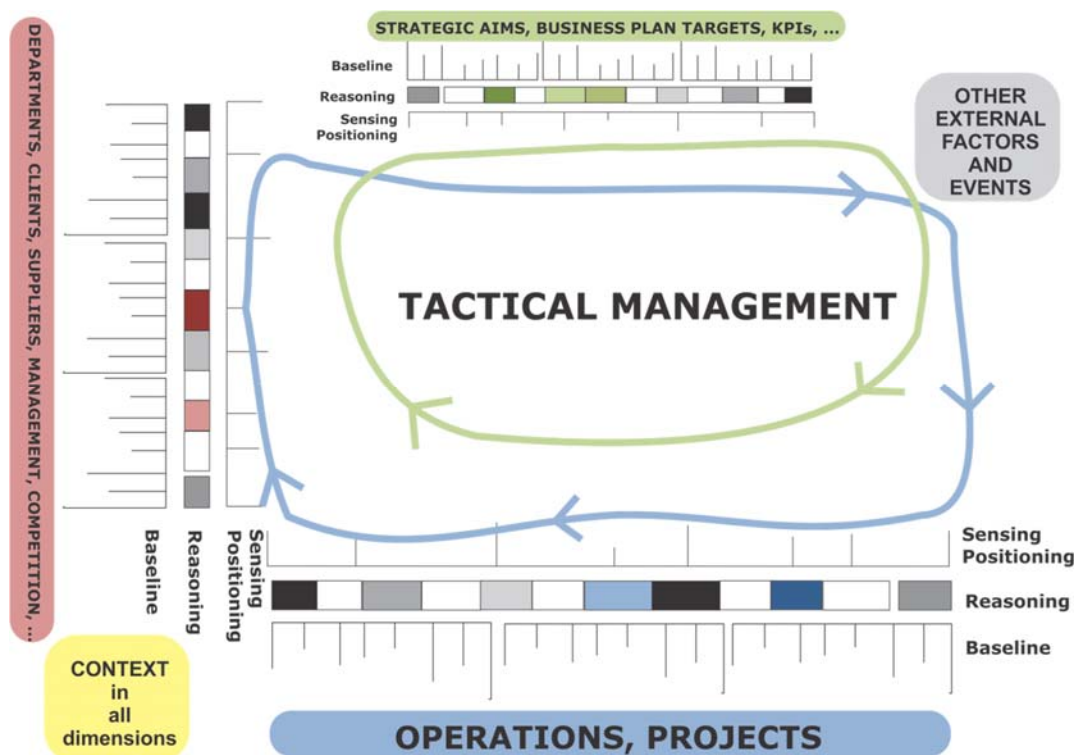


FIGURE 1.5 VISUALIZATION OF TACTICAL MANAGEMENT ROLE AND NEED FOR ADAPTABILITY IN THE INTERNAL AND EXTERNAL CONTEXT

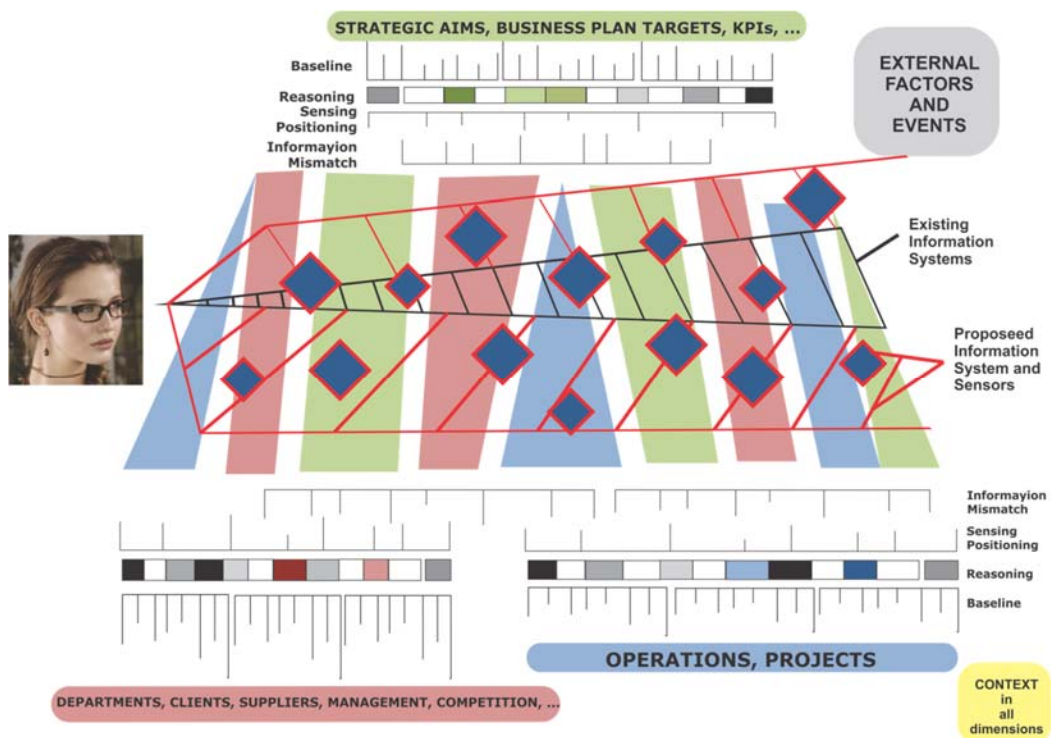


FIGURE 1.6 VISUALIZATION OF THE CURRENT VS. POSSIBLE STRUCTURING AND POSITIONING OF THE SCOPE OF INFORMATION SYSTEM ENTITIES FOR TACTICAL MANAGEMENT

We are proposing that for tactical management one needs to think in terms of ‘system design’, not process flow, content-wise. The system a tactical manager sets up should be adaptable – one should be able to make modifications to it, so that consequently it adapts to changes. This would be the articulated purposeful adaptable mechanism that should give a framework for the manager to steer and for the people to follow. The Tactical Management Information System should capture and assist this behavior appropriately. Tactical management can be considered as a capability in the sense that it represents an ability to deliver a certain business value continuously, while the circumstances are dynamically changing (as denoted by the concept of business capability (Stirna et al. 2012)). Tactical management is also a dynamic capability, defined as the ability to integrate, build and reconfigure internal and external competences to address the changes in the environment (Teece et al. 1997). Tactical management facilitates continuous adaptation of an open system of interrelated entities to achieve goal(s) through dynamically changing expectations, resources, circumstances – by maneuvering with what is given.

The current information system models and solutions are addressing tactical management in a rudimentary form – mostly because they are not considering its specificity and needs (Chapter 2). The information system supporting tactical management should provide continuous context capture, broad scope of information entities and diverse type of information attributes. At the same time, it needs to support a systems view and handle the mismatch of the incoming data with expected outcomes. By addressing tactical management as static, rigid, mid-term planning oriented and process-prescribed managerial function that is similar to strategic or to operational management, the information systems are not supporting in an effective manner this uncovered source of competitive advantage.

Our work follows the direction of the dynamic alignment modeling discourse of (Danesh et al. 2015) who provide a framework to offer systematic methods and tools for capturing, representing, and reasoning about enterprise and IT capabilities when co-designing organizational and IT architectures; the runtime adjustments of (Zdravkovic et al. 2013); along with the dynamic capability modeling for strategic management (Stirna et al. 2012). Our work is complementing these approaches with the goal for shaping and addressing the dynamic capability of tactical management, its adaptability and information systems. Our specificity is in the way how to achieve it by placing a focus on the person – the manager. We are situating the research in the domains of Management and Information Systems. In order to emphasize the adaptability of this capability, we based our solution on a managerial method that endorses strategic adaptability (based on the Sense-and-Respond framework (Haeckel 1999; Haeckel 2016)) and developed and applied it for tactics. To map its information requirements we incorporated components in the method which enable information system continuous self-design and revision. We are arguing that by enabling design of a personalized information system by the person in the role of manager we are contributing an important component in the realization of the adaptability i.e. dynamic capability of tactical management towards effective business-IT alignment.

1.1. MAIN RESEARCH QUESTIONS

To summarize our problem investigation of **how should the tactical manager think, reason and act, in order to facilitate toward accomplishment of purpose**, the research is aiming to result with an artifact as a method for the person in the shoes of a tactical manager that embodies principles, guidelines and prescriptions on how to achieve adaptability for the tactical management function and proper information system self-design. We are addressing the following research questions: **(1) what are the Tactical Management adaptability needs; (2) which are the Tactical Management Information Systems requirements and (3) how to design a method for a person in the role of tactical manager that addresses those needs.** The support for adaptability is the primary goal of the research, hence the first research question is to find out what the adaptability needs are. Tactical management is mostly about achieving a purpose within given boundaries (goals, resources, limitation imposed by/opportunities offered by contextual factors) that can change in unpredictable ways. It is also about initiating change to achieve a purpose. Hence, adaptability to unpredictable changes of givens and to initiated changes is ‘key’ to success in tactical management. Support for adaptability is sought in the design of information systems that are specifically directed towards support of tactical management, hence the second research question: how to translate the adaptability needs into information system requirements. Finally, while the first and second research questions are meant to deeply investigate the problem, the third research question is targeted towards looking for a solution: a method to design a managerial and information system that addresses the adaptability needs of tactical management.

2. POSITIONING OF THE RESEARCH

We are investigating few interdependent problems – the tactical management’s need for modern definition and recognition; its adaptability and the tactical management’s information systems design. It is necessary to derive the second and third from the first, while emphasizing the emergence of the adaptability as a most significant feature of tactical management as a managerial function.

Strategic managerial and management information system support:

Strategy is determining the goals of the organization along with the set of coherent choices concerning the allocation of resources, activities and approaches to realize those goals. The main concerns of strategic management are effectiveness and organizational alignment. Strategic management involves strategy formulation, implementation, and measurement of strategic benefits realization. Support for these activities is available in the form of a rich and diverse set of conceptual tools and management instruments (e.g., Balanced Scorecard, Strategy Maps, VMOST analysis, SWOT analysis, the Value Chain concept, 5 Forces Analysis, the Performance Prism). Business Informatics research has integrated such techniques in the design of several modeling techniques providing understanding, analysis and design support for strategic management (e.g., the Business Motivation Model (Berkem 2008), the Business Intelligence Model (Nalchigar & Yu 2013), the Business Model Canvas (Osterwalder et al. 2010), the Component Business Model (Cherbakov et al. 2005)). Furthermore, strategic management information in the form of scorecards and dashboards with KPIs is offered by different types of enterprise information system (Neely et al. 2003; Neely et al. 2001).

Operational managerial and management information system support:

The key element in the contemporary view on **operations** is the process (e.g., production process, service process, or business process in general). The main concern of operations management is process efficiency in terms of cost, time and quality. Appropriate managerial methods and techniques include Six Sigma, Theory of Constraints (TOC), Total Quality Management (TQM), (Lean) Six Sigma, Statistical Process Control (SPC), Agile and others. Operations are nowadays characterized as a “high frequency – low latency environment” (Khan 2013).

Tactical managerial and management information system support:

Compared to operational and strategic management, relatively few managerial methods and techniques relate to **tactics**. The managerial function most closely practicing tactical management is project management – addressed with PMBOK, Prince2, Scrum, MS Project. However, a project is “a temporary endeavor undertaken to create a unique product, service, or result” (Project Management Institute 2004; PMI 2008) and “must be completed by a specific time, within budget, and according to specification” (Wysocki 2009) – tactical management continues for an undetermined period of time and requires a ‘systems’ approach and capability for adaptability rather than a ‘projects’ approach and predictability.

In Chapter 2 based on an in-depth review of the literature we observed that when examining the support of information systems for different management levels, there is significantly less coverage of tactical management in general, while operational management has a nexus for solutions, followed by strategic management. There have been attempts at interconnecting business intelligence and performance management in a closed-loop approach (Kemper et al. 2013). For instance, the Business Activity Monitoring (BAM) approach integrates strategic and operational management levels through closed loops, providing for tactical management informational input for an event-driven complement of traditional monitoring (Kim et al. 2007). The diffusion of BI into operational and tactical management layers has been coined Operational BI (Kemper et al. 2013). Another example is the Corporate Performance Management (CPM) Integration Grid (Rausch et al. 2013; Kemper et al. 2013) that attempts to provide a multidimensional approach where the tactical management level is cohered to the strategic level. In general, we concluded that there is a significant ‘ingestion’ of tactics by operations or strategy resulting in a scarcity of information systems and business informatics modeling and analysis tools that support the specificities of tactical management. These specificities relate mainly to taking a systems view of the organization (rather than processes or projects view) and the need for right-time information on contextual changes (rather than real-time information).

More than anything else, tactical management information systems should help realizing tactical management's essential feature of adaptability, as much as it was associated with mid-range planning, in the past.

The main threads of answers (investigation elaborated in heading 3.1) with regards to how appropriate the IS in the company is for the manager dealing with tactical issues – have been that strategic dashboards don't capture the current context, while the operational real-time data is too overwhelming and not needed for tactical management (with some exceptions). The interviewees had all different interfaces (paper, electronic, combined) for organizing the wide variety of obligations deriving from their tactical management function. In terms of reporting for tactical management needs – the users addressed a struggle between daily, detailed operational reports and periodical (monthly, quarterly, annually) reports, usually being too late for something to be effectively improved. The interviews shed light on the notion that numerous entities (stakeholder, other department, external collaborator) or events (developments) are not captured in the information flows for tactical management. With regards to the managerial methods, the users practiced Agile, Scrum, Microsoft SureStep, Waterfall models or any method or tool implicitly incorporated in the IS. The finding of unaddressed mismatch of incoming data and expected KPIs has been consensual for all.

The offer for systematic methods and tools for capturing, representing, and reasoning about the enterprise, its subsystems and the IT capabilities when co-designing organizational and IT architectures is scarce. Danesh et al. recognize the need to “(i) represent and monitor the environment in which the enterprise is situated, (ii) represent and analyze the strategic objectives and positioning of the enterprise (Teece et al. 1997), (iii) design flexible and reconfigurable enterprises that enable transformation (Combs, 2011), and (iv) specify and build adaptable services that can adhere to changes in their context and deliver value to consumers (Zdravkovic et al. 2013)” (Danesh et al. 2015). Complementary to these needs, we are investigating whether for tactical management there can be person-not organization-oriented support for IS design; handling the mismatch of incoming data and expected goals; incorporating risk management; using visualizations for communication and orchestration purposes; supporting systems design.

3. RESEARCH METHODOLOGY

The methodological foundation for the research is not a straightforward one. We are naming it – methodological kaleidoscope. The Design Science Research (Hevner et al. 2004) covered the big-picture of the investigation towards identifying the need, engineering and validating an artifact; the Action Design Research (Sein et al. 2011) was initially chosen to help with the manner of how to produce an artifact that comes from business-academia collaboration. When performing the ADR, the Nested Problem Solving (Wieringa 2009) guided the researcher on which questions to ask and problems to address when steering towards solutions and knowledge; while the CIMO logic (Denyer et al. 2008) helped the evaluation, especially since the artifact was derived as solution-in-context and demanded quest for realist evaluation, which can represent stable ground for DSR. These main methodological pillars and tools are being constantly referred to in the following chapters. In each occasion we are attempting to clarify the methodological overlaps, while pointing out the use of the distinctions of the methodological kaleidoscope for the methodological soundness and complementarity of the research.

3.1. DESIGN SCIENCE RESEARCH

The research has followed Design Science Methodology (Hevner et al. 2004) respecting the guidelines of the organizational design and information systems design. This research is a socio-technical one. It attempts to first acquire knowledge of a specific issue (of tactical management) in the world as it is; analyze, synthesize and investigate in order to address a problem with solution and contribute with theory for a world to-be. By using the constructs and apparatus of the social science research methods and techniques (Bryman 2015) (Bryman 2011) (Bhattacharjee 2012) we have been able to achieve proper problem investigation, continuously monitor and reflect on the behavioral and organizational aspects of the research. However, this descriptive knowledge has enabled us to

properly position, develop, revise and generate the prescriptive knowledge (Gregor & Hevner 2013) that will hopefully serve science and practice in social, technical and socio-technical terms.

Design Science Research (DSR) has substantial importance in current Information Systems research. It enables the scientists, by going through the Relevance Cycle (Requirements, Field testing), the Design Cycle and the Rigor Cycle (Grounding, Additions to Knowledge Base) to carry on scientifically acceptable and real-life implementable designs that reduce the time to improve the world with our contributions, especially since the artifacts are designed with assistance of current real-life entities. DSR can result with constructs, models, method, instantiations, or, according the reformulation of (Pries-Heje & Baskerville 2008): goals, environment, alternative design theories, theory nexus, and design solutions. The DSR seven guidelines help in a generic manner, to orient the goals and the course of the actions undertaken in the research (Figure 3.1).

Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

FIGURE 3.1 DESIGN SCIENCE RESEARCH GUIDELINES (HEVNER ET AL. 2004)

Design Science Research (DSR) provides the overall guiding framework for our research. The DSR generic figure from (Hevner et al. 2004) has been used to show the steps undertaken in the research, the incorporated concepts and the overall implementation of the methodology. Visualization of our research in the DSR is presented on Figure 3.2.

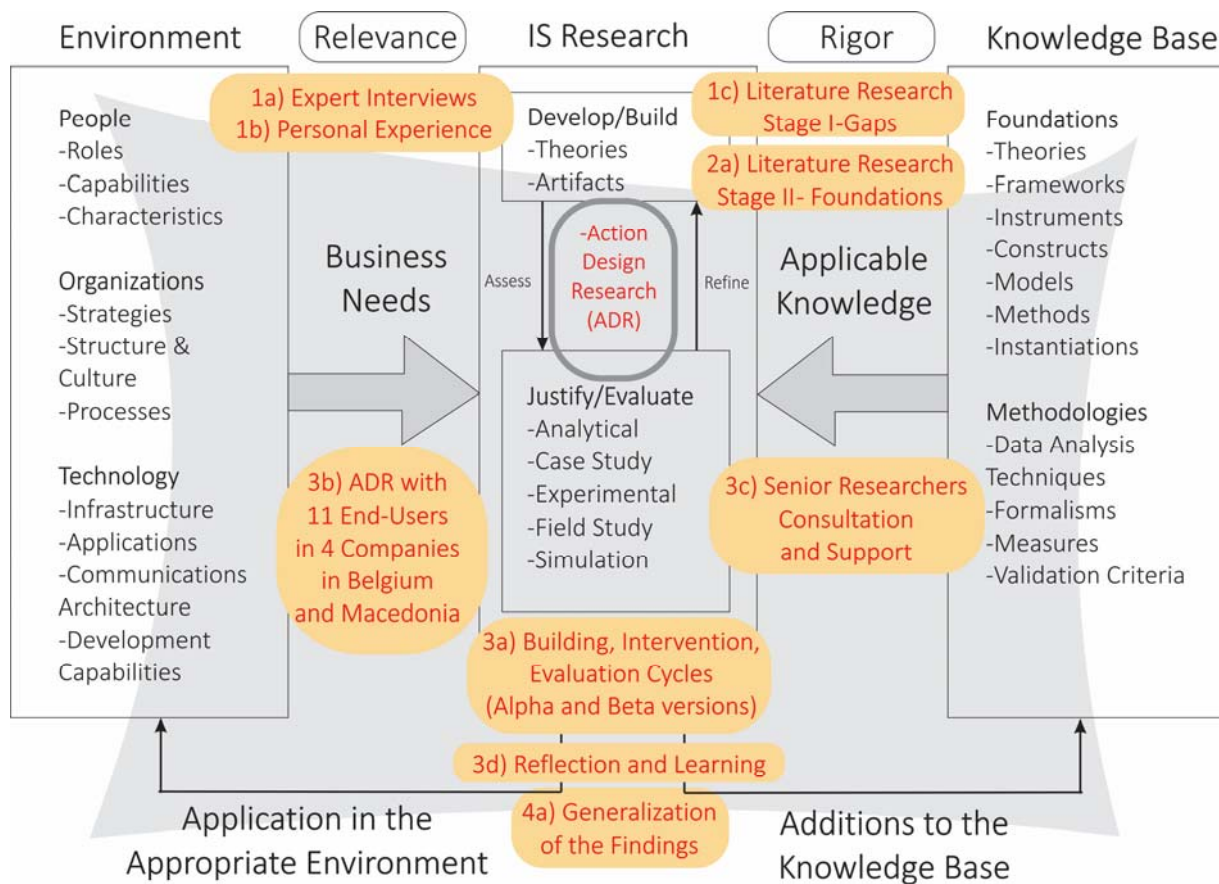


FIGURE 3.2 THE PHD RESEARCH IN THE DESIGN SCIENCE RESEARCH FRAMEWORK (ADAPTED FROM (HEVNER ET AL. 2004))

During the course of the research, the main focus of the initial stage of the investigation was recognizing and verifying there is a problem. The research was initiated by conducting semi-structured interviews with 30 managers on various levels (Senior, Middle, Project managers, SME Owners) from, mostly international companies, but also SMEs situated in Belgium and in Macedonia, with geographic scope of work nationally and internationally. This activity supported the more accurate positioning of the problem; and provided us with expert opinions on various practices (Figure 3.2, label 1a). The personal experience of the main researcher has been mostly on middle management positions such as head of department, branch manager, project coordinator – which enabled right to the point insight where to look for unaddressed issues and problems that needed support (Figure 3.2, label 1b). Also, we investigated current state-of-the-art contributions in literature, for tactical management adaptability and information systems (Figure 3.2, label 1c).

A separate search has been performed to find an appropriate theoretical foundation for the envisioned method (Figure 3.2, label 2a). To provide rigor to our research, we wished to ground the design of the envisioned method in existing theoretical frameworks and concepts that we deemed appropriate for addressing the tactical management adaptability needs and information system requirements identified in the first stage of the research. We therefore looked at various contributions in different fields like Strategic and Operational Management, Leadership, Information Systems, Knowledge Management, Complexity Theory, Behavioral science, Systems Theory, Network Theory, Social Network Analysis, and Social Systems Design. The Sense-and-Respond framework has been selected as foundation for our DSR contribution in TM. It provides (1) System Design and (2) Sense-Interpret-Decide-Act Loop for continuous discovering of early signals, reasoning upon them, and introducing changes and reconfiguration to the system accordingly. The main elements of the framework are purpose, strategy, structure, governance, system design which we are attempting to shape for the use of tactical management. The research

activities discussed above have been incorporating social science research methods and techniques (Bryman 2015; Bryman 2011) (Bhattacharjee 2012) which will be exploited in the course of the overall research.

The process of developing/building and justifying/evaluating the artifact (Figure 3.2, label 3a, 3b, 3c, 3d, 4a) has been guided through the stages of Action Design Research (Sein et al. 2011; Purao et al. 2013) which will be elaborated in details next, in Heading 3.2. When designing and especially when implementing the research plan and writing about the research, we needed a roadmap, a workflow to follow in order to effectuate the DSR guidelines. For this purpose, we incorporated the nested problem solving of (Wieringa 2009) that will be addressed in Heading 3.3. The research logic that has been used in the research is CIMO logic (Denyer et al. 2008; Van Aken & Romme 2012) which will be addressed in Heading 3.4. The implementation of each of these methodological foundations is being continuously addressed and referred to in Chapter 4.

3.2. ACTION DESIGN RESEARCH

To strengthen the relevance of the research, and to develop, build, justify and evaluate an artifact that has been immediately proven to work in at least one real environment, we performed Action Design Research (ADR) (Sein et al. 2011).

ADR distinguishes the stages of Problem formulation, Building-Intervention-Evaluation Cycles, Reflection and Learning and Formalization of learning, which are interrelated, somewhat simultaneous and/or consecutive and with multidirectional connections. In our research, the specificity is the positioning the Action Design Research within the Design Science Research – the gray polygon area on Figure 3.2. It is visible that it covers a big portion of the DSR methodology, but also there have been steps undertaken as DSR pursuit for relevance and rigor (mainly labeled as 1: identifying Tactical Management adaptability needs and Information System requirements and 2: investigating literature for grounding reasons) that are out of the scope of ADR, but then continue with the problem formulation stage of ADR.

The Building-Intervention-Evaluation cycles (BIE) of the ADR took place in 4 companies in Belgium and Macedonia – 2 small and 2 big ones (Company 1, 2, 3, 4) with 11 managers as end-users. Company 1, big consultancy with Headquarters in Belgium – a senior manager and 9 Project Managers and Team Leads have been our End-users 1-9; Company 2, small software implementations and consultancy in Belgium – the Owner/manager of the company has been our End-user 1(because he transitioned from being employed in Company 1 to owning Company 2, remaining our End-user 1); Company 3, small geodesic and engineering bureau in Macedonia – the Owner/manager of the company is our End-user 10; Company 4, big production company with Headquarters in Macedonia – the Director of the development department is End-user 11. In Company 2 and 3 we have investigated tactical management issues of optimizing staff utilization across projects and shifting the customer perception of the company – and proposed a S&R framework-based solution for the management to follow. We consider these to be the Alpha-version in the artifact design. In Company 1 we have investigated the tactical management issues of enabling customer's management to spend least time possible on remote communication with geographically scattered staff members. In Company 4 the issue was to provide earliest possible information status and discrepancies to management in a new factory and equipment alignment project. The solution design for the last two companies is advancing from Alpha- to the Beta-version in the artifact design. The research with practitioners encompassed group sessions and individual conversations.

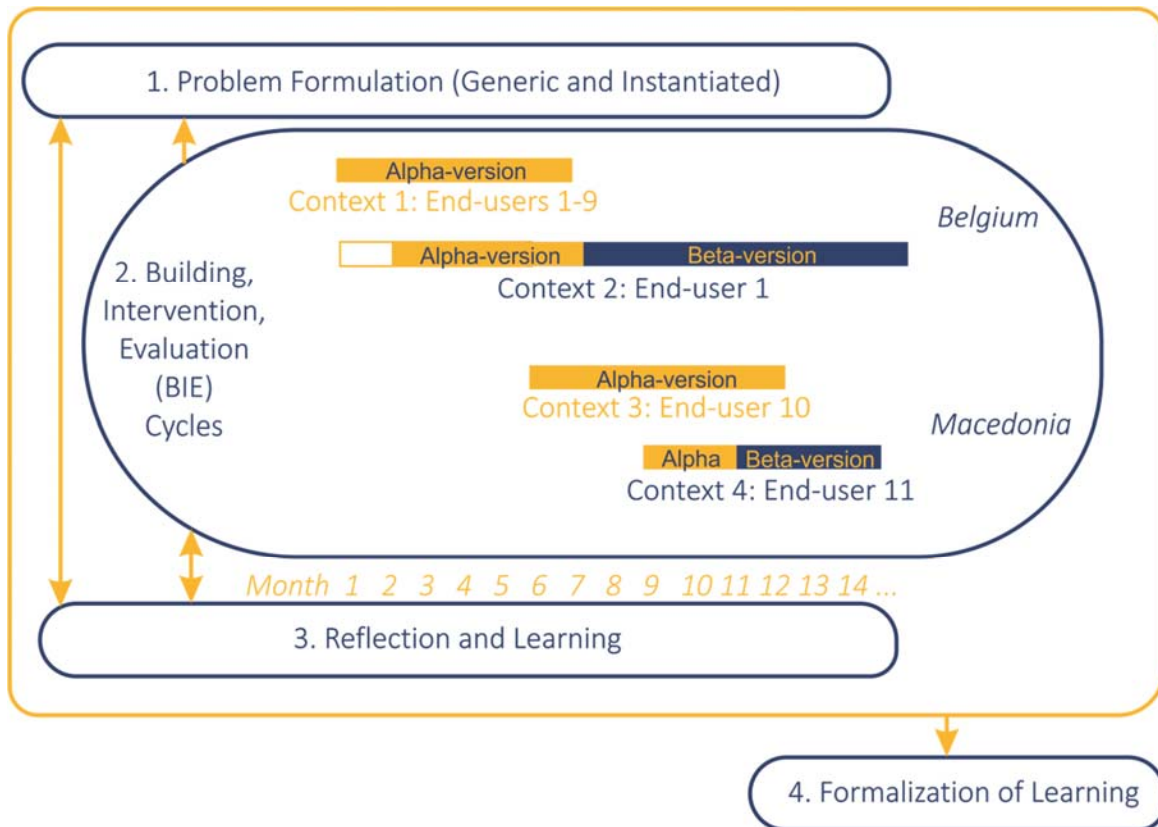


FIGURE 3.3 THE PHD RESEARCH IN THE ACTION DESIGN RESEARCH METHOD (ADAPTED FROM (SEIN ET AL. 2011))

To properly position a tactical management issue in the companies, we performed in-depth analysis of the company, business, mission, vision, goals, strategy, current systems, tactical management approach, expectations and SWOT and PEST analysis by conducting interviews, panel discussions with the End-users and cross-discussions with the management. We tried to point out the usefulness of the ADR in their company both for the researchers and for the company utilizing their expert opinion and constructive criticism which was valuable for the outcome. After start, we trained the End-users with the primitive concepts and roadmap of the S&R framework.

The following of the Action Design Research method has enabled us, throughout the timeline of 14+ months of work with the End-Users, to go through advancing the Alpha- and Beta- versions of the design. We approached each End-User and company with the same initially designed version of the initial artifact (in Excel Workbook of 4 sheets) which they filled and individually revised by performing the SIDA loop, but we informed each newly involved End-User with the benefits of the use from the previous ones. It is certain to say that the ‘reflection and learning’ on the side of the researchers, has been communicated with the End-Users back and forth.

The ‘formalization of learning’ stage occurred after completion of the research with practitioners. Namely, when following the levels of generalization (Rossi & Puro 2012), a scientist should be able to generalize the problem into a class of problems, the solution as artifact in use into a class of solutions and to synergize the effect of combining the class of problems, class of solutions and design principles into contributing to a high level design theory which in return improves a design process for further solutions to problems. This stage can be perceived as the crown of a PhD research because of the possibility to distinguish and clarify what has been done and how worthy for scientific, methodological and practical improvements it is.

3.3. NESTED PROBLEM SOLVING

For the workflow of the research dilemmas, crossroads and chosen directions, we found it most appropriate to use the nested problem solving for design science (Wieringa 2009) (Figure 3.5). As Wieringa suggests, the reasoning between practical problems and knowledge questions is of primary importance for clarification of many standpoints and dilemmas, especially in the head of the researcher(s). Also, this way of thinking helps streamline the contributions to both worlds – the practical and the theoretical. A practical problem is “a difference between the way the world is experienced by stakeholders and the way they would like it to be”, while a knowledge problem(question) is “a difference between current knowledge of stakeholders about the world and what they would like to know” (Wieringa 2009). Practical problems are addressed with solutions that are implemented or implementable in the real world context, meaning that the real world is changed to suit human purposes and fit stakeholder goals; and solutions are evaluated with the stakeholder criteria. The knowledge questions are the ones for which we give answers by acquiring knowledge about the world without necessarily changing it, and we evaluate them by applying independent criteria of truth (or what is currently positioned as such). By making a proper distinction between these two, a design science research can properly position its starting point – in a practical problem that needs a solution; prescribe and follow its course of action – bouncing between the practice and science with the regulative cycle until satisfied with the design research, the artifact and the outcomes; evaluate and pave foundation for generalizing the contributions in terms of solution(s) and answer(s). We used the classification of problems of (Wieringa 2009) as categorization of the practical problems and knowledge questions (Figure 3.4). The practical problems are in red color while the knowledge questions are in blue color (Figure 3.5).

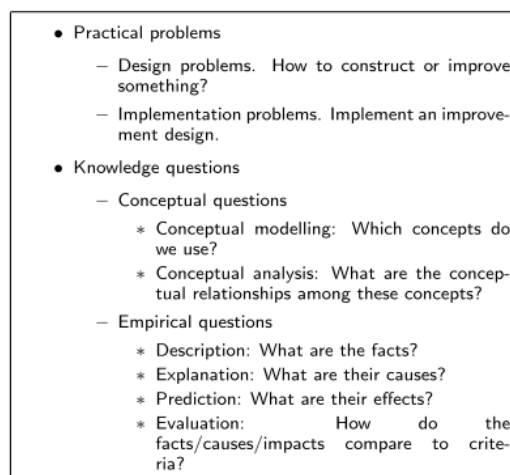


FIGURE 3.4 CLASSIFICATION OF PROBLEMS WHEN APPLYING NESTED PROBLEM SOLVING FOR DESIGN SCIENCE (WIERINGA 2009)

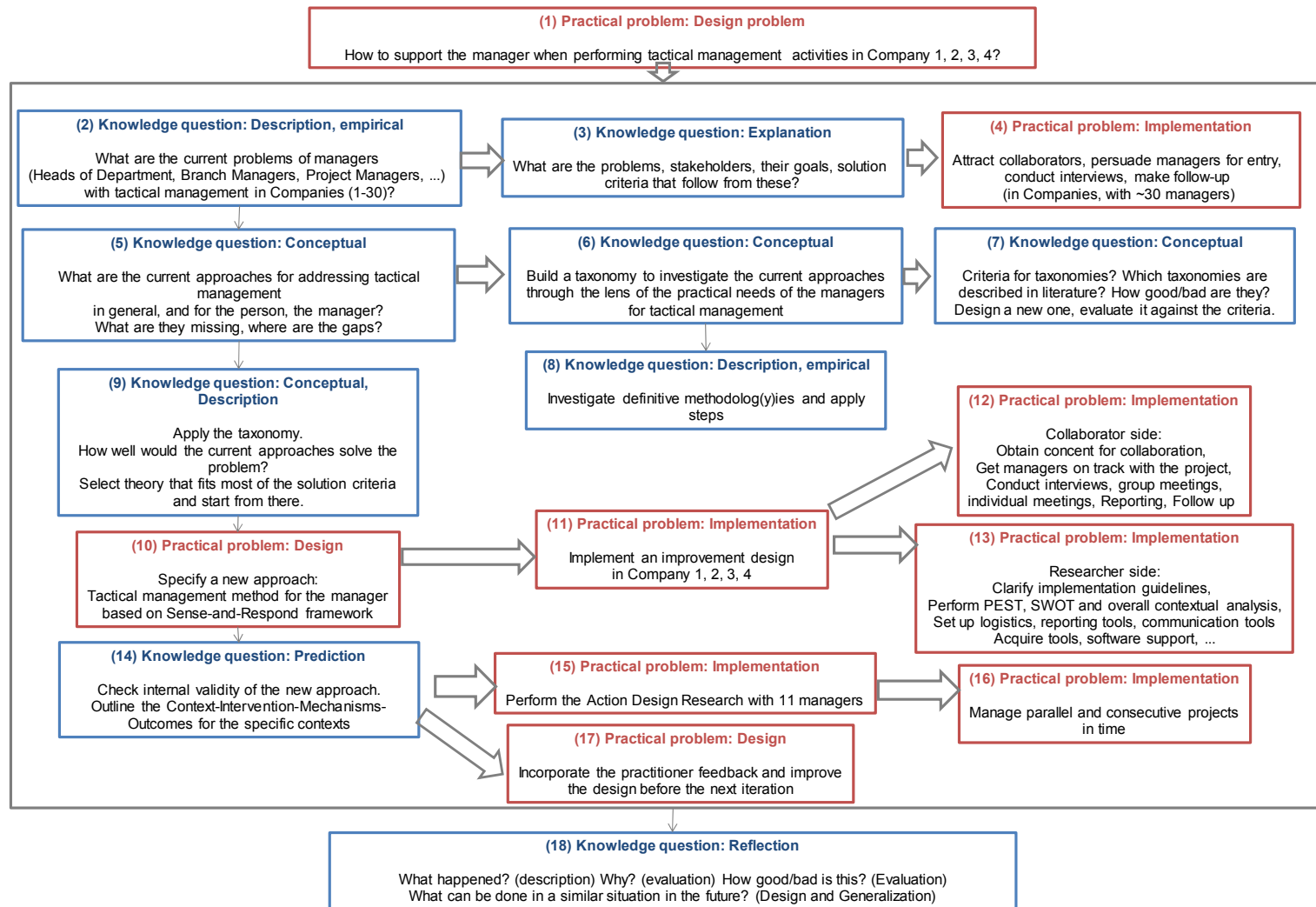


FIGURE 3.5 NESTED PROBLEM SOLVING FOR THE PHD RESEARCH (ADAPTED FROM (WIERINGA 2009))

3.4. CIMO LOGIC

The nested problem solving as roadmap for this design science research, has been combined with the CIMO (Context-Intervention-Mechanism-Outcome) research logic (Denyer et al. 2008) (Van Aken & Romme 2012) (Van Aken 2007) to evidence-based management in design science. The CIMO logic enables proper analysis and evaluation of organizational and project development through research interventions by aiding the observation of the solution concept into its application context (Ropes et al. 2014). The components of the CIMO logic – Context, Intervention, Mechanism, Outcome are defined in Figure 3.6.

Component	Explanation
Context (C)	The surrounding (external and internal environment) factors and the nature of the human actors that influence behavioural change. They include features such as age, experience, competency, organizational politics and power, the nature of the technical system, organizational stability, uncertainty and system interdependencies. Interventions are always embedded in a social system and, as noted by Pawson and Tilley (1997), will be affected by at least four contextual layers: the individual, the interpersonal relationships, institutional setting and the wider infrastructural system.
Interventions (I)	The interventions managers have at their disposal to influence behaviour. For example, leadership style, planning and control systems, training, performance management. It is important to note that it is necessary to examine not just the nature of the intervention but also how it is implemented. Furthermore, interventions carry with them hypotheses, which may or may not be shared. For example, ‘financial incentives will lead to higher worker motivation’.
Mechanisms (M)	The mechanism that in a certain context is triggered by the intervention. For instance, empowerment offers employees the means to contribute to some activity beyond their normal tasks or outside their normal sphere of interest, which then prompts participation and responsibility, offering the potential of long-term benefits to them and/or to their organization.
Outcome (O)	The outcome of the intervention in its various aspects, such as performance improvement, cost reduction or low error rates.

FIGURE 3.6 CIMO-LOGIC – THE COMPONENTS OF DESIGN PREPOSITIONS (DENYER ET AL. 2008)

Design science research prescribes designing an artifact that is founded in theory but predominantly inspired and proven in practice. The prevention of detaching theory from practice is the context – which has to be captured, mapped and referred to, along with the main problem we are addressing and solving through the artifact design. For this reason, in order to reach a state where we can generalize that: ‘if you want to achieve a given outcome for this generic problem-in-context, then use this generic intervention’ (Van Aken 2007), p.146) we have to explore the actual (C)ontext, adapt and apply with actual (I)ntervention, recognize, enforce and maneuver with actual (M)echanisms and record actual (O)utcomes; and then, through the principles of design science research, argue that there is supportive evidence to base evaluation and generalization on. We have explored, through the Action Design Research, four contexts (C1, C2, C3, C4), where in each we recognized and explored eight mechanisms (M1, M2, M3, M4, M5, M6, M7, M8) that resulted with two expected outcomes (O1, O2) with nine solution interventions (I1, I2, I3, I4, I5, I6, I7, I8, I9). Each of the intervention components, mechanisms and outcomes have been considered, adapted, analyzed and fine-tuned resulting with four Intervention sets (Ic1, Ic2, Ic3, Ic4), four Mechanism sets (Mc1, Mc2, Mc3, Mc4) and four Outcome sets (Oc1, Oc2, Oc3, Oc4) for each of the four contexts (C1, C2, C3, C4) (as presented on Figure 3.7).

CONTEXT(S)	INTERVENTION(S)		MECHANISM(S)	OUTCOME(S)
C1, C2, C3, C4	Ic1, Ic2, Ic3, Ic4		Mc1, Mc2, Mc3, Mc4	Oc1, Oc2, Oc3, Oc4
End-users	I1	Tactical authority level	M1	Personalized IS self-design
Company profile	I2	Big picture overview (Business ecology), Scope	M2	Simplicity of the artifact use
Industry	I3	System design of Roles and Accountabilities	M3	Multifaceted Context-capture
Organizational structure	I4	Clarity of Purpose and Governing Principles	M4	Maintaining the system till purpose is reached
Tactical issue/problem	I5	Guidelines to the manager on reasoning and acting for informing and translating decisions on business and information level	M5	Double loop organizational learning
Managerial structure	I6	Sense-Interpret-Decide-Act Loop for adaptability	M6	Effective communication
Problem type	I7	Plan-Do-Check-Act Loop for improvements	M7	Empowerment of the entities in Roles
Artifact version	I8	Incorporating Risk in parallel with Outcomes	M8	Situation awareness
	I9	Visualizations		

FIGURE 3.7 CIMO-LOGIC FOR DEVELOPING DESIGN PROPOSITIONS THROUGH RESEARCH SYNTHESIS (DENYER ET AL. 2008) FOR THE TACTICAL MANAGEMENT ADAPTABILITY AND INFORMATION SYSTEMS ACTION-DESIGN RESEARCH

The Design Science Research (Hevner et al. 2004) foundation, the Action Design Research (Sein et al. 2011), the Nested Problem Solving (Wieringa 2009) and the CIMO logic (Denyer et al. 2008) as main methodological pillars and tools are being constantly referred to in each of the following chapters. The combination of these has enabled emergent effect both in direction of the research content and in methodological terms.

4. STRUCTURE OF THE DISSERTATION

The dissertation is structured in the following manner (Gregor & Hevner 2013):

Chapter 1 – Introduction

Initially, the first chapter outlines the research context – starting with tactical management, its definition, managerial and information system distinctiveness and needs. The outlining of the research context continues with reference to the manager as our subject of interest, what is being managed and in what kind of environment. These constructs define the course of the research and its goal. The theoretical positioning of the research follows. The research methodology is presented along with visualizations how the research implements it. Publications for the research are listed.

Chapter 2 – Problem Investigation and Solution Requirements

This chapter encompasses all activities undertaken to investigate the problem and outline the solution requirements. Important element is our definition for tactical management, which is interwoven through the entire research. The interviews, the literature review, the distinction of strategic, operational and project management are investigated for the purpose of properly stating what tactical management is, what it needs in terms of managerial methods and which are its information system requirements. At the end of this chapter, the taxonomy through which the current contributions are being evaluated is given. This chapter lays the foundation for our artifact design, evaluation criteria and research expectations.

Chapter 3 – Theoretical Background

This chapter should answer the question to what is the design of the artifact. Which are its main theoretical foundations (Complex Adaptive Systems, Purposive adaptability, Uncertainty and Unpredictability), how tactical management influences the expectations of the design performance and what is the basic selected course of action with the Sense-and-Respond framework, that fits the criteria and expectations set up in Chapter 2.

Chapter 4 – Artifact Development and Evaluation

This chapter is the ‘heaviest’ one, in terms of content and structure. It is because of the necessity to elaborate the artifact design process through the lens of the somewhat complicated methodological platform deployed for the research. The Action Design Research phases are detailed with research content along with the CIMO logic and nested problem solving reasoning. This chapter also contains the reflection, learning, evaluation, generalization and artifact description.

Chapter 5 – Conclusion and Future Challenges

The last chapter contains overall conclusions from the research and initiates several directions for future challenges that hopefully will add up on it. The contributions from the research are articulated once again and appropriate references for their elaboration throughout the chapters are given.

Figure 4.1 orients the components, stages and activities of the research following the methodology, methods and techniques deployed – DSR (Figure 3.2), ADR (Figure 3.3), Nested problem solving (Figure 3.5) and CIMO-logic (Figure 3.7).

Chapter	DSR	ADR	Nested problem solving (KQ – Knowledge Question, PP – Practical Problem)	CIMO-logic
Chapter 1	Motivation and idea, research context, methodology			
Chapter 2	Problem Investigation 1a) Interviews 1b) Personal experience 1c) Literature review Defining and delineating Tactical Management Solution Requirements	Problem formulation – generic	1) PP – how to support tactical manager in adaptability (managerial and IS) 2) KQ – interviews 3) KQ – what can be derived 4) PP – attract collaborators 5) KQ – investigate literature 6) KQ – build a taxonomy 7) KQ – criteria 8) KQ – investigate existing contributions	(C)ontexts
Chapter 3	2a) Theoretical Foundations	Problem formulation – generic	6) KQ – build a taxonomy 9) KQ – select foundation theory and go	(C)ontexts – (I)nterventions – (M)echanisms
Chapter 4	3) Develop/Build 4) Justify/Evaluate through Action Design Research, CIMO-logic	Problem formulation – instantiated Building-Intervention-Evaluation Cycles Reflection and Learning Formalization of Learning	9) KQ – select foundation theory and go 10) PP – design the novel approach 11) PP – implement 12) PP – collaborators 13) PP – researchers 14) KQ – internal validity – CIMO for the 4 contexts 15) PP – implement with managers 16) PP – manage simultaneous projects 17) PP – enforce Beta-version 18) KQ – Reflect and evaluate – CIMO realist	(C)ontexts – (I)nterventions – (M)echanisms – (O)utcomes
Chapter 5	Conclusions, Implications, Limitations (theory and practice)			

FIGURE 4.1 STRUCTURE OF THE DISSERTATION THROUGH THE METHODOLOGICAL KALEIDOSCOPE

To wrap up with the definitions of the main concepts used in the research:

- *Context*: the circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood
- *Strategic management*: the full set of commitments, decisions, and actions required for a firm to achieve strategic competitiveness and earn above-average returns or the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources.

- *Operational management*: the systematic design, direction, and control of processes that transform inputs into services and products for internal, as well as external customers
- *Tactical management*: managerial function concerned with how to achieve what is expected by utilizing what is given and following certain governing principles in the current context of the organization and environment
- *Strategy*: refers to the choice of business model through which the firm will compete in the marketplace
- *Tactics*: refers to the residual choices open to a firm by virtue of the business model that it employs. In this sense, strategy refers to the choice of 'type' of business model (e.g., freemium business model, low-cost business model) whereas tactics refers to the instantiation of the chosen type of business model (e.g., Spotify designed a business model of the freemium type, Ryanair designed a business model of the low-cost type). This concerns the content. Tactics is also the manner of 'how' to effectuate that content.
- *Adaptability*: the quality of being able to adjust to new conditions but also as the capacity to be modified for a new use or purpose
- *Adaptable*: is a characteristic of something that is responsive when being subject of actions to alter its state
- *Adaptive*: is a characteristic of something that alters its state to respond to some action. Hence adaptive implies that the 'something' can itself take actions to change, whereas adaptable implies that the 'something' is passive and acted upon to change.
- *Complex Adaptive System*: is a dynamic network of agents acting in parallel, constantly reacting to what the other agents are doing, which in turn influences behavior and the network as a whole. The ensemble of independent agents interact to create an ecosystem, their interaction is defined by the exchange of information, their individual actions are based on some system of internal rules, they self-organize in non-linear ways to produce emergent results, and exhibit characteristics of both order and chaos and evolve over time
- *Managerial system*: is a projected system, virtual interface that reflects and visualizes manager's ideas on the mechanisms, components and links that should work towards accomplishment of goal(s) and is shared and communicated with all the entities that are collaboratively interrelated towards the mutual goal(s).
- *Managed system*: the interrelated entities that populate the roles and effectuate accomplishment of goal(s). In our case, the managed system is a socio-technical CAS.
- *Management Information System*: is the result of a formal method of making available to management the accurate and timely information necessary to facilitate the decisionmaking process and enable the organization's planning, control, and operational function to be carried out effectively

5. PUBLICATIONS AND ACHIEVEMENTS

This dissertation contains parts of papers presented on conferences and/or published in international journals. Below is a list of all publication in the course of the past 5 years along with mentions of prizes and achievements.

CAiSE Radar 2016, Ljubljana, Slovenia, John Krogstie • Haralambos Mouratidis • Jianwen Su (Eds.)

“Identifying and Addressing Adaptability and Information System Requirements for Tactical Management”
Renata Petrevska Nechkoska, Geert Poels, Gjorgji Manceski

<http://eprints.fri.uni-lj.si/3341/1/Radar-proceedings.pdf>

ELECTRONIC JOURNAL OF INFORMATION SYSTEMS EVALUATION. 18(2). p.146-158 (2015)

“Bridging operational, strategic and project management information systems for tactical management information provision”

Renata Petrevska Nechkoska, Geert Poels, Gjorgji Manceski

<http://www.ejise.com/volume18/issue2/p147>

Proceedings of the CAiSE'2015 Doctoral Consortium at the 27th International Conference on Advanced Information Systems Engineering (CAiSE 2015). 1415(0074-1415-4). p.19-27

“Tactical management in focus: adaptability and information systems”

Renata Petrevska Nechkoska, Geert Poels, Gjorgji Manceski

<http://ceur-ws.org/Vol-1415/CAISE2015DC03.pdf>

8th European Conference on IS Management and Evaluation – ECIME 2014

“From Strategy to Operations and Vice-Versa – a Bridge that needs an Island”

Renata Petrevska Nechkoska, Geert Poels, Gjorgji Manceski

<https://biblio.ugent.be/input/download?func=downloadFile&recordId=5697122&fileId=5697123>

8th European Conference on IS Management and Evaluation – ECIME 2014

“Meeting Point of Strategy and Operations – Tactical Management Sense-and-Respond Framework Enhancement”

Renata Petrevska Nechkoska, Geert Poels, Gjorgji Manceski

<https://biblio.ugent.be/input/download?func=downloadFile&recordId=5697122&fileId=5697123>

Publications not directly related to the dissertation research:

Horizonti, Journal, Vol. 12, ISSN 1857- 856X, University St. Kliment Ohridski Bitola,
Macedonia, pages 179-193 (2014)

“Triggers of the subprime mortgage crisis still not defeated by the world”,

Renata Petrevska Nechkoska http://www.uklo.edu.mk/files/attachments/HORIZONTI_12.pdf

CIIT 2012 Bitola, Macedonia

(iKnow – Innovation and Knowledge Management towards eStudent Information System –

Project TEMPUS JPGR 511342, <http://iknow.fon.edu.mk/Home.aspx>)

“Benefits and SWOT analysis of iKnow software project for eStudent Services for all

Higher education system in Macedonia” Renata Petrevska Nechkoska, Gjorgji Manceski
http://ciit.finki.ukim.mk/data/CIIT2012_detailed_schedule.pdf

ICT Innovations Ohrid, Macedonia (2012)

“Specific Skill Set Training for Working Professionals by Faculties via e-Learning”

Renata Petrevska Nechkoska, Gjorgji Manceski

http://www.ict-act.org/index.php?option=com_content&view=article&id=130&Itemid=121

Achievements

BEST POSTER AWARD - “Tactical Management in Focus”

8th European Conference on IS Management and Evaluation – ECIME 2014

Renata Petrevska Nechkoska, Geert Poels, Gjorgji Manceski

<http://academic-conferences.org/ecime/ecime2014/ecime14-home.htm>

SCHOLARSHIP: Erasmus Mundus Action II – Basileus IV Scholarship, European Commission

PhD Research (November 2013 – April 2014), UGent Belgium,

BASILEUS_20120196

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CHAPTER II

PROBLEM INVESTIGATION

AND

SOLUTION REQUIREMENTS

THE IDEA TO HAVE STARTED WITH

The idea that initiated this research was: how to improve the tactical management function by assisting the manager as a person. The goal is to provide a solution – a managerial method that will assist the persons fulfilling the role of tactical manager from both managerial and management information systems points of view. In the very beginning of the research, emerged the requirement to clarify what exactly is *tactical management* and how its real essence can be exposed. Especially, since companies are nowadays in rapidly dynamic and changing environments, with numerous uncertainties (Demartini 2014), tactical management necessitate constituent(s) of adaptability. Accordingly, tactical management appeared as the right place to look for requirements and components of adaptability. The intuition that denoted a “start from organizational problem to be solved” in order to “then design an artifact to solve this concrete problem” (Wieringa & Morali 2012) came from personal experience; and was carried on the streamlined process of Design Science Research (Hevner et al. 2004) and relevance and rigor cycles (Hevner 2007) through expert interviews, literature search, and of course through the reflections in the Action Design Research (Sein et al. 2011) and further technology-transfer with academic and business collaborators from Belgium and Macedonia.

This chapter starts with brief explanation of the methodology followed to investigate the problem, a researcher has experience and insight about, obtaining current context capture of the tactical management problems in real environment and capture of provisions and limitations in literature. The findings from these activities interweave into a more clear perception of the ‘as is’ situation, along with what is needed and some insights on how to address it. As intermediary step in this part of the research, we are effectuating the first contemplation that is necessary to continue towards solution requirements – we are providing a working definition for tactical management and a clear distinction what it is and how it differs from strategic, operational and project management. With these settings in mind, we are summarizing the solution requirements:

- Research methodology (Section 1 – Research Methodology for Problem Investigation and Solution Analysis)
- Individual interviews with experts in tactical management issues (middle managers, senior managers, project managers, team leaders, operational managers, SME owners) (Section 2.1 – Interviews)
- Literature review for determining how current solutions address or lack to support tactical management managerial and IS needs through ten specific criteria (Section 2.2 - Literature review) and
- Investigation of managerial methods and management information system solutions for strategic, operational and tactical management (Section 2.3 - Identifying managerial methods and management information systems support)
- Defining tactical management (Section 3 – Defining Tactical Management)
- Conceptual positioning of tactical management versus operational/strategic/project managerial functions with a systematization of the most important categories that distinguish and/or align these managerial functions (Section 4 – Delineating Tactical Management among Operational, Strategic and Project Management)
- Solution requirements for the artifact (Section 5 – Solution Requirements)

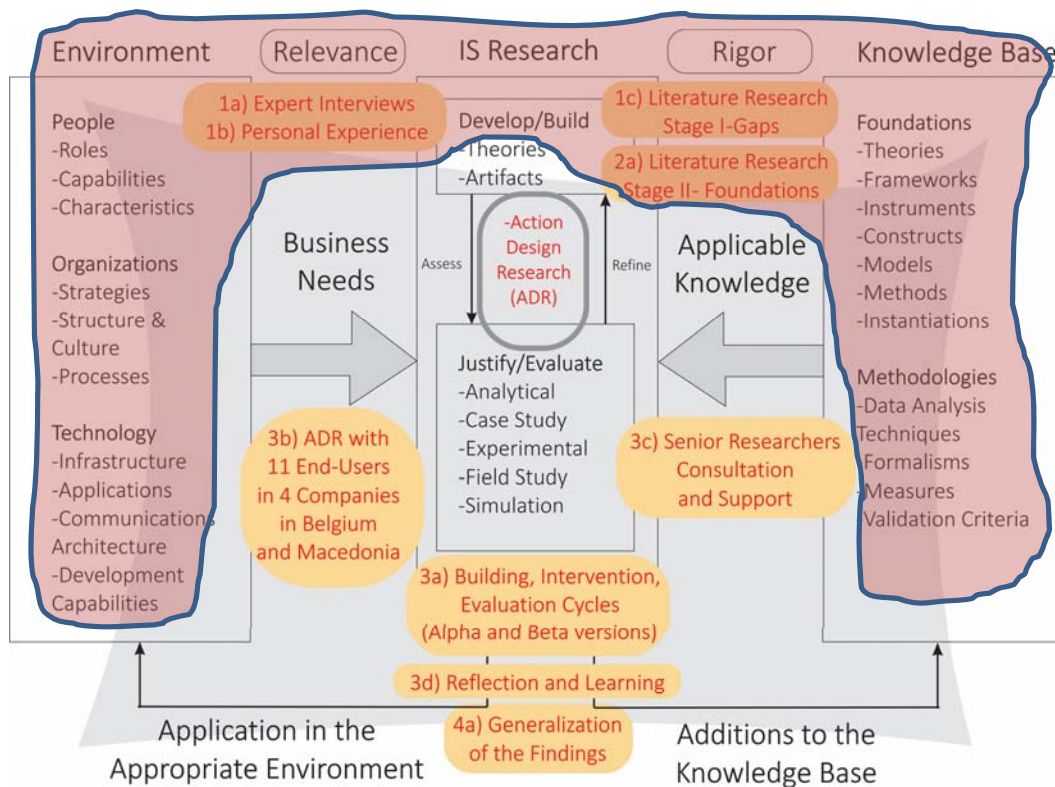


FIGURE 1.1 TACTICAL MANAGEMENT RESEARCH IN THE DESIGN SCIENCE RESEARCH FRAMEWORK (HEVNER ET AL. 2004)

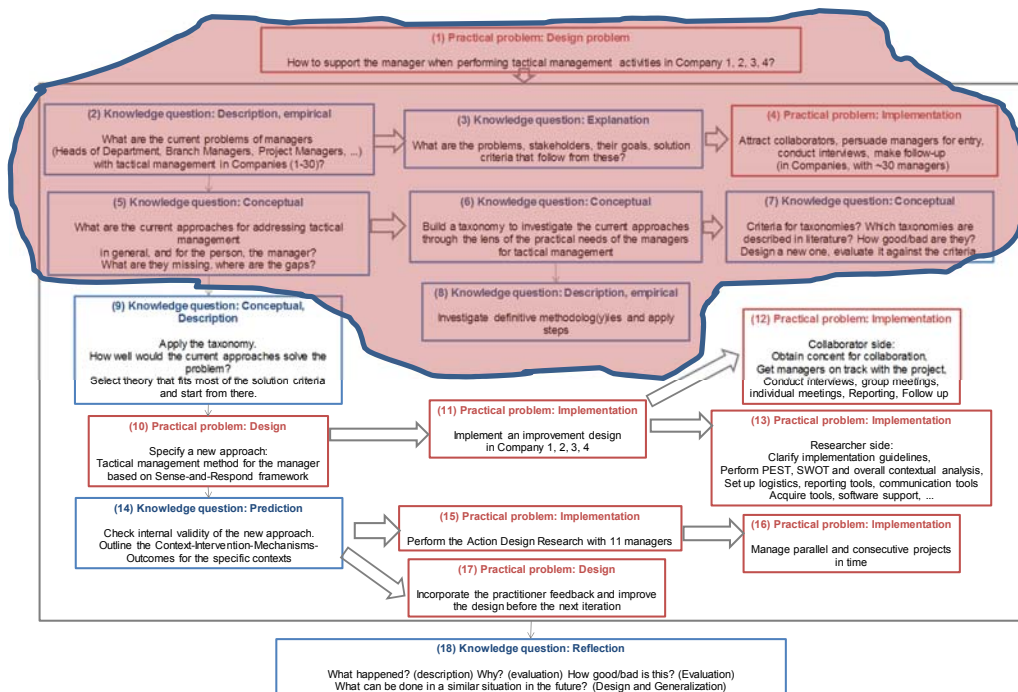


FIGURE 1.2 NESTED PROBLEM SOLVING FOR THE TACTICAL MANAGEMENT RESEARCH (ADAPTED FROM (WIERINGA 2009))

1. RESEARCH METHODOLOGY FOR PROBLEM INVESTIGATION AND SOLUTION ANALYSIS

With the aim to investigate the current condition of tactical management with regards to managerial methods and information support, we have conducted:

- Interviews (Figure 1.1, label 1a)
- Reflected insights from the researcher's own professional experience as middle manager (Figure 1.1, label 1b)
- Literature review (Figure 1.1, label 1c and 2a)

Through the relevance cycle for identification of requirements ((Hevner et al. 2004; Hevner 2007)) (Figure 1.1, label 1a, 1b), we gathered understanding on what the situation with tactical management in practice is – capturing the environment (in terms of people, organizations and technology); what is missing and obtained some ideas on how the shortcomings can be addressed (through the interviews, elaborated in 2.1).

The rigor cycle ((Hevner et al. 2004; Hevner 2007)) (Figure 1.1, label 1c, 2a) led to first stage of grounding in literature in terms of identifying the current situation of tactical management managerial methods and management information systems support, with special accent on adaptability. This analysis helped detect what is missing and capture some common denominators that a possible solution should be based upon (elaborated in 2.2). We have also systematized the managerial approaches and management information system support for tactical, operational and strategic management, based on the literature review (elaborated in 2.3).

After grasping which problems tactical management faces (managerial, informational, , ...), especially in terms of adaptability, we are taking the first steps suggested by the investigation with interviews and in literature: the necessity for a working definition for tactical management (Heading 3) and clarification how it is distinctive/similar from strategic, operational and project management (Heading 4. We find this intermediary action crucial in order to clarify the solution requirements for the artifact which is a method (for helping tactical managers set up, monitor and adjust their personal management information system that provides them with the right information to achieve goals of tactical management, with particular attention to support for adaptability) (Heading 5).

2. PROBLEM INVESTIGATION

Before initiating the investigation of the problem of tactical management, there is a necessity to anchor this managerial function into the managerial domain as well as in the management information systems domain. While the latter is rather clear – management information systems can be investigated from the point of view of the person, their function and in relation to their actual business content and needs and addressed in focused manner, the managerial backbone is more specific. Firstly, the introduction of the new name of 'tactical' management is with regards to the military categorization of strategy, tactics and operations (elaborated in the definition in Heading 3 of this Chapter). However, this research addresses implementation, operationalization and effectuation of strategy or, in terms of Anthony's (1) strategic planning and control, (2) management control and (3) operational (task) control we could position tactical management under management control perceived both as a system and as "the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (Anthony 1965). The development of management control continues with (Ouchi 1979) and (Lawrence & Lorsch 1967) who add to the concept of management control the environmental uncertainty; (Scott 1981) portrays the organizations open systems perspective analyzing the relationships between rather than the features of the components of the system; and (Beer 1994) provides cognitive representation based on the human neural system of the firm as a non-elemental viable system and incorporates dynamics, to which (Simons 1995) reflects by recognizing the dynamics of creating value, making strategy and of the human behavior. Each of these constructs are investigated in our research through practitioner's and theoretical viewpoints. The information

requirements according the decision category, for the management control are addressed by (Gorry & Morton 1971) who differentiate different management information system needs for management control with regards to source of the information, scope, level of aggregation (detailed, combined, aggregated), time horizon, current/old, accuracy and frequency of use – a baseline for our tendency of multifaceted context capture within the management information system for tactical management. Simons' levers of control (beliefs systems, boundary systems, interactive control systems and diagnostic control systems) interrelate the management control discipline into components and roadmap of strategic effectuation into action (Simons 1995). He clarifies the tensions of intended and emergent strategy, self-interest and desire to contribute, uncertainties and risks and perceives middle managers as “especially important in making the interactive control process work effectively. They are key node of the information network that reveals senior management's concerns and moves newly collected information up, down and sideways in the organization.” (Simons 1995). To conclude the expansion and purification of the management control discipline, (Malmi & Brown 2008) introduce the term ‘package’ because in most contemporary organisations there are a number of management control systems (MCS). If all those were designed and coordinated intentionally, we might call the whole system a MCS. However, the concept of a package points to the fact that different systems are often introduced by different interest groups at different times, so the controls in their entirety should not be defined holistically as a single system, but instead as a package of systems. This being said, management control suggests to strategic managers ways and components to implement strategy, answering the What, Why, How, When, Who maneuvers the organizational ‘levers’. What is different is the ‘Who’ in management control being mostly senior managers while in tactical management mostly middle managers – which gives them the ability to set goals and governance (in management control) or consider them as a ‘given’ (in tactical management). In our case of tactical management, the goal is to complement management control with the What – given strategy and expectations with given resources in dynamic environment; Why – accomplish outcomes; How – personalized managerial method that provides adaptability, When – continuously. To wrap up, we are investigating a problem of adaptability of tactical management and its management information systems. This research contributes to the management control domain as means of effectuating strategy in dynamic and unpredictable environment by providing managerial and management information system adaptability.

2.1. INTERVIEWS

For the purpose of ensuring the relevance of the organizational problem of tactical management that we address in our research (Figure 1.1), we conducted interviews with different manager profiles, from various educational and experience backgrounds; that according to our working definition are considered to be involved in tactical management. The job positions held by these interviewees were diverse and included middle managers (heads of departments, branches, units, ...), senior managers, project managers, team leaders, operational managers, entrepreneurs and SME owners. Geographically, the research took place in Belgium and Macedonia, with 30 managers working in SMEs and international corporations with company locations in BeNeLux, France, Macedonia and USA, from various domains (consulting, software development, production, construction, engineering, banking, ...) on national and/or international level. The interviews have been conducted mostly during the year of 2014.

Figure 2.1 lists the details of the interviewees, with information about position held, company and country. The ‘Middle manager’ category includes head of department, Branch manager, Unit manager; the ‘Senior manager’ category includes executive managers, partners, and top managers in general; the ‘Project manager’ category enlists various hierarchical and cross-cutting positions that are in charge of projects; the ‘SME owner’ category incorporates owners and/or managers (that act as all-in-one managers) in SMEs.

Position	Name and Surname	Position	City	Company	Country	Domain
Middle Manager	Damien Braeckman	Principal EPM Consultant	Gent	Real Dolmen	Belgium	International Corporation
Middle Manager	Mattias Van Holm	Store Manager	Antwerp	Decathlon	Belgium	International Corporation
Middle Manager	Natasja Ramakers	Business Unit Controller	Diegem	Deloitte	Belgium	International Corporation
Middle Manager	Nathan Goddefroy	Department Manager	Gent	Decathlon	Belgium	International Corporation
Middle Manager	Sabine Gosuin	Supervisor	Brussels	Moore Stephens Verschelden	Belgium	International Corporation
Middle Manager	Christophe Catry	HR Manager	Kortrijk	Ad Ultima Group	Belgium and France and Netherlands	International Corporation
Middle Manager	Karl Vandebroek	Delivery Manager	Brussels	SAP	Belgium and Luxemburg	International Corporation
Middle Manager	Daniela Naumova	Treasury Department Senior Specialist	Skopje	ProCreditBank	Macedonia	International Corporation
Middle Manager	Elena Atanasova Stefanovska	Head of Legal Department	Skopje	Halkbank	Macedonia	International Corporation
Middle Manager	Violeta Vukelic	HR Manager	Skopje	Carefour	Macedonia	International Corporation
Middle Manager	Zlatko Lazic	Head of Corporate Department	Skopje	Alpha Bank	Macedonia	International Corporation
Project Manager	Jeroen Rambour	Project Manager/Team Leader	Kortrijk	Ad Ultima Group	Belgium and France and Netherlands	International Corporation
Project Manager	Kurt Van Osselaer	Project Manager/Team Leader	Kortrijk	Ad Ultima Group	Belgium and France and Netherlands	International Corporation
Project Manager	Peter Tanghe	Project Manager/Team Leader	Kortrijk	Ad Ultima Group	Belgium and France and Netherlands	International Corporation
Project Manager	Wim Van hoorde	Project Manager/Team Leader	Kortrijk	Ad Ultima Group	Belgium and France and Netherlands	International Corporation
Project Manager	Zharko Kachakov	Director of Development Department	Prilep	Vitaminka AD Prilep	Macedonia	SME
Senior manager	Alexandre Streel	Partner	Brussels	BDO	Belgium	International Corporation
Senior manager	Alice Collignon	HR Business Partner	Antwerpen	Moore Stephens Verschelden	Belgium	International Corporation
Senior manager	Benoit Hubain	Senior Manager Audit & Assurance Services	Gent	BDO	Belgium	International Corporation
Senior manager	Charlotte Vanrobaeys	Partner	Brussels	Deloitte	Belgium	International Corporation
Senior manager	Filip Bossuyt	Owner	Kortrijk	Ad Ultima Group	Belgium	International Corporation
Senior manager	Frederik Berckmoes Joos	Executive Partner	Antwerpen	Moore Stephens Verschelden	Belgium	International Corporation
Senior manager	Bertrand Andries	Managing Director	Brussels	SAP	Belgium and Luxemburg	International Corporation
Senior manager	Maja Palcevska	Regional Manager	Skopje	Sparkasse Bank	Macedonia	International Corporation
SME Owner	Benjamin Ball	Owner	Gent	YourCoach	Belgium	SME
SME Owner	Marc van Aerde	Owner/Manager	Antwerp	Suelto GCV	Belgium	SME
SME Owner	Borche Stojanovski	Manager and Owner	Bitola	GeoBalkan	Macedonia	SME
SME Owner	Drazen Koteski	CoOwner	Prilep	Donia	Macedonia	SME
SME Owner	Sasho Naumoski	General Manager	Prilep	Vitaminka AD Prilep	Macedonia	SME
SME Owner	Stephan Haeckel	Manager and Owner	NewYork	Adaptive Business Designs	USA	SME

FIGURE 2.1 LIST OF INTERVIEWED MANAGERS, COMPANIES, COUNTRIES AND THEIR POSITIONS

The interviews have been semi-structured (Bryman 2015) (Bernard 2006), motivated by our need to investigate practical tactical management issues and problems that are not necessarily documented in literature. The focus was placed on the (1) managerial methods for improving effectiveness of the work and on the (2) supporting management information systems used in the companies. Of interest to explore were the personal experiences of the managers on their tactical management issues and their approaches to handle the challenges as well as the difficulties they are facing. Important input for our research was the opinion on how a managerial method that embraces adaptability and own management information system design would help them, as traits of tactics, discussed in Chapter 1. The guidelines for the interviewer to organize the one hour discussion have been as in Figure 2.2, Figure 2.3 and Figure 2.4.

The thematic design of the interviewer guidelines has its foundations in literature. Namely, this investigation needs to answer and give insights on several themes:

- Identify what managers in practice understand with the term ‘tactical management’ and where and how they position the ‘tactical management’ in the organizational structure. This is necessary to properly explore the concepts and definition (as discussed in Heading 3 of this chapter) and clarify distinctions among the managerial functions (as discussed in Heading 4 of this chapter)
- Investigate a holistic impression of the person – the manager and his/her approach to tactical management and management information systems as well as the role such manager has in the organization. The motivation of this lays in the idea that tactical management has a core need to be adaptable because it is surrounded by ‘givens’ that are dynamic and change in time, place, content, ... (strategy, goals, expectations on one hand, and resources, processes and circumstances, on the other); as well as due to the manager’s acts to enforce intentional changes. In general, adaptability (or non-rigidity) is what should be investigated and supported (as explored and elaborated in depth in Chapter 3: Heading 1.2 – Tactical management postulates for purposive adaptability). Furthermore in this theme, we wanted to investigate whether and how managers capture context that supports realization or imposes problems in implementing plans and expectations and whether and how they act on being informed and aware of the daily situation as well as projected future developments, all of which dynamic and to some extent unpredictable in time and space. Also, a sub-category here is which elements do they pay attention to, and how broad or narrow that scope scan is. These questions relate to the theoretical concepts elaborated in Chapter 3: Heading 1.2.2. – Context capture and situation awareness in dynamic systems. Issue of interest has been also how the managers communicate with their teams and what is needed to enhance that communication (inspired by the theoretical concepts of visualization for effective and continuous communication (in Chapter 3: 1.2.3 – Effective continuous communication and visualization). The last issue to be explored in this theme was the reflection of all the managerial challenges with regards to tactical management to the management

information system the person has or would like to have, which was paralleled in Chapter 3: Heading 1.3 – Management information systems nature for tactical management.

- The third thematic constellation is from the point of view of the company as a whole. The idea is to capture and portray the organizational environment in which tactical management should effectuate and how it enables or constrains the tactical manager's role, through clarity or ambiguity of mission, vision, governance principles, organizational structure, authority levels, transparency, management information systems support, performance measurement and multi-directional communication flows, as motivated in the theoretical concepts of primary purpose, governing principles, make-and-sell vs. sense-and-respond (in Chapter 3: Heading 1.4) and organizational and managerial paradigms of complexity and uncertainty (Chapter 3: Heading 1.1. Particular postulates on what is being managed, in which environment and how to address it).

The interviews always began with 10-15 minute introduction of the research, the motivation and goals, after which the discussion was facilitated to explore the interviewee's organizational context, profile, experiences, problems and standpoints. The interviewer used several visualizations to better position the aim of the research, so the induction stage is reached fast and common ground is shared with regards to what is to be achieved with the interviews. The interviewees have been professional, selfless in sharing their experiences and ideas, and very accurate on a generic level about the problems they were facing and some preliminary ideas what kind of a new artifact may solve them.

TACTICAL MANAGEMENT IN FOCUS - GOALS OF THE INTERVIEWS	
Measure the existing positioning of information sensors	
Comprehend whether the managers approach to information themselves or use what is given	
Capture current practices in handling the complexity	
Realize how is being achieved what is being achieved by contribution from:	
a. People, Processes, Technology, Business Management	
b. The exact person as a tactical manager	
Interviewees	
Middle Management (Branch Managers, Heads of Departments, ...)	
Senior Management	
Project Managers	
Operational Managers	
SME Owners	
Possible Input Documentation	
Job Descriptions	
Organizational Structure	
Business Plan/Targets	
Possible IS Maturity Estimate	
Possible Output Documentation	
Confidentiality Statement	

FIGURE 2.2 GUIDELINE FORM – 1 FOR THE INTERVIEWER

TACTICAL MANAGEMENT IN FOCUS - CONCEPTS USED IN THE RESEARCH	
Research Defined Entities (RDE)	Research Defined Processes (RDP) that are carried by Research Defined Entities within and outside the organization
Employees	Core business operations Projects Other business operations
Financial Resources	Core business operations Projects Other business operations
Material Resources	Core business operations Projects Other business operations
Functional segments of the Unit	Fulfillment, Monitoring, Enabling, Needs, ...
The Unit as a whole	Fulfillment, Monitoring, Enabling, Needs, ...
Internal Collaborators	Dependencies, Expectations, Direct business Influencers, ...
External Collaborators	Dependencies, Expectations, Also Clients?, Direct business Influencers, ...
Clients	Acquisition, Customer Care, Cross-selling, Retention, Satisfaction
Competition	Products, Developments, Also Clients?, Direct business Influencers, ...
Management	Directions, Guidelines, Trends, ...
Immediate Environment	Town, Neighborhood, ...
State	Legislative, Events, ...
World	Economy, Crisis, Wars, ...

FIGURE 2.3 GUIDELINE FORM – 2 FOR THE INTERVIEWER

TACTICAL MANAGEMENT IN FOCUS - INTERVIEW STRUCTURE FOR MANAGERS			
Topic	Type of data	Links	Info
A Interview Details			
1 Date	Date		
2 Time	Time		
3 Place	Text		
4 Manner	Text (In Person, Skype, E-mail)		
5 Duration	Text		
6 Submitted Confidentiality Statement	Yes/No		
7 Agreement to continue communication	Text (Interview, Email, None)		
8 Obtained Official OrgaChart	Yes/No		
9 Obtained Official Job Description	Yes/No		
10 Agreement to mention as reference for the research	Yes/No		
11 Willingness to try/evaluate the Artifact	Yes/No		
B Company Information			
1 Name	Text		
2 Activity	Eurostat, Statistical Classification of Economic Activities in the European Commu	Link to the classification	
3 Domicile country	Text		
4 International network	Yes/No		
5 International network countries/entities	Text		
6 National network	Yes/No		
7 National network cities/entities	Text		
8 Number of employees in the company	Numeric		
9 Number of employees in Belgium	Numeric		
10 Organization structure (OrgaChart)	Descriptive (file, text, ...)		
11 Entity name (1, 2, 3, ..., n)	Text (Branch, Department, Division, Unit, ...)		
12 Entity description, function (1, 2, 3, ..., n)	Text		
13 Number of entities of entity type (1, 2, 3, ..., n)	Numeric		
C Unit Information			
1 Entity name	Text (Branch, Department, Division, Unit, ...)	Topic B, question 11	
2 Address	Text		
3 City	Text		
4 Number of employees	Numeric		
5 Manager of the unit	Text		
D Information about the Tactical Manager			
1 Name, Surname	Text		
2 Current Position	Text		
3 Educational Background	UNESCO, ISCED Fields of Education and Training, EU Labor Force Survey	Link to the classification	Pages 16-18
4 Employment Status	ILO, International Classification by Status in Employment (ICSE) Classification	Link to the classification	1993 Groups
5 Number of employees/units under direct supervision	Numeric		
6 Number of employees under indirect supervision	Numeric		
7 Professional Experience total duration	Numeric (duration in years)		
8 Professional Experience on the position	Numeric (duration in years)		
9 Professional Experience in the company	Numeric (duration in years)		
10 Professional Experience Area	Text		
11 Related trainings	Text (Tactical Management, Time management, Business Plan, ...)		
E Company IS Maturity			
1 People			
2 Processes	Unorganized, Defined, Optimized, Redundant, ...		
3 Technology	Hardware, Software, what kind, for what use, Departmental software solutions, Excel workbooks, Way of communication in the company, ...		
4 Business Management			
F Company Strategic Management Approach			
1 How does the company define strategic plans and expectations?	Performance Framework (BSC, Tripple Bottom Line, ...), Business Plan, Targets, ...		
2 How does the company monitor the fulfillment of strategic plans and expectations?	KPIs, Quartal/Monthly/... Meetings, Reports, ...		
3 What categories are measured for fulfillment of the strategic plans for the specific unit?	Increase of Client Number, Lower the duration of a project, ...		
4 How do you measure/follow the fulfillment of strategic plans for your specific unit?	Reports, Meetings with supervisors, Combination, ...		
5 What is the company Mission/Vision?	Descriptive		Cross-Check on goal oriented reasoning

G Recording Manager's Opinion			
1	What do you think is Tactical Management?	Employees, Budget, Physical assets, ...	
2	What kind of decisions do you make?		
3	What are the company expectations from the persons on your position?	To capture the widest scope of Goals/Targets/Strategy, Research Defined Entities, Research Defined Processes as personal Job Description interpretation	Cross-Check Job Description
4	What information do you have on RDE, RDP?	To capture the information provided for Goals/Targets/Strategy, Research Defined Entities, Research Defined Processes	Cross-Check Business Plan
5	According to you, what information do you need on RDE, RDP?	To capture the information needed for following Goals/Targets/Strategy, Research Defined Entities, Research Defined Processes	Cross-Check IS Maturity
6	What do you spend most of your time on?	Troubleshooting, Planning, Training, Client meetings, Reporting, Budgeting, Negotiating, ...	
7	What do you spend least of your time on?	New projects, Appraisals, Personnel issues, ...	
8	Please name and range the biggest stress-triggers for you doing your work?	Description and Ranging	
9	What is in your Central Vision of perception?	In terms of RDE, RDP categories	All Answers with regards to: Scope, Frequency, Details, Event driven/On demand, Content, Context
10	What is in your Peripheral Vision?	In terms of RDE, RDP categories	
11	What is out of your sight?	In terms of RDE, RDP categories	
12	What do you think should be in your Central Vision of perception?	In terms of RDE, RDP categories	
13	What do you think should be in your Peripheral Vision?	In terms of RDE, RDP categories	
14	What do you think should be out of your sight?	In terms of RDE, RDP categories	
15	How do you match following incoming information towards expected outcomes?	Driver KPIs/Outcome KPIs mismatch	
16	Do you use any Dashboard/Portal to overview your business and entities?	Provide with paper or electronic overviewing system ...	
17	Do you feel you have the necessary information for doing your job properly (regarding your own and company's principles)?	Descriptive	
18	Do you feel you have the immediate possibility to ask for information and obtain one, to do your job properly?	Descriptive	
19	Name the Reports you are receiving, in terms of way of obtaining: Automated, Semi-automated, Un-automated, and the RDE, RDP category they are reflecting?	Comprehension for the currently positioned information points	
20	How frequently and in which example you have to handle operation issues?	Potentials for delegation	
21	How frequently can you delegate responsibility to a colleague, is it functioning? Please explain		
22	Comment frequency of Activities in the Important/Not-so-important and Urgent/Not-urgent matrix?	Descriptive	
23	What was the performance of the Unit for the past year regarding targets?	Categorized as their specific Business Plan targets (Numeric and Descriptive)	
24	Possible comments on reasons for unfulfilled targets?	Slow reaction, Not enough attracted clients, Internal processes, ...	
25	What does the expression "right-time" information mean to you?	Descriptive	
26	Do you use any methods such as CPM, PERTH, SWOT analysis, in your work? If Yes, which ones and for what purpose?	Yes/No	
27	Do you remember any problem or lost business opportunity or value due to lacking/untimely/inappropriate information? Please explain	Descriptive	
28	Do you sometimes feel that your brain is steaming of overload and responsibilities? Please describe such occurrence	Descriptive	
29	Do you feel that some nice things can never be done because all things are 'burning issues'?	Descriptive	

FIGURE 2.4 GUIDELINE FORM – 3 FOR THE INTERVIEWER

The qualitative analysis of the interviews resulted with the following summary of the findings (Figure 2.5). The purpose of the interviews to feed the research with existing problems regarding tactical management and its support by applied managerial methods and management information systems has been achieved. The interviews contained rich discussions with elaborate themes and qualitative content – that assisted the next step of offering a solution design to address most of those issues.

Regarding the context of the companies, we observed that most of the interviewed managers worked in matrix-organizational structures – and in Make-and-Sell companies (Haeckel 2004), that were governed with top-down principles; or, in the case of SMEs, they were free to change goals and action plans even few times per year. In the matrix-organizational structures, the senior managers felt that they had to pull managers towards actions and

motivate proactivity. This was valid especially for improvements of the system, relations with employees, clients – in general, qualitative issues. However, the business logic in all companies was (i) how to earn profits by satisfying clients; in others (ii) how to earn profits by satisfying clients and employees; or (iii) in the case of SMEs to adapt to changes and pursue the next good thing. The presence of the business paradigm that by satisfying the clients the company would achieve its goals hasn't been recorded. Regarding their perception of the company's IS maturity – regarding People, Processes, Technology, Business Management, the subjective rankings varied from (a) using notes, mails, Excel sheets; through (b) having existing software that covers something but not everything and (c) ERP applications that can answer everything, you just have to put the right question. In these cases the manager still exported the reports and made their own dashboards, calculations and plans. In order to pursue proper goals in the expected manner, the middle managers ought to be aware of the company mission/vision in the same extent as the mission/vision needs to be clear and feasible. However, this wasn't the case and the responses ranked from (i) not aware about the mission; (ii) there is something on the web-site, I'll look it up; (iii) it's about best client service; (iv) the presence of multiple unconsolidated mission/vision statements. These situations disabled all the stakeholders in the proper communication and execution of their efforts to accomplish the goals. Interviewee's personal opinions and approaches have been discussed to a great extent, and the findings involved the following. Most decisions being made in tactical sense have been for the team activities, as projections, while still, the final decisions are done by top management. The expectations from the middle manager position have been unanimous - to do everything with the most limited resources possible 'to be the wizard of the impossible'. With regards to the information at hand offered by the current systems, the answers varied from (a) nothing is in the form that I needed and asked for; to (b) spam reports with data not needed at all. Also, the frequency of the information flows has been from (i) daily e-mail reports about irrelevant (for the specific manager) details – usually never opened or used; to (ii) not having basic info on new recruitments for own department. With regards to the use of time as the most important resource, the managers discussed they were spending most of the time on - communication with clients (solving problems); and least of the time spent on - talking to their people about themselves, problems, career (except in formal appraisals). In their own words, the biggest stress-triggers have been: not being informed on time, especially from other departments; asking multiple times for some necessary information which resulted with the feeling that the manager is chasing to solve 'burning issues' - all the time. With respect to the assessment of the as-is and would-like-to-be situation about the information entities that they need proper information about, the interviewees discussed their (a1) current central vision of perception - Goals, Targets, Reports, Clients; the (b1) peripheral vision – employees; and (c1) out of sight - other departments in the same company. What they would like to have in (a2) central vision – their employees, their projects; what would like to have in (b2) peripheral vision - top management, other departments being dependent on and what they would like to have (c2) out of sight – repetitive and technical steps, for example how to export reports from Excel and do own calculations over and over again; and how to convert own data, calculations and metrics to something understandable as manual or customized reports for top management. Furthermore, with regards to the own management information system setting the respondents had mostly own self-designed Excel + whiteboard with Post-its, Notes and drawings. This arrangement was common for each participant of the middle management/project management profile; the senior managers had nice responsive computer-screen dashboards. With regards to the responsiveness of the management information system, possibility to acquire immediate new information or report; change information structure or characteristics the managers emphasized difficulties. 'If you put request on ERP helpdesk for a modified or new report, it will take months or years – if it's approved within budget'. Tactical management necessitates capturing changes and management information systems did not support flexible managerial information flows on daily basis. The important issue of using scientific methods or tools for managing, business and project planning (CPM, PERT, PMBOK, ...) - the situation has been that the use is personal and upon educational background, or only if something is incorporated in the system.

SUMMARY OF INTERVIEW RESPONSES PER CATEGORIES	
A Company IS Maturity - People, Processes, Technology, Business Management	
1	Notes, mails, Excel sheets
2	Existing software that covers something but not everything
3	ERP that can answer everything, you just have to put the right question (but the manager still exports and makes own calculations and plans)
B Company Strategic Management Approach	
1	KPIs, Goals
2	Top down, measured. Problem how to motivate middle managers to be proactive bottom-up. Various soft skills and engagements
C Business logic of the company	
1	To grow, earn most profits (Make-and-Sell mindset)
2	To grow and earn profits by keeping the clients satisfied
3	To grow and earn profits by keeping the clients and employees satisfied
4	To adapt and 'carpe diem'
D Company Mission/Vision	
1	Not aware
2	There is something on the web-site
3	I'll look it up, it's about best client service
4	Multiple unconsolidated mission/vision statements
E Recording Manager's Opinions and Approaches	
1	Most decisions being made: For the team, projections, final decision are done by top management
2	Expectations from the Middle manager position: To do everything with the most limited resources possible
3	Information at hand offered by the current systems: From nothing is in the form like I need it, to millions of data I don't need. From daily eMail reports about who spent 5 minutes on what - never opened and un-useful to - not having basic info on new recruitments for my department
4	Spending most of the time on - communication with clients (solving problems)
5	Least of time spent on - talking to my people about themselves (except in formal appraisals)
6	Biggest stress-triggers - not being informed on time, especially from other departments; asking multiple times for some necessary information
7	Central vision of perception - Goals, Targets, Reports, Clients
8	Peripheral vision - employees
9	Out of sight - other departments in the same company
10	Would like to have in central vision - My employees, my projects
11	Would like to have in peripheral vision - Top management, other departments I depend on
12	Would like to have out of sight - How to export reports from Excel and do my own calculations over and over again; How to convert my data, calculations and metrics to something understandable for the system reports for top management.
13	Following numeric KPIs and goals - Weekly, Monthly, Quarterly, Yearly KPIs and Business Plans
14	Own Information System setting - Mostly my own Excel + whiteboard with Posted-s, Notes and drawings
15	Feeling of the necessary information for doing your job properly - Somethings are in abundance, others not sufficient
16	Immediate possibility to adjust Information Flows because of change in context - No, if you put request on ERP helpdesk it will be months or years - and out of budget.
17	Scientific methods or tools used in the management, business and project planning (CPM, PERTH, PMBOK, ...) - No, only if something is included in the system
18	Feeling that the manager is chasing to solve 'burning issues' - All the time

FIGURE 2.5 SUMMARY OF QUALITATIVE FINDINGS FROM THE CONDUCTED INTERVIEWS

From our interviews we derive the following general problems and issues for tactical management in companies:

1. Positioning of the own sensors (information flows that detect what the user asks) for information is person-specific, and occurs with what is at hand (worksheets, whiteboards, drawings, stickers)
2. The software systems offer automated logic that doesn't quite serve the middle managers and tactical management needs
3. Provision of Management Information System Self-Support doesn't really exist in practice – existing software systems are rigid and flexibility is expensive
4. There is great deal of unstructured or semi-structured information tactical manager records in handwritten notes or computer scrapbooks

5. The alignment of the Tactical Reasoning with Strategy/Business Plan/Goals is very automatized and mostly quantitative, even though middle managers rely on qualitative and contextual information
6. Managers almost all the time think in terms of processes and efficiency on one side and people and job descriptions on the other
7. There is near real-time information supply (that means overwhelming data supply) but right-time information need (that means structured and timely data, according the manager) for tactical management
8. There is awareness for right content and structure of information but not enough to enforce it to the system
9. The ongoing revisioning of the positioned sensors is manual, person specific, and depends on the manager's energy and efforts
10. There is rare incorporated lightweight science in project management, decision making and problem solving
11. The encompassing of central and peripheral managerial vision in context is hard to achieve
12. There is little support for cross-functional overseeing and communication (especially for projects)
13. The managers need to make sense of small signals and peripheral noise – but can't manage because of too many 'burning issues'
14. The hierarchical level of authority of the middle managers is not sufficient to make the necessary moves

In the next steps of the research, elaborated in the following chapters, we will be addressing most of these issues with conceptual design of the solution artifact as a method aimed for the manager.

2.2. LITERATURE REVIEW

“Tactics play a crucial role in determining how much value is created and captured by firms” (Casadesus-Masanell & Ricart 2009). It is important to define and explore it in details, in order to be able to point out its managerial distinctiveness as well as similarity with the operational, strategic and project management; and the mutual connecting points and dependencies. There is hard time behind doing the tactical management job, trying to coordinate, translate and/or align operations/strategy, details/summaries, management/employees, clients/company, manual/automatized management information systems, human, technical, business, ... aspects of work. The translation and alignment of the mismatch of all these signals, especially observed from the point of view of the person, is highly complex, diverse and changeable, and should be addressed properly. In the continuing challenges for sustainable management information systems, Loucopoulos et al., (Loucopoulos et al. 2006) observe the aspects of ecological complexity – perceiving the double sided nature of the companies and the management information systems as complex socio-technical systems; product complexity; project management – for getting the wrong requirements and not focusing on the outcome of and management information system engineering and implementation; and education. The successful performance of the tactical management function differentiates the success of the company throughout the time, and it is person- and company- specific. Defining and embedding processes and structures in the organization that enable both business and IT people to execute their responsibilities in creating value from IT-enabled business investments (Grembergen, W; De Haes 2009) is a current tendency on the side of the researchers and practitioners, also supported by standardization (such as ISO 38500 – the International Standard for Corporate Governance of IT, ISO 31000 – for Risk Management (International Organization for Standardization 2011)). This motivation is fueling numerous theoretical contributions and business solutions – however the connection points are sporadic, especially when the entire organization or the widest stakeholder structure is observed (Van Grembergen et al. 2004).

This research of literature aims to point out current Management Information Systems contributions in terms of concepts, approaches, artifacts and implementations with regards to Operational, Tactical, Strategic and Project Management, through the lens of Tactical Management distinctive needs – with the aim to reveal the tactical management specific management information system needs and to make visible the junctures where tactical management bridges with operational, strategic and project management. Our standpoint is that tactical management is distinctive from other managerial functions with the:

- High need for adaptability to changing context (organizational and environmental) (motivated in the deep literature investigation in Chapter 3: Heading 1.2.2 – Context capture and situation awareness in dynamic systems)
- Complexity of issues of different nature to be dealt with (motivated in the theoretical concepts elaborated in Chapter 3: Heading 1.1. – Complex adaptive systems, edge of chaos, adaptable/adaptive and purpose, uncertainty)
- Widest scope of stakeholders, entities, processes, developments to be informed about (as our initial standpoint described in Chapter 1: Heading 1 – Research context: starting point – tactical management) confirmed with the Interview investigation (elaborated in Heading 2.1 of this chapter)
- System design approach, prior Process flow (analyzed in depth in Chapter 3: Heading 1.2.1. System design and system thinking)
- Variable set of diverse incoming and outgoing information flows that can't always be predefined, and whose mismatch needs to be addressed (as a standpoint described in Chapter 1: Heading 1 – Research context: starting point – tactical management)

Hence, the tactical management need for management information systems is very specific, and can't be satisfied only with cascading goals, reports and automatized processing logic. It needs theoretical specification, relevance confirmation by real-business research, and special provision by the management information systems. The direction is towards individualized extraction and combination of inputs, dynamic processing logic, immediate environmental and organizational context capture and customizable outputs in terms of information. It also needs continuous revising of the context to be able to sustain towards an outcome in changing context – in order to capture earlier the relevant impulses and have a mechanism for proper response (Welsh et al. 2011). We are in favor of “heterogeneous requirements engineering” (Loucopoulos et al. 2006) in order to avoid social or technological reductionism in sustainable addressing the tactical management function with information. In terms of business pursuit for an “end” (strategic guidelines, KPIs, targets, goals), it is generally a ‘given’ variable. In terms of operations, the prescription of business processes, the pursuit for efficiency and optimization, gives throughout the time (year(s)) certain rigidity and repetitiveness in their existence. However, in terms of tactical management, there are numerous and various in nature specific aspects to be taken care of, while pursuing a goal, with somewhat fixed operational inputs, in terms of alternative paths and adaptations to a very dynamic and generally uncertain and/or unpredictable environment.

In the highly dynamic business world, one should ‘know earlier’ the most quiet peripheral signals that may shape the future of the work – but that is possible only if one points a radar towards them. From this narrative, we would like to point out the tactical manager's duty - to continuously properly position the sensing of information (Sense), and align the mismatch of information received (Interpret) processes and actions (Decide), with some reasoning and maneuvers to translate them in order to provide and control the right path to fulfillment (Act) – SIDA loop (in the Sense-and-Response Framework, (Haeckel 2004)) After confirming the need for adaptability through the Interviews (Heading 2.1 of this Chapter), the concepts of managerial support for adaptability as elaborated in depth in Chapter 3: Heading 1.4 – Sense-and-Respond framework towards providing managerial and informational adaptability for tactics serve as a prism through which this segment of the literature review has been performed. This SIDA loop is perceived as the perpetual engine to adaptability, if continuously run to revise the context (both organizational and environmental). Such capturing of context is of utmost importance for the lens of this research – with the aim not to suffer from the discrepancy between design-time and run-time (Zdravkovic et al. 2013) states of the socio-technical system being managed. The SIDA loop is also enabling more precise mapping of the management information system needs for tactical management, that differ in manner of obtaining, frequency, content, and many other aspects.

We see the tactical management as a very important and flexible crossroad that should be able to trace a number of alternative paths for the existence of any business. This specific nature of tactical management does need specific addressing with Management Information Systems and with Managerial Concepts. The organization of the paper is as follows: firstly, we are delineating tactical management from the other managerial functions; after which, brief definition of the concepts used as baseline, the research strategy and criteria according which the subject papers have been filtered, are explained. The analysis performed upon the research categories and interpretation of results and conclusions are given in the last section.

2.2.1. RESEARCH DESIGN

2.2.1.1. CONCEPTS IN THE RESEARCH

With the abovementioned Tactical Management definition and characteristics in mind, we have performed a theoretical research in order to get deeper insight in the support that the tactical management is having at this point in time, with broad management information systems artifacts, frameworks, methods and tools. To be more specific, the literature research was guided by the following questions: (1) understanding of the essence of the paper, the proposed contribution and its integration in management per level (Operational, Tactical, Strategic, Project) and the proposed combinations, with regards to the positioning of the ‘tactical’ management as adaptable means to achieve management control (Anthony 1965; Gorry & Morton 1971; Simons 1995; Malmi & Brown 2008); (2) analyzing the specific information and processing input for Tactical Management, depending on the used Tools, Methods, Approaches, Artifacts, with regards to the nature of information and communication flows discussed in Chapter 3; (3) detection of how the proposed artifact takes in consideration (used the term “closing” with) an End – may it be performance measurement framework, such as Balanced Scorecard, Triple Bottom Line, ... or Business Plan, KPIs, Goals, Targets, Reason for Being, Purpose, Accountability, with regards to management control and effectuation of strategy; (4) how the work handles the mismatch of the information for tactical management; (5) the prescription of Real-time or tactical management specific Right-time information need; (6) The presence or absence of Sense-and-Respond Framework and the adaptability loop (such as Sense-Interpret-Decide-Act (SIDA) Loop), as elaborated in Chapter 3: Heading 1.4; (7) the support for Adaptability, as elaborated in Chapter 3: Heading 1.1.3 (8) the perception of Predictability in the specific approach (9) the Context capture approach, as elaborated in Chapter 3: Heading 1.2.2 and (10) the artifact’s underlying focus on System Design, Process Design or both, as elaborated in Chapter 3: Heading 1.2.1..

2.2.1.2. RESEARCH STRATEGY

The background idea that is guiding this research is to detect the provisions of adaptability i.e. and Management Information System requirements for tactical management.

The initial stage of the research was performed on 350 theoretical contributions obtained from EBSCO database; Web Of Science Listing of high ranking Management Information Systems journals, Google Scholar engine; Research Gate Portal; searched with the keywords: information systems, management information systems, tactical management information system, operational management information system, strategic management information system, project management information system, business and IT alignment; decision support systems; enterprise architecture, enterprise ontology, business process modeling, business modeling. Also, snowballing technique was used, cross-checking and expanding the search with referenced publications in the initially selected works. This literature review investigates in-depth 25 theoretical contributions published in the time frame of 2004-2015 that are offering management information systems artifacts, implementations and knowledge to the operational, tactical, strategic and project management, using various foundations technologies and combinations, and from different viewpoints. The selection of 25 papers out of 350 was performed according specified inclusion and exclusion criteria. As initial step, we recognized the widest foundations for positioning the management information systems foundations in the categories Enterprise Architecture, Enterprise Ontologies, Business Modeling and Business Process Modeling. With the intention to provide overarching representation of contributions, we have conducted selection of 25 papers to represent extensions in use of these categories. The inclusion criteria was regarding the content of the works – addressing management information systems for operational, tactical, strategic, project management in at least two managerial functions (operational and tactical; tactical and strategic; ...); containing information for tactical management information input, output, handling of mismatch; treatment of real-time or right-time information; inclusion of adaptability or predictability feature; addressing context capture and system or process design in the management information system design. The works that had input for the before-mentioned criteria have been shortlisted and selected according belonging to the use of the four categories, described as initial foundation. Contributions that have been domain specific or business line specific have not been taken in consideration. Another, exclusion criteria was commercialized tools and solutions – the analysis is performed on theoretical artifacts only. Third exclusion criteria was for contributions that are addressing only one of the operational or strategic management, and every artifact in the shortlist addresses at least two of the managerial functions – inevitably including, or overseeing tactical management, which has been very useful to observe.

2.2.2. ANALYSIS

The analysis of the selected literature according the questions stated in the concepts follows:

2.2.2.1. PRIMARY ORIENTATION IN TERMS OF OPERATIONAL, TACTICAL, STRATEGIC, PROJECT MANAGEMENT AND COMBINATIONS OF THE CONTRIBUTIONS

The management information system support for tactical management, we argue, should be approaching the target audience according its characteristics - not generalization as any other type of management. As discussed in the introduction, the tactical management is facing high complexity and unpredictability. Since it is being the way to achieve the expectations of the company's existence, and since it is so much diverse and person- and company-dependent, it is addressed with the general principles of a certain level of management. From this standpoint, it was an interesting quest to see in what way which artifacts are assisting tactical management. Hence, the initial categorization is to be made by which level of management the analyzed papers are focusing on.

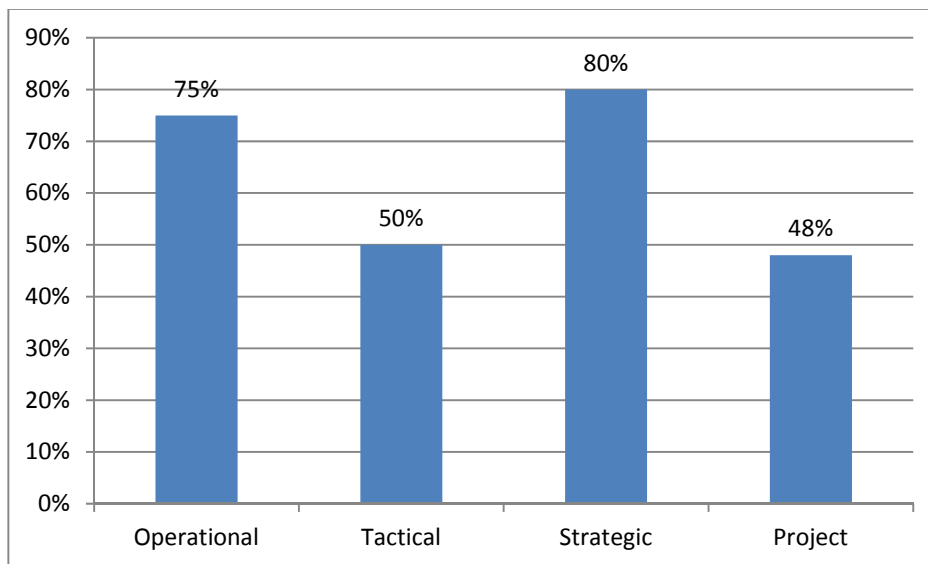


FIGURE 2.6 COVERAGE OF THE MANAGERIAL FUNCTIONS (OPERATIONAL, TACTICAL, STRATEGIC, PROJECT MANAGEMENT) BY THE INVESTIGATED WORKS

Of course, one can argue that this is not complete and thorough literature review but more an “emerging issue that would benefit from exposure to potential theoretical foundations” (Webster & Watson 2002) and as such, conclusions about absence of focus to the characteristics of the tactical management and appropriate management information systems can't be made. However, this investigation shows that there is significantly less coverage in some form addressing tactical management in general, present in only 50% of the papers, while Operational is in a hive of solutions with 75% preceded by Strategic with 80%. Project management has been addressed in 48% of the works (Figure 2.6).

Figure 2.7 shows the combinations that exist in the reviewed artifacts and approaches: interestingly, 30% of the investigated works tend to overarch Operations to Strategy (Iafrate 2013), (Kapoor et al. 2005), (Kim et al. 2007), (Hoogervorst 2009), (Ba et al. 2008) (Bērziša et al. 2015); the one end of Operational and Tactical issues is being tackled by 15% of the works (Chisholm et al. 2008), (Kim et al. 2007), (Hill 2009); and the other end of Tactical and Strategic by 10% of the works (Maes 2007), (Cherbakov et al. 2005) (Francesconi 2012) (Frank 2014) and complete solutions for Operations, Tactics and Strategy are being given in 25% of the investigated works (Barone et al. 2010), (Gill 2013), (Berkem 2008), (Forno 2012), (Haeckel 1999), (Poels et al. 2013), (ISACA 2013)

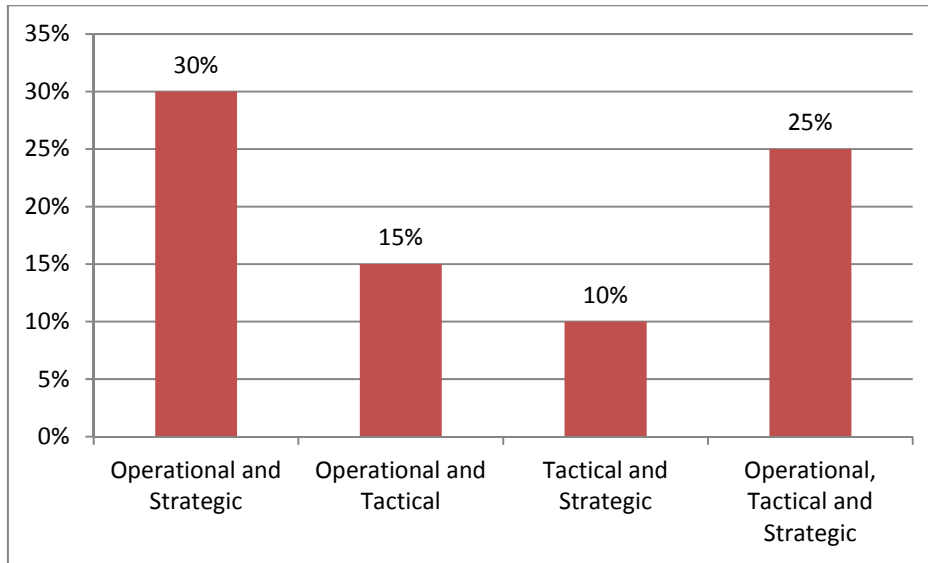


FIGURE 2.7 COMBINATIONS OF FOCUS OF THE MANAGEMENT INFORMATION SYSTEM SOLUTIONS OF THE ANALYZED WORKS IN TERMS OF OPERATIONAL, TACTICAL, STRATEGIC AND PROJECT MANAGEMENT

2.2.2.2. INFORMATION AND PROCESSING INPUT FOR TACTICAL MANAGEMENT, DEPENDING ON THE USED TOOLS, METHODS, APPROACHES, ARTIFACTS

This aspect is browsed through the literature in order to perceive the provision of tactical management with information from the operations and/or wider entities and processes that are happening in the everyday work. This is one aspect that supports our idea that the tactical management is facing mismatch of incoming information vs outgoing information flows and outcome expectations. The idea behind is that tactical management proper information is much more than standard reports or automated dashboards because there are many operations, modifications and maneuvers that need to be done to any incoming data prior the tactical management information is appropriate for use. The solutions in literature are diverse. Starting from wide range of event driven and on-demand data with near-zero-latency Business Intelligence, predictive modeling, incorporating best practices and exceptions management (Iafrate 2013) Big analytics, massive data capture and business intelligence, “what-if” analysis, forecasts and trends (Kapoor et al. 2005), support with processed data and integrated business intelligence (Buckley et al. 2005), as well as use of Business Event Processing, heterogeneous event types, internal and external multiple sources, event processing logic maintained by user – dashboards (Chisholm et al. 2008) and personalized monitoring dashboards (Kim et al. 2007) that incorporate event-driven and on-demand information to be given at hand (Kapoor et al. 2005). Number of contributions are noted using enterprise architecture to facilitate context analysis (Hoogervorst 2009) (Gill 2013), ‘Business Execution layer’ feeding information (Simon et al. 2013). Enterprise modeling is being used in providing design of the sensing mechanism based on the Business Intelligence Model (BIM) and i* (Horkoff et al. 2012), in order to monitor the achievement of strategic goals, develop alternative responses, select the most suitable alternatives, implement and monitor the response (Barone et al. 2010). Frequent is the observation that the tactical choices that are available depend on the business model chosen by the firm in the first stage that depends on the strategy (Casadesus-Masanell & Ricart 2010), while Ba et al. develop method aimed at effectively organizing, integrating, reusing knowledge and model components in direction of providing information and knowledge input for the alternatives, scenario models and model solutions of the decision maker (Ba et al. 2008). With Component Business Model (CBM) (Cherbakov et al. 2005) have seen information support through the componentization and the dynamic processes, while the Business Motivation Model (BMM) and Service Oriented Architecture (SOA) are the basis for designing ‘The Why (Business motivation), the What (Services) and the How (Service Description and Realization)’ (Berkem 2008) to provide organized information supply. Business Process Execution Measurement Model (BPEMM), Business Activity Monitoring (BAM) and Process Mining (PM) are the basis for Overall Business Process execution measurement and Improvement approach that serves the levels of management with relevant BP information (Delgado et al. 2014). Modeling selected Business Processes,

Describing functions, Roles, Alternatives, Actions is the approach used by (Frank 2014) Noteworthy designs for information provision and automated decision-making are seen in the SIFT framework an abstract artifact (a framework comprising of models, measures and a method) for Information Quality improvement (Hill 2009), Integrative framework for Information Management (Maes 2007) where Strategy, Structure and Operations are differentiated and in the Adaptive Enterprise Service System Model (Gill 2013). Goals cascade and the Process-Practice-Activity concepts, especially the inputs and outputs of the Practices being useful for Tactical Management in the COBIT 5 framework (ISACA 2013). Tactical view (for internal aspects of tactic) and Partnership view (for the partnerships among enterprises) are the way of addressing tactic in the TBIM (Francesconi 2012). Core concepts, Ecology concepts, Execution concepts, Evaluation concepts are the main elements which intertwine in the work of (Poels et al. 2013) To end with the other side of this spectrum, with the approaches of Forno and Haeckel, where proper positioning of information sensors with regard to the current accountability is recommended. (Haeckel 2004) (Forno 2012)

2.2.2.3. OUTPUT EXPECTED OF TACTICAL MANAGEMENT ('ENDS')

With regard to the expected outputs or outcomes from the tactical management function, the literature analysis has resulted with the notion that most of the contributions expect the 'endings' to be Key Performance Indicators (KPIs), some of which using the Balanced Scorecard (BSC) as strategic framework, with the following modalities: KPIs (Ba et al. 2008) (Chisholm et al. 2008) (Delgado et al. 2014); Indicators and KPIs (Kim et al. 2007) (Bērziša et al. 2015); KPIs that align with strategic goals (Iafrate 2013); KPIs, Goals and Objectives (Buckley et al. 2005); KPIs and projections (Maes 2007); two loops for monitoring KPIs and ex-post periodic analysis (Buckley et al. 2005); KPIs through BSC perspectives (Kapoor et al. 2005) (Horkoff et al. 2012) (Nalchigar & Yu 2013) (Barone et al. 2010). 'Endings' in broader sense are defined and used as Mission, Goals (Hoogervorst 2009); Goals and Priorities (Gill 2013); Targets, Goals (Cherbakov et al. 2005); Strategic guidelines reflected in the selected business model (Casadesus-Masanell & Ricart 2010); Business motivation, Business Model (Simon et al. 2013); and Metrics (Hill 2009). Business goals as part of the ends drive courses of actions (strategy and tactic), directives (rules and policies) till business processes in the (Berkem 2008) paper. Strategic goals are used in the work of (Francesconi 2012) (Frank, 2014) The RACI charts roles that address tactical manager's role expectations as well as the integrated goal cascades are used in COBIT 5 (ISACA 2013). Evaluation concepts (quality, productivity, legal compliance, sustainable innovation) serve as KPIs in the work of (Poels et al. 2013). To complete the horizon with the Reason for being (Purpose) and the Outcomes accountable for, that are used as 'endings' defined and used by (Forno 2012) and (Haeckel 1999) while achieving whatever indicators a company needs.

2.2.2.4. HANDLING MISMATCH OF INFORMATION

According the previous two concepts, our standpoint that the tactical management position in the middle of Strategy and Operations, Clients and Company and Management and Employees faces mismatch of incoming and outgoing information that needs to be handled in some way. Usually, the additional operations of data exported from the existing systems are performed by the manager him/herself; but there is significant variance in time, quality, personal approach and effects when that operation is performed individually. The theoretical approaches offer different solutions for this problem: starting from Automatized conversions and reasoning of data (Iafrate 2013) and automated decision making (Hill 2009); Sense and Respond Business Performance Management that orchestrates dynamic, structured and unstructured information within a continuous, adaptive event-based planning process, also determines business rules and policies and orchestrates among the value partners to achieve better overall performance (Buckley et al. 2005) through management by exception, most of the data is automatically converted with some prescribed reasoning and processing logic (IBM 2008). Business Process design and KPI definition (Rausch et al. 2013) and essential alignment of measures that are related to business strategy and goals for the entire organization with the ones that are specific for each business process (Delgado et al. 2014) are another type of approaches trying to address the mismatch of information on tactical level. Modeled conversions and reasoning of data are visible in the papers of (Kapoor et al. 2005), (Nalchigar & Yu 2013), (Ba et al. 2008), (Kim et al. 2007), all the way to more specific, short-term, semi-structured modeling possible for Mid-level management control (Barone et al. 2010). "Means (Strategy, Tactics) and Ends (Vision, Goal, Objective) to cover the "total disconnection" of the business processes with the business goals and rules" (Berkem 2008). Comparison of the model (requires vs. produces) is intended to handle the in-out mismatch of information (Frank 2014). Noteworthy for our suggestion for tactics is the design of "establishing capability delivery patterns and context indicators that monitor whether the design for capability delivery is still valid for the current context situation" (Bērziša et al. 2015) Heads Up displays for every role (Haeckel 1999) and no ambiguity in the defined Purpose and Governing principles together with

proper communication and sensors while negotiating towards the outcome (Forno 2012) are the approach that can be adapted to any level of management, including tactical.

2.2.2.5. RIGHT-TIME INFORMATION OR REAL-TIME INFORMATION

Our idea for tactical management underlines the necessity of right-time information, which has some low latency in terms of time and frequency and almost no latency in terms of structure and scope. However, theoretical contributions discuss and strive for real-time information (Iafrate 2013), (Buckley et al. 2005), (Kapoor et al. 2005), (Ba et al. 2008), (Chisholm et al. 2008), (Kim et al. 2007), (Cherbakov et al. 2005), (Delgado et al. 2014), (Barone et al. 2010); or in terms of shortening the latencies (Nalchigar & Yu 2013), (Forno 2012), (Haeckel 1999). Some of the papers are not addressing this issue at all, not being focus of their approach.

2.2.2.6. SENSE-AND-RESPOND FRAMEWORK AND ADAPTABILITY LOOP

We perceive the Sense-and-Respond managerial concept as introduced by Haeckel in 1999 as good starting point for attempting to solve the adaptability, ambiguity, uncertainty and complexity the tactical management is facing with (Petrevska Nechkoska et al. 2016). Its component, the SIDA Loop is the revising mechanism that provides the adaptability to changing environment, circumstances, stakeholder needs and accountabilities. From this standpoint, we submit the reviewed contributions also to these concepts to perceive whether they have been used or not, and with which understanding and implementation. No explicit use of these concepts has been noted in the papers of (Hoogervorst 2009), (Ba et al. 2008), (Kim et al. 2007), (Hill 2009), (Berkem 2008), (Maes 2007), (Simon et al. 2013), (Delgado et al. 2014), (Casadesus-Masanell & Ricart 2010). However, according our perception, the SIDA loop has been implicitly integrated in the BPCIP (Delgado et al. 2014); in the Plan-Do-See-Act design (Kim et al. 2007); and addressed through the Input of the Knowledge Provider, the Processing of the Knowledge Broker and the Output of the Decision Makers (Ba et al. 2008) and Scan&Sense, Interpret&Analyze, Decide&Respond (Gill 2013). In an own interpretation, both terms have been used by (Barone et al. 2010) and separately with BIM to sense and interpret and with their artifact to decide and act (Nalchigar & Yu 2013). The TBIM (Francesconi 2012) uses the automated reasoning techniques, including 'what if' and 'is it possible'; SWOT analysis - all included in the BIM as baseline framework. In the work of (Frank 2014) the MEMO steps (Multiperspective Enterprise Modeling) are prescribed to provide adaptability of the system and processes. IBM's definition and approach to these concepts is visible in the work of (Chisholm et al. 2008), (Cherbakov et al. 2005), (Buckley et al. 2005), (Kapoor et al. 2005) and in a way that the S&R system uses available data, such as forecasts, customer orders, and supply commitments, and aims to provide an early warning system for conditioning with an important innovation - a new algorithm that identifies potential problems by using historical information and future indicators to forecast trends for customer orders and to compare trends and forecast as lead indicators of future occurrences (Kapoor et al. 2005). The core definition, Knowing earlier, Managing by wire, Dispatching capabilities from the event back, Designing a business as a system (Haeckel 1999) as Sense-and-Respond basics are explicitly used by (Forno 2012).

2.2.2.7. ADAPTABILITY

The concept of Adaptability is analyzed in conjunction with modularity, and the deduction is as follows: when the discussion of the authors is in terms of business processes, the adaptability is perceived in their adjustment (Iafrate 2013), predefinition (Kapoor et al. 2005), corporate agility (Chisholm et al. 2008), Monitoring Modeling, Event Modeling, Indicator Modeling, Alert and Response Modeling (Kim et al. 2007), Business Processes and stable and loosely coupled services (Berkem 2008) all the way to setting up continuous improvement cycle for business processes implemented by services in organizations based on BP execution measurements (Delgado et al. 2014). Enterprise design and architecture create the ability to adapt and change for the future and systems thinking is significantly present in the adaptability aspect of the work of (Hoogervorst 2009). Enterprise-wide business processes and setting the context, designing for change, executing the SIDA loop - process for re-engineering the enterprise are significant for Kapoor et al. 2005, while composite services and dynamic processes based on componentization, partner networks; value nets, service oriented enterprise are discussed by (Cherbakov et al. 2005). (Maes 2007) sees the modularity and the adaptability prescribed in the structure of the company, while their determination by the selected business model is present in the work (Casadesus-Masanell & Ricart 2010), (Barone et al. 2010) (Simon et al. 2013), (Ba et al. 2008), culminating with continued focus on responsiveness and adaptability provided by a model-driven capability design and an architectural framework of loosely coupled components for adaptive business management (Buckley et al. 2005). Adaptive Enterprise Service System Model and underlying adaptive enterprise architecture into adaptive enterprise architecture capability for handling complex enterprise transformations based on the view of the enterprise as a system with subsystems are largely discussed by (Gill

2013). Adaptability is not explicitly set up but is recommended in the accountabilities in COBIT 5 (ISACA, 2013). Alternative plans are the prescribed way of addressing adaptability in the work of (Francesconi 2012) and (Frank 2014). The SIDA loop as generator of adaptability, the constant negotiations and the system design of the enterprise existence with flexible role occurrences are used in their generic sense by (Haeckel 1999) and (Forno 2012).

2.2.2.8. PREDICTABILITY

For indirect support of our choice of the Sense-and-Respond concept is the investigation how do all these different authors perceive predictability or unpredictability of the environment into account for their contributions, we performed the scan of the approaches through the lens of this concept. If we set aside the works where this issue hasn't been addressed or not being focused on, there are two general standpoints: attempts to provide forecasting, what-if alternative analysis, extrapolation, optimization and predicting ability to the management, by different tools, algorithms and business intelligence activities (Chisholm et al. 2008), (Kim et al. 2007), (Hill 2009), (Delgado et al. 2014), (Barone et al. 2010) (ISACA 2013), through the variation of identifying runtime variations (Werner 2013) and maintaining lowest latencies possible (Nalchigar & Yu 2013) all the way to assuming unpredictability and uncertainty (Hoogervorst 2009), (Gill 2013), (Forno 2012), (Haeckel 1999), (Cherbakov et al. 2005). Patterns that reflect best practices and their run-time or execution-time adaptation are the specific instrument used in the work of (Bērziša et al. 2015)

2.2.2.9. CONTEXT CAPTURE

Capturing the context is of primary importance for any managerial function. It becomes strikingly observable for tactical management – both in terms of organizational context (changes in purpose, goals, governance, priorities, structure, resources ...) and in terms of the environment (immediate events that influence the work, early signals from important entities or events, ...) “The temporal dimension has been found to play a central role in the understanding of the explanatory factors of IS success and failure in an organizational context (Alter 2013; Pettigrew et al. 2001)” (Dwivedi et al. 2014). The authors Berzisa et al. (2015) and Zdravkovic (2013) define in a plastic way as ‘design-time’ (“by eliciting business goals, Key Performance Indicators (KPI), designing generic business processes and resources, as well as by specifying capabilities, relevant context sets and patterns”) and ‘run-time’ (when the IS ability “to handle changes in different context is put to test”). This concept has been addressed in abundant diversity. We have grouped the findings in regards to contextual scanning in three main directions, and we will present the different original approaches within, by the various contributions:

- Approach 1: Real-time context scanning
 - o Real-time monitoring (Buckley et al., 2005) (Cherbakov et al. 2005) (Maes 2007)
 - o Business Activity Monitoring (Chisholm et al. 2008)
 - o Dashboard with user-defined rules for alerts; Management by Exception (Kim et al. 2007)
 - o Context-Mechanism-Outcome Configuration (Hill 2009)
 - o Zero-latency contextual scanning (Iafrate 2013)
 - o Set the context, Design for change, Execute the SIDA loop - process for re-engineering the enterprise (Kapoor et al. 2005)
 - o Continuous Business Process Improvement; real-time monitoring on business process execution and BP improvement (Delgado et al. 2014)
- Approach 2: Contextual scanning and reaction according needs – potential for ‘right-time’ information
 - o Sense-and-Respond and/or SIDA loop use for context capture (Buckley et al. 2005) (Kapoor et al. 2005) (Nalchigar & Yu 2013) (Forno 2012) (Haeckel 1999)
 - o Scan&Sense, Interpret&Analyze, Decide&Respond (Gill 2013)
 - o Feedback and the Monitoring process (ISACA 2013)

- Context indicators monitor whether the design for capability delivery is still valid for the current context situation (Bērziša et al. 2015)
- Ecology concepts aggregates the service system entities that are involved in the service system and Evaluation concepts(quality, productivity, legal compliance, sustainable innovation) that serve as KPIs that are monitored for realization (Poels et al. 2013)
- Approach 3: Ex-post periodic analysis and comparisons
 - Two loops, monitoring KPIs, ex-post periodic analysis (Rausch et al. 2013)
 - Discrete, What-if and SWOT analysis (Barone et al. 2010) (Berkem 2008) (Francesconi 2012)
 - Enterprise Architecture facilitating context analysis, Learning rather than planning (Hoogervorst 2009)
 - Comparison of the model (requires vs. produces) (Frank 2014)

Our interest in tactical management defines our standpoint that when performing this function, the manager should continuously scan the context both for changes organization-wise (in the goals, governing principles, priorities, ...) that happen occasionally, but also for daily organizational changes (staff, resources, incidents, cascading changes in plans, ...) and environmental changes (competitors, other stakeholders, clients, other departments, ...) Adaptation of the work to all these changes, while still pursuing the given goal, is necessary, especially for the tactical management. From the three approaches observed in literature, we would be in favor of right-time contextual scanning – in order to relief the burden of unnecessary real-time information enterprise systems investments and still provide proper alert for the manager.

2.2.2.10. SYSTEM DESIGN, PROCESS DESIGN FOCUS OR COMBINATION OF APPROACHES

From a managerial point of view, the need for system view, if not even system design, is highest for strategic management and tactical management (including project management), and the accent on process design is needed for operational management. Of course, strategic management pays attention to efficiency and processes, at the same time; while, in our perception, the tactical management puts effectiveness before efficiency – and system design prior process design. There are contributions that address Operational and Tactical Management but persist in the process design usage - 12%, Operational and Strategic Management and still retain the process design – 16% and 4% of approaches that treat Tactical and Strategic Management with Process Design only (Figure 2.8). The rest of the contributions, use either system design or both system and process design because they are addressing the whole company or Tactical and Strategic Management.

Focus on system, process design (content) or both	Operational, Tactical	Operational, Strategic	Tactical, Strategic	Operational, Tactical, Strategic
Process design	12%	16%	4%	
System design			12%	8%
System and Process design		20%	12%	16%

FIGURE 2.8 OVERVIEW OF PROCESS, SYSTEM OR COMBINED APPROACH USAGE IN THE INVESTIGATED WORKS

2.2.3. INTERPRETATION OF THE RESULTS AND CONCLUSIONS

The tactical management specificity should be stressed to a great extent when designing management information systems for the companies. This research reaches several important findings in the direction of under-addressing with specific approach by the management information system contributions; ingestion or assimilation of the tactical by the operational or strategic management; attempts to automatize the handling of mismatch of incoming and

outgoing information; to some extent unnecessary strive for real-time information environments; divided tendencies towards providing adaptability or predictability to the management; diverse ideas for context capturing and treatments of tactical management as process or system.

The feeding with information to the tactical management is done mostly on a technical level of implementation, and usually with structured, automatized data and automatic connections and dashboards. The present tendency of closing with endings by shooting real-time operational data towards strategic dashboards that are performing some sort of KPI monitoring on different levels of management is visible in 30% of the papers  Figure 2.7, which, according to our standpoint, is too big of a distance, and too present of mismatch for feasible implementation in the real business world. Hence, the current support for handling the mismatch of information in the middle is done with automatized logic, that can't always be prescribed, with modeling and incorporation in business processes, but maybe with not exploited enough governing principles and purpose that individualize the conversion logic and bring it down to context and structure.

The top-down approaches starting from strategic level, cascading outcomes, quantitative but also qualitative expectations, are somewhat assimilating tactical management specifics. There is significant 'ingestion' of the tactics by operations or strategy, in the last period of time.

In terms of adaptability, still, the solutions base on the somewhat rigidity of business processes, or their continuous improvement, while tactical management needs flexible support in flexible/unstructured/dynamic processes. Unpredictability is still little concern to the contemporary solutions, which for the whole companies and especially for tactical management should not be assumed. The context capture is of interest in all the contributions, noting diverse ideas and approaches on how to address it. With regards to tactical management the context capture is an ongoing process of revising the current setup – sensing, interpreting what it means to the functionality of the socio-technical system and its outcomes, deciding what should be changed, which is the trigger to being informed and mapping the management information system needs for this function, and acting. Last, but not least, we would like to contribute with the finding that the tactical manager needs system thinking and system design in order to facilitate the socio-technical system towards an outcome and effect, while the efficiency should be a second criterion when reasoning and acting.

Hopefully, this research will turn the lights towards tactical management, as present and making a difference in every pore of life, especially in business, with its specifics and elasticity, rather than general managerial treatment; which should be addressed with appropriate identification of characteristics and followed up by innovative management information systems concepts and solutions.

2.3. IDENTIFYING MANAGERIAL METHODS AND MANAGEMENT INFORMATION SYSTEMS SUPPORT FOR STRATEGIC, TACTICAL AND OPERATIONAL MANAGEMENT

Tactical management is a managerial function that communicates and aligns with strategy and operations and their respective management. Based on the positioning of the problem investigation in Heading 2, and the literature review discussed in Heading 2.2, we start by clarifying our vision of operations, strategy and tactics, analyze their support with managerial methods and techniques, and examine the management information system approaches that are currently at hand for proper support of management in these areas.

2.3.1. STRATEGY

2.3.1.1. MANAGERIAL METHODS

The strategy is perceived as the one “creating fit among an organization’s activities” (Porter 1990). Strategy is “determining the goals of the organization and the set of coherent choices regarding the allocation of resources and activities to realize the goals.” (Andrews 1971). For strategic management, we note concepts such as effectiveness

and organizational alignment. Amongst the many instruments and conceptual frameworks for strategic management, we find the Balanced Scorecard (Kaplan 2010), Triple Bottom Line (Elkington 2001), the Performance Prism (Neely et al. 2001), Skandia's Navigator (Edvinsson 2002), Intangible Assets Monitor (Sveiby et al. 2002), The Tableau de Bord (Epstein 1999) (Bourguignon et al. 2004), The Performance Measurement Matrix (Keegan, D.P., Eiler, R.G. and Jones 1989), the Strategic Measurement and Reporting Technique Pyramid (Lynch & Cross 1991), The Results and Determinants Framework (Fitzgerald et al. 1991), the Levers of control of (Simons 1995), The Input-Process-Output-Outcome Framework (Brown 1996), Objectives and Key Results (Google, ...), the Performance Wheel (McNair & Watts 2010) and others. Many of these approaches require evolving through stages such as strategic mapping, strategy-management-implementation and 'business compass' orientation for value creation and promote balanced measurement systems, mapping the flows and transformations and linking financial to non-financial dimensions of organizational performance (Neely et al. 2003). Here we also identify a great diversity of methods, tools and techniques, such as SWOT, PEST, GAP analysis, Porter's 5 forces, Customer satisfaction analysis, Benchmarking, Customer Value analysis, Product Life-cycle analysis, Cost-benefit analysis and dozens more (Afonina & Chalupský 2013).

2.3.1.2. MANAGEMENT INFORMATION SYSTEMS PROVISIONS

With respect to management information system approaches that support strategic management, there is quite a diversity, stated here according to the managerial framework they are integrating, such as with the use of indicators and KPIs, and such that are using strategic goals, 'ends' in broader sense like mission, goals, strategic guidelines, priorities, outcomes (as discussed in Heading) wrapping up with (ERP) systems, such as SAP, PeopleSoft, Oracle, and Baan. The overarching approaches addressing management information systems in general, and aligning them with the business needs, can also be signified with strategic and/or operational support, or for providing assistance for the managers in organizations. These approaches are diverse, starting from Enterprise Ontologies, Enterprise Architectures, Business Modeling, Business Process Modeling – extended in works such as Component Business Model, Business Motivation Model, Service Oriented Architecture, Business Intelligence Model (BIM) (Barone et al. 2010) and i*(Horkoff et al. 2012), Business Event Processing, all the way to Business Activity Monitoring (Kim et al. 2007), Process Mining, Information Quality Improvement (Westin & Sein 2014).

2.3.2. OPERATIONS

2.3.2.1. MANAGERIAL METHODS

Key elements in contemporary operations management are business processes and efficiency. Appropriate managerial methods and techniques include Six Sigma (Mcfarlane 2014), Theory of Constraint (TOC)(Hois et al. 2009), Total Quality Management (TQM)(Johnston 2008), Lean Six Sigma (Kop et al. 2012), Statistical Process Analysis, Benchmarking, and Statistical Process Control (SPC) (Mcfarlane 2014), Agile (Gunasekaran et al. 2008) and others.

2.3.2.2. MANAGEMENT INFORMATION SYSTEMS PROVISIONS

Operations are nowadays characterized as a "high frequency – low latency environment" (Khansa et al. 2012). The engaged resources and efforts are in direction of closely monitoring every sequence of the operational processes. The real-time data is pumped up towards monitoring the operational processes and their performance indicators. Operations management as "the systematic design, direction, and control of processes that transform inputs into services and products for internal, as well as external customers" (Krajewski et al. 2012) is provided with management information systems support for almost every aspect of the resources and processes. The actualization of IoT, Industry 4.0, blockchain and other disruptive technologies support in the same direction the abundance of ground data that needs to be further structured and contextualized, in order to provide useful information for the managers.

Relevant management information system elements are real time and near-zero-latency business intelligence, big data analytics, massive data capture and business intelligence, forecasts, trends and what-if analysis, integrated business intelligence, Enterprise Architecture, enterprise modeling; all the way through componentization and dynamic processes; Information management and information quality improvement .

2.3.3. TACTICS

2.3.3.1. MANAGERIAL METHODS

With regards to tactics, we are distinguishing priority of effectiveness before efficiency; outcomes over outputs; system before process design. Compared to operational and strategic management, there is a scarcity of managerial methods and techniques specifically addressing tactics. There are tools and techniques such as Work Breakdown Structure, Network Planning, Realistic Scheduling, Accurate Estimating (Verzuh 2005)(Verzuh 2003) and others. Also, the general managerial theories and principles can apply for tactical management, too, but we are trying to point out how it differentiates in the needs for being addressed with a tailored method. On one side, we have the established ground of Project Management, and considered in this sense, the managerial support with methods, tools and techniques is valuable, such as PMBOK, Scrum, Prince 2 (PMI 2008)(ISACA 2013). In surveys of major projects, it frequently comes out that the majority of projects had cost overrun, cost overruns of 50 to 100 percent were common, and overruns above 100 percent were not uncommon (Flyvbjerg 2011). With this remark, we are introducing the need for adaptability instead of just predictability.

To continue with the PMBOK support for Project Management, as managerial function most closely practicing tactical management (the resources, ends, context are given), there are prescriptions on basic process groups and ten knowledge areas coverage (Project Management Institute 2008). The reasons that define 'projects' are becoming the reasons why project management is kind of tactical management but not vice-versa. "A project is a temporary endeavor undertaken to create a unique product, service, or result" (PMI 2008). "A project is a sequence of unique, complex, and connected activities having one goal or purpose and that must be completed by a specific time, within budget, and according to specification" while "project management is organized common sense" (Wysocki 2009). The project management is perceived in terms of 'activities' and 'processes', 'phases', 'sequences' and 'project life cycle', while we are attempting to offer tactical management a 'systems' approach for being adaptable in the everyday dynamics, while continuing for undetermined period of time as in, for example, the Sense-and-Respond framework (Haeckel 2004).

2.3.3.2. MANAGEMENT INFORMATION SYSTEMS PROVISIONS

With regards to management information systems for tactical management, we are starting the argument with their perception by knowledge workers. "For information to be valuable, we therefore need to focus on how information can contribute to smart (efficient or effective, depending on the context) behavior of information workers. Storing information in IT systems is just basic hygiene, but often not contributing to the real value of information." (Baan 2013). Our recent investigation, focused on the tactical management support by the management information systems in their widest scope points out that "there is significantly less coverage of tactical management in general, while Operational is in hive of solutions, followed by Strategic" (Petrevska Nechkoska et al. 2015). Some authors are trying to interconnect business intelligence and performance management, "closed-loop approach" (Devos et al. 2014). The Business Activity Monitoring (BAM) approach also integrates Strategic and Operational levels through the two closed loops, providing, for the Tactical Management needs aspect of informational input, as the "event-driven complement of traditional monitoring" (Schmidt & Wilhelm 2000) or, how we aim to put it, as informational readiness to be invoked by the tactical manager, when needed. "The diffusion of BI into operational and tactical management layers has been discussed under the label "Operational BI"" (Kemper et al. 2013). A "Corporate Performance Management (CPM) Integration Grid" (Rausch et al. 2013) attempts to provide a multidimensional approach where, the tactical management level is cohered to the strategic level. The conclusion that "there is significant 'ingestion' of tactics by operations or strategy, in the last period of time" continues to be supported by investigating the latest contributions in management information systems.

3. DEFINING TACTICAL MANAGEMENT

In the introductory chapter we discussed the nature of tactical management extensively. The interviewees as well as the theoretical definitions lacked clarity on what tactical management is, and how it is different from the other managerial functions. Here, we would briefly step towards providing a working definition that summarizes our standpoint on what tactical management is, and refer to it throughout the research.

As discussed before, we would put ‘tactics’ in the middle of operations and strategy, but definitely not as ‘mid-range planning’. The definition of tactics, even though modestly present in literature, stated by Merriam-Webster dictionary, is as follows: (a) the science and art of disposing and maneuvering forces in combat; (b) the art or skill of **employing available means to accomplish an end**; (c) **a system** or mode of procedure”; deriving from Latin ‘tactica’, from Greek ‘taktika’ meaning ‘fit for **arranging**, to arrange, place in battle formation’ (Merriam-Webster 2016). "Tactics teaches the use of armed forces in the engagement; strategy, the use of engagements for the object of the war." There are basic **principles and governance, rules** as well as constant discussion on purpose and effectiveness that interweave tactics, strategy and deployment of resources in specific time and place (Von Clausewitz 1812). The military prevalence of the definition can be translated to the business context as arranging and employing the available means to accomplish an end (goal). Another definition relates the strategy, tactics and the business model: “Strategy refers to the choice of business model through which the firm will compete in the marketplace. Tactics refers to the **residual choices open** to a firm by virtue of the business model that it employs” (Casadesus-Masanell & Ricart 2009). Here, we are identifying the element of multiple choices that tactics generate. Other theoretical definitions for tactics refer to specific aspects of tactics, such as marketing tactics, risk management tactics and others. To end with the quotes “do not repeat the tactics which have gained you one victory, but let your method be regulated by the **infinite variety of circumstances**”, adding the **context** as essential element for tactics, and “he who can **modify** his tactics **in relation to** his opponent and thereby succeed in winning, may be called a heaven-born captain”, important for our research (Rossi 2009) because of the incorporation of **adaptability** to the opponent (in our terms, the competition, but we would prefer, to the stakeholders and competitors, in the new era of borderless enterprise) and the context. (Giles 1910) Related to the tactics in the new era, we perceive its implications for a setting where “the most productive business strategies will become **cooperative**, not competitive” (Haeckel 1999), and therefore, the tactics to realize these strategies, will be maneuvering for the interests of the widest scope of the stakeholder and supply network, with the mutual resources.

At this point, we are refining our working definition of tactical management as a managerial function as **How** to achieve what is **expected** by **utilizing** what is **given** and following certain **governing principles** in the **current context** of the **organization and environment**.

We would elaborate on the most important fragments of this definition, and their relation with the strategy and operations:

- **How** to achieve (tactics)
- what is **expected** (strategy)
- by **utilizing** what is **given** (operations)
- and following certain **governing principles** (strategic guidelines)
- in the **current context** of the **organization and environment** (adaptability)

The highlighted words are purposefully pointed out to capture the most important traits we perceive distinctive for tactical management – it is the ‘how’ to achieve what is prescribed as ‘expected’ in the strategy (goals, targets, expectations, quantifiable and non-quantifiable results, ...). Of course, one should make decisions and guide the teams, organization, projects according agreed governing principles, since that narrows and streamlines the possible behavior and decision making and provides governance. We perceive governing principles as the shade that overarches all the way from top to bottom of the organization and in all directions in the middle. And last, but most certainly not least, what we would like to emphasize regarding tactics is the capability of adaptability, both within the current context of the organization (i.e., time dimension of context) and the environment (i.e., multi-faceted dimension of the context).

4. DELINEATING TACTICAL MANAGEMENT AMONG OPERATIONAL, STRATEGIC AND PROJECT MANAGEMENT

It is of primary importance for this research to distinguish the characteristics of tactical management as a managerial function. Especially because the proper positioning of this managerial function can serve as a foundation for distinctive addressing with Management Information Systems – and should divert from the current tendency of assimilation of tactical management by operations or strategy (as discussed in Heading 2.2.2). It is not a straightforward task, to point out the similarities and the differences of the tactical management from operational, strategic and project management. However, informed by the interviews (Heading 2.1) and our literature review (Heading 2.2), and taking into account the complex deliberation of adaptability and management information system needs and issues, we propose the following comparison as summarized in Figure 4.1. The ordinal scale used for the categorization is from Very low (1), Low (2), Medium (3), High (4) to Very high (5). Rather than aiming for accuracy, we wish to distinguish in broad lines tactical management from other types of management.

Category of managerial adaptability and management information system needs and issues	Tactical management	Operational management	Strategic management	Project management
A. Business Process design and optimization	Very low (1)	Very high (5)	High (4)	Very low (1)
B. System design and system thinking	Very high (5)	Very low (1)	Very high (5)	High (4)
C. Real-time information	Moderate (3)	Very high (5)	Low (2)	Medium (3)
D. Right-time information	Very high (5)	High (4)	Very high (5)	High (4)
E. Efficiency focus	Low (2)	Very high (5)	High (4)	Low (2)
F. Effectiveness focus	Very high (5)	Very low (1)	Very high (5)	Very high (5)
G. Dependence on resources as a 'given' input	High (4)	Very high (5)	Low (2)	Very high (5)
H. Perception of 'ends' as a 'given' outcome	Very high (5)	Very high (5)	Very low (1)	High (4)
I. Uncertainty level, that influences behavior, results and adaptability	Very high (5)	Very low (1)	High (4)	High (4)
J. Scope of entities captured in the information flows	Very high (5)	Very low (1)	Very high (5)	High (4)
K. Depth and details needed	High (4)	Very high (5)	Low (2)	Medium (3)
L. Frequency of obtaining and updating the information	Medium (3)	Very high (5)	Medium (3)	High (4)
M. Risk consideration	High (4)	Very low (1)	High (4)	Very high (5)

FIGURE 4.1 COMPARISON OF TACTICAL/OPERATIONAL/STRATEGIC/PROJECT MANAGEMENT (DIFFERENCES, SIMILARITIES)

FIGURE 4.2 visualizes on a radar chart the similarities/differences of the Tactical, Operational, Strategic and Project management with delineation of Tactical Management as a filled area.

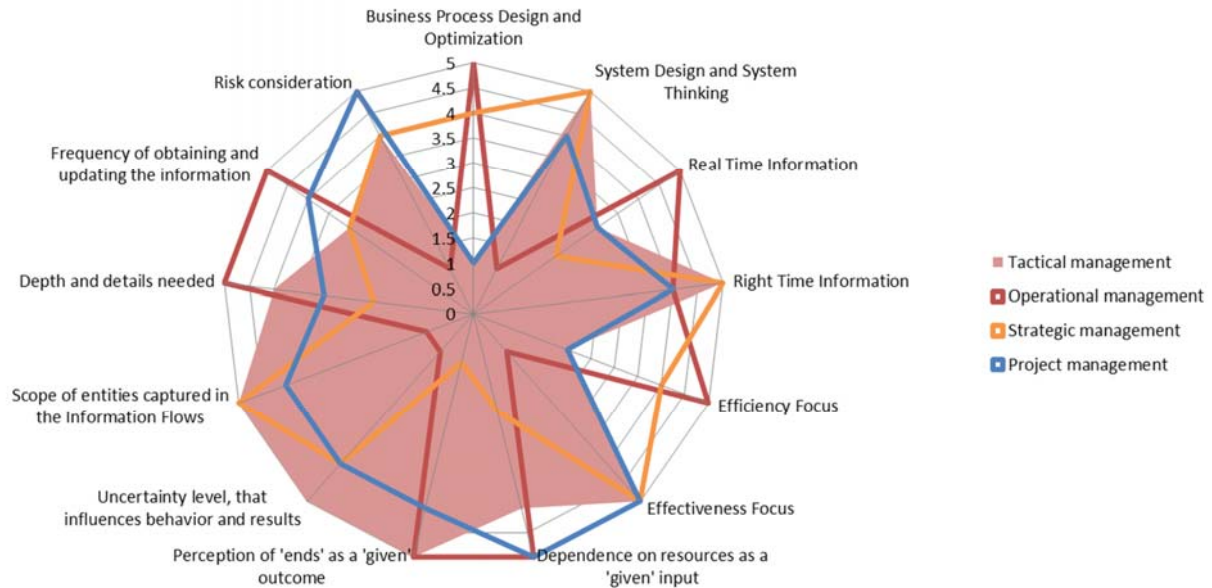


FIGURE 4.2 RADAR CHART VISUALIZATION OF THE SIMILARITIES/DIFFERENCES OF THE TACTICAL/OPERATIONAL/STRATEGIC/PROJECT MANAGEMENT WITH DELINEATION OF TACTICAL MANAGEMENT

Our initial perception was that operational management is striving towards **business process optimization** while strategic management finds equally important both the business process optimization and the system design of the organization as a whole. However, for tactical and project management, it is neither very hard to design a comprehensible process for these managerial functions. This is because they need to provide flexibility and adaptability to numerous changes that happen at any moment, in the organization or outside of it.

Whether proper **system design** is in place, with all necessary components interacting among each other towards a given goal – is of utmost importance for tactical, strategic and project management, while the operational management focuses on the flow of the processes. Hence, the system design and systems thinking is allocated to the higher managerial profiles. When aiming towards a goal, a purpose, with numerous ‘givens’ (in terms of resources, constraints, even in terms of expectations) – the tactical manager needs to provide adaptability to changes having the widest overview of the big picture. Same goes for strategic management, while the project managers are relying on a big picture overview but limited to the interest regarding the scope of the project. The discussed need is lowest for operational management.

The provision of **right-time** data and **real-time** business intelligence has to take consideration justifiable investments, rich contextual data (Schneider 2007) and the 4 V-s (Volume, Variety, Velocity, Veracity) (Embley & Liddle 2013). These investments make sense in operations more than any place else. Conversely, the need and the justifiability of the real-time data for tactical, strategic and project information are much lower. The discussion regarding real-time data imposes focusing on thinking about right-time data. At this point, defining ‘right-time’ data is out of scope of this research.

When examining **efficiency** and **effectiveness**, there is quite a point to be made in making proper distinction among the four managerial functions analyzed in Figure 4.1. Namely, operations generally strive towards efficiency. The effectiveness is more a concern of the overall business process architecture, i.e., the organization of the system of interacting business processes of an organisation. Currently, for project management, the issue of efficiency is rarely possible to focus on, since the projects are temporary endeavors and create unique product or service (Project Management Institute 2004). Effectiveness, on the other hand, is highly strived for, if not over exaggerated. Tactical

and strategic management pay attention primarily to the effectiveness – in order to sustain a pursuit towards purpose(s); but also secondarily, are interested in efficiency – in order to sustain the business through time.

Another important aspect for clarifying the similarities and differences among the four managerial functions – operational, tactical, strategic and project management – is the distinction on how they depend on **‘given’** inputs, ends, constraints, governing principles and constraints. That is to say, when operations are managed, there exist a lot of ‘givens’ and very little autonomy of the managerial actions that could make significant changes to the process or its output. Similarly, projects are pretty much handing the manager ‘given’ resources, expectations, rules of the work and constraints, while the managers should attempt to steer the whole system with what is given. When we are discussing this connotation, strategic management has the least dependence on ‘givens’ since it is in the hands of the strategic managers to make strategic choices on what is given and what can be get from outside the organization (i.e., strategic sourcing). Tactical management faces high level of ‘given’ resources and ends, governance and constraints while being expected to manage adaptively with what is given.

The next category complementing the discussion for managerial dependence on ‘givens’ is the **level of uncertainty** (Simon 1996) influencing the managerial behavior and results. Highest uncertainty is faced by the tactical and project management, to a certain extent, because of the high number of degrees of freedom that these categories face and can’t do a lot to change it. A moderate level of uncertainty is assumed for the strategic management, because of slower dynamics of large-scale changes and because strategic management is in position to alter some parameters and variables in the work of the organizations. The important observation on the need for adaptability is deriving from facing uncertainty, dealing with changes and how certain management profile can influence or has to handle them. “Adapting to the changing environment is competitive factor” (Ahlemann et al. 2012) The need for adaptability is the lowest for operations, moderate for strategic and project and highest for tactical management.

For operations, the **scope of entities** the manager needs to be informed about is defined and limited to the business process entities – because an operational manager relies and adapts to the changes in the immediate environment, while other managerial functions worry about cascading effects of other disturbances. The scope of entities project manager needs to be informed about, is defined by the scope of the project entities and stakeholders. The strategic managers need timely info on widest scope of entities within and outside of the organization – as well as in-depth details on request. Tactical managers similarly, need widest possible scope of entities to be informed about – since they can’t change the numerous givens but need to adapt and design the way how to manage incorporating the givens and the changing environment.

The previous issue complements with the **depth and details of information needed** for successful performance of the respective managerial function. Hence, for operations, the depth of details needed for achievement of operational excellence is biggest; for tactical management – moderate; while for strategic and project management the details are needed per request (e.g., drill-down functionality).

With regards to the **frequency of obtaining and updating information** positioned for the scope of entities in the widest sense, operations note highest, while tactical, strategic and project management need to be informed on regular intervals as well as to be able to invoke and moderate frequency of receiving information per need. The content type prevalence in the information flows is important for organizing the information representation and content for the specific managerial functions. Operations are in primary need of quantitative information, then qualitative; tactical and project management need competing supply of qualitative and quantitative data; strategic management asks for provisions of qualitative, then quantitative data and KPIs.

Considering **risks** is not necessary only as a separate position or function in the management world. At least some basic principles of risk management should be incorporated in any managerial function – in terms of identifying what can go wrong; what controls are currently in place, evaluating the current exposure to the organization (or unit, department, ...); how to reduce and whether and how to carry a cost-benefit analysis for the risk management approach (Miller & Engemann 2012). With this viewpoint, the risk consideration for operational management should be on a low level – meaning only basic alertness and reliance on the already integrated operational risk management instruments and automated mechanisms. The risk presence in the tactical and strategic management should be concurrent with every other essential task of the manager – from moderate level up. For project management the risk alertness and proactivity is on a very high level. Ultimately, the management information system design, needs and proposal for the four managerial functions is given to contemplate the standpoint on managerial functions’ distinctive needs when addressing with information provisioning and adaptability.

5. SOLUTION REQUIREMENTS

Tactical management is a managerial function that effectuates strategy. It welds with the strategic goals and guidelines that (should) become its 'northern star' and uptakes various resources and operations steering them towards fulfillment of what is expected. In time, strategy, operations, resources, environment and context change – and tactics should be adaptable enough to maintain and manage that interrelated and interactive system of entities dynamically. In the analogy with the stars, tactics becomes 'the morning star', announcing daylight and the true path to follow at that specific moment in time and space. The system being steered towards goal(s) is a socio-technical one and requires continuous managerial-informational communicational interchange reflecting in action and reaction of all involved parties. The human resources need facilitation, utilization and guidance, in order to self-motivate and collaborate with each other to accomplish what is expected of them and their interactions. The concept of 'managerial system' needs to be scoped defined, explained and positioned. We are considering the 'managerial system' as a projected system, virtual interface that reflects and visualizes manager's ideas on the mechanisms, components and links that should work towards accomplishment of goal(s) and is shared and communicated with all the entities that are collaboratively interrelated towards the mutual goal(s). This summary sets our challenge's solution requirements and expectations, obtained and identified through interviews and literature reviews, categorized in the following most important ones.

We are aiming for a solution for tactical management that represents a managerial method which provides managerial and management information system adaptability through time. On one hand, the adaptability is needed because of the nature of tactical management to steer towards accomplishment of 'given' goals by utilizing 'given' resources in continuously changing circumstances. On the other hand, equally, and even more importantly than the adaptability as reaction, is the adaptability on initiated change that tactical management inflicts in order to accomplish improvement, growth and fulfillment of goals. For these reasons the managerial mechanisms and information channels need to be functional and multi-directional.

The first level of solution requirements consists of the following:

1. The method should be designed for the manager (for the person) – taking his/her perspective (not organization wide, not for the role of a consultant that acts as intermediary to translate business to information flows and vice versa);
2. Both managerial and management information system elements should be incorporated fully and complementary to each other. In other words, the method should enable continuous business-information system alignment on personal level;
3. Simplicity of use;
4. The method should improve communication of all stakeholders, providing individual and shared situation awareness;
5. The method should enable dynamic multifaceted context capture;
6. The method should take systems perspective and provide managed system design around a purpose and at a level of roles, enabling their pursuit and accomplishment;
7. The method should incorporate risk management

The insights from the interviews guided the researchers to aim for personal support of the managers, with something simple enough to use for their own reasoning and for communicating with the others; structuring manager's own information flows and continuously changing them was a managerial requirement that needs to be addressed with the method, but also getting every various stakeholder from the 'big picture' on board around common purpose(s). The managers also needed informational support without intermediaries for effectuating their informational needs when needed and capturing broad range of signals. They also desired that everyone did their own part of the job – which signaled radical shift from producing an output towards accomplishing outcome. The literature review suggested that an adaptability loop is needed in order to perform continuous scanning of the contextual, environmental changes; and system design along with level of roles (with higher level of genericity than job positions) need to be considered. The personal experience guided the incorporation of risk awareness and risk management in the tactical management adaptability because of the continuous trade-off tactical managers need to do when running a system that produces an effect.

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CHAPTER III

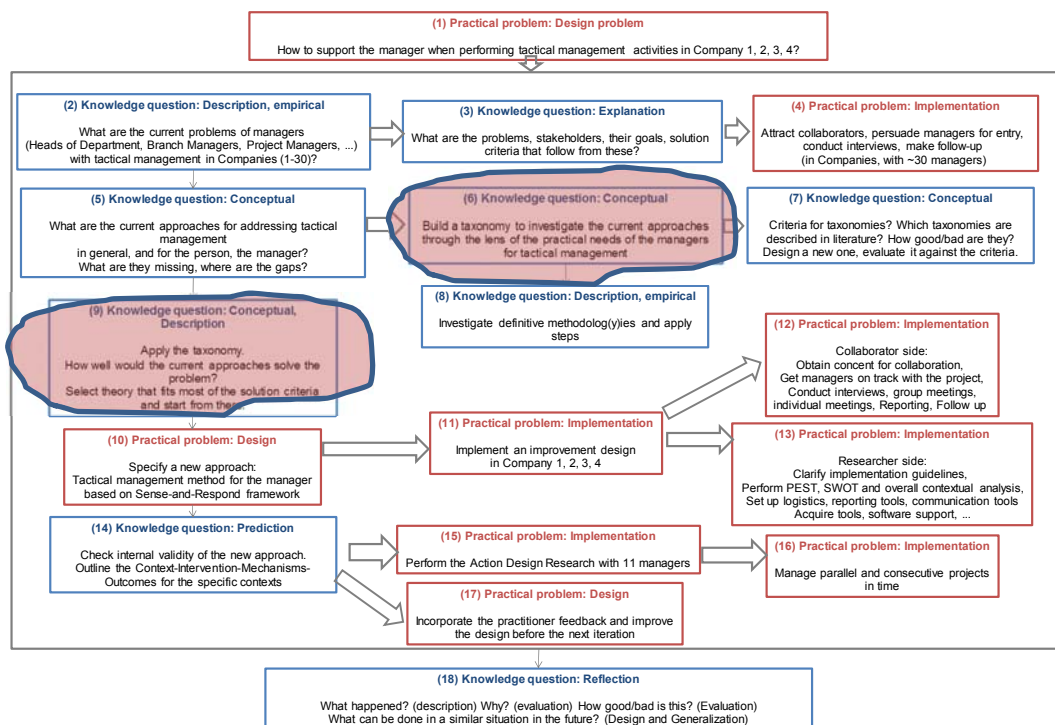
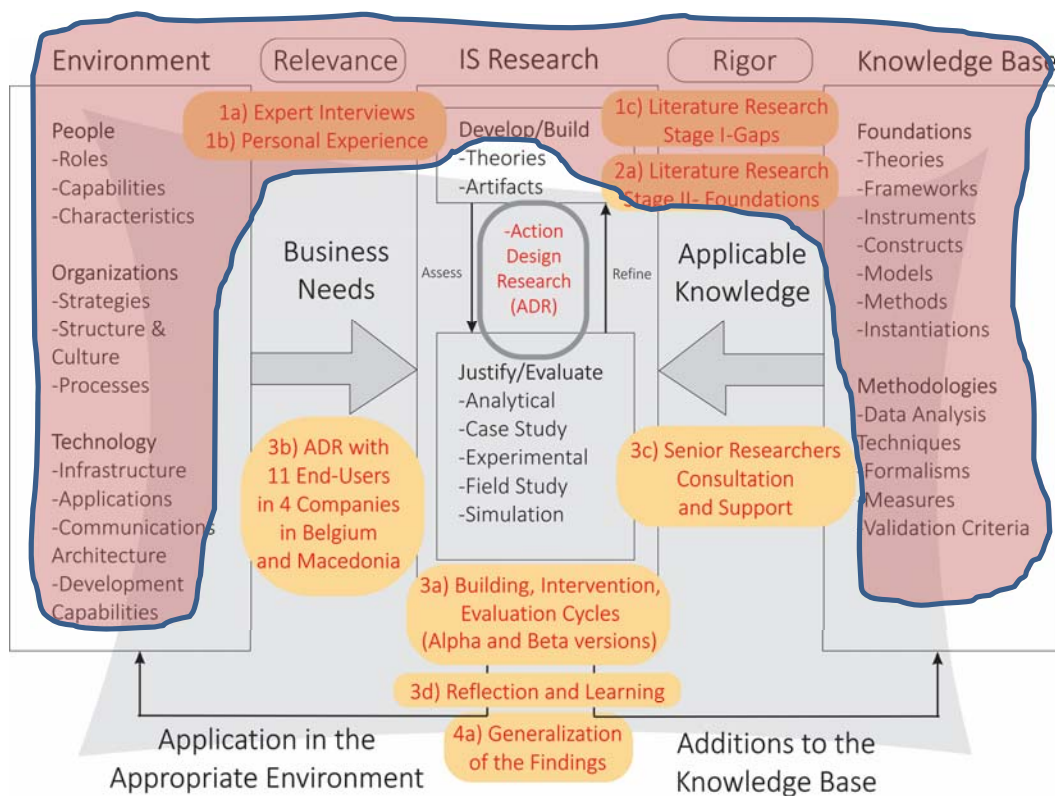
THEORETICAL

BACKGROUND

THEORETICAL FOUNDATIONS

This chapter aims to portray the theoretical construction of the research, and argument how and why it was designed in the described manner. Our initial question in addressing tactical management with a managerial method was – what is the tactical management managing? What kind of organism, mechanism is being managed and which are its characteristics and properties so that the manager can approach them most appropriately. This question has been answered by the Complexity theory and Chaos theory with the Complex Adaptive Systems. The concepts of ‘adaptive’ and ‘adaptable’ are distinguished and clarified for the purpose of defending why we are aiming to design an ‘adaptable’ managerial mechanism to help manage a complex ‘adaptive’ system towards a purpose. The next issue of how Complex Adaptive Systems are to be managed, is investigated through the Cynefin framework, Stacey matrix and Complexity theory – in order to situate the need where our artifact will have biggest use. Then, tactical management’s postulates are examined, in order to incorporate them in the design. These are system design and system thinking, context capture and effective continuous communication and visualization. They enable the introduction of dynamic systems, cognition, cognitive artifacts, cognitive systems, distributed cognition and situation awareness, and very importantly, visualizations and representations of networks, Social Network Analysis and Dynamic Network Analysis. The Management Information Systems for tactical management are conceptualized at one segment, but reflected to in the entire chapter. As a selected response to the specificities of the managed system (CAS) and the tactical management postulates for purposive adaptability, the Sense and Respond framework is introduced. At the end of the chapter, there is a mapping among the properties of Complex Adaptive Systems, Social Network Analysis/Dynamic Network Analysis and Sense and Respond framework, in order to prove the compatibility of the selected theoretical choices that will further on be subject to effectuation and validation through the research. The steps undertaken in this segment of the rigor cycle are structured as follows:

- Elaboration on the particular postulates on what is being managed, in which environment and how to address it (*Section 1 – Particular Postulates on: What is Being Managed, in Which Environment and How to Address It*)
 - o Here we are discussing the Complex Adaptive Systems, their characteristics, behavior and properties; the environment of the edge of chaos as a zone of unpredictability and complexity; the concepts of adaptive and adaptable and incorporation of purpose and what are the recommendations for managing socio-technical Complex Adaptive Systems in uncertainty
- Clarification on the tactical management postulates for purposive adaptability (*Section 2 - Tactical Management Postulates for Purposive Adaptability*)
 - o At this point we introduce the necessity for system design and systems thinking as one important tactical management distinction; context capture as another key element, and effective continuous communication and visualization as a third topic of interest
- Specification of the distinctive traits of the Management Information Systems for tactical management (*Section 3 - Management Information Systems Nature for Tactical Management*)
- Introduction of the Sense-and-Respond Framework towards providing managerial and informational adaptability for tactics, that addresses appropriately the tactical management needs for managing a CAS (*Section 4 - Sense-and-Respond Framework towards Providing Managerial and Informational adaptability for Tactics*)
- Summary of the theoretical framework for the research by mapping Complex Adaptive Systems, the Sense and Respond framework and Social Network Analysis (*Section 5 - Mapping Complex Adaptive Systems, Sense and Respond framework and Social Network Analysis*)



1. MAIN THEORETICAL FOUNDATIONS FOR THE ARTIFACT DESIGN

'We cannot solve our problems with the same thinking we used when we created them'

Albert Einstein

1.1. PARTICULAR POSTULATES ON: WHAT IS BEING MANAGED, IN WHICH ENVIRONMENT AND HOW TO ADDRESS IT

The edge of chaos is an exciting place where evolution happens. If one 'falls off' the edge on one side (figuratively speaking because the edge is a zone, not a thin line), one descends into chaos. On the other side it is much better – it's an uphill designating reintegration at a higher level of growth and complexity. Can we make it there? As humanity, as socio-technical system(s), as natural system, as organizations, value networks, states, as set of interrelated systems influencing each other every step of the way? And how do we make it there? On the opposite side of the chaos? Are we not in chaotic stage already? Are we aware that evolution actually means co-evolution? How can we aim towards the goal of improved life and co-evolution and manage our path to there?

"The complex adaptive social systems view of the world allows us to explore the spaces between simple and strategic behavior, between pairs and infinities of agents, between equilibrium and chaos, between richness and rigor, and between anarchy and control. These spaces lie between what we currently know and what we need to know. They are not subtle refinements on the landscape of knowledge but represent substantial deviations from what we typically assume. The story is told of a geologist who walks to the rim of the Grand Canyon and remarks "something happened here." Social scientists seem to be haunted by their own canyons, and it is time that we actively engage these mysteries and begin to explore them." (Miller & Page 2007b)

1.1.1. COMPLEX ADAPTIVE SYSTEMS (CAS)

We, as humans, are Complex Adaptive System (CAS). Such are the states, unions, insect colonies, immune systems, brains, but also economies, organizations, departments, the world wide web (Mitchell 2009) – they are lower level sub-systems networked together as autonomous agents interacting towards own and collective purposes (Gell-Mann 1992; Garcia 1999; Holland 2010; Lichtenstein, Uhl-bien, et al. 2006; Chan 2001; Gintis 2006; Eidelson 1997; McGrath et al. 2000; Higgs 1999; Miller & Page 2007a; Mitchell & Newman 2002; Waldrop 2013; Center for the study of Healthcare Management 2003). By definition, a complex adaptive system (CAS) is a dynamic network of agents acting in parallel, constantly reacting to what the other agents are doing, which in turn influences behavior and the network as a whole (Holland 1975a). (Mitchell 2009) defines the complex system that is being adaptive as 'a system in which large networks of components with no central control and simple rules of operation give rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution' ((Mitchell 2009), p.13). Such systems have few common properties which are complex collective behavior, signaling and information processing and adaptation (Mitchell 2009). Complex adaptive systems are characterized by diverse agents that interact in a dynamic, open network. This interaction results in an overall system that evolves and adapts to its environment (Nikolic 2009; Van Dam et al. 2012). Several examples of complex adaptive systems are "stock markets, social insect and ant colonies, the biosphere and the ecosystem, brains and immune systems, commercial business (national, international), any human social group-based endeavors in cultural and social systems (e.g., political parties, communities), new product development organizations, inventors/innovators, international relations organizations, unconventional warfare, insurgencies, transnational crime, conventional forces operating under maneuver warfare, revolutionary political movements, ..." (Dettmer 2007) The economic system and its component sub-systems are, undeniably, 'complex adaptive systems' (Foster 2004). When we examine a

productive system, such as a firm, what we see are network structures in which elements are connected by flows that are energetic, material and virtual in nature. Economies and their constituent firms are network structures in which connections are unlimited and thus, they are complex systems (Foster 2004). Until we acknowledge that our societies, our planet and many of its sub-systems are complex adaptive systems and address them accordingly, we will never punctuate the equilibrium (Gersick 2009; Lichtenstein, Uhl-Bien, et al. 2006; McKelvey, Bill; Lichtenstein 2007; Lichtenstein 2000) that necessitates changing to go to the next level. What else is very important about complex adaptive systems? They are open systems, dynamic, adaptive, self-organizing, non-deterministic, with highly interactive elements, with non-linear interactions where small changes can have large effects; to name just few of the most important characteristics. Non-linearity here refers to cause-effect observance of different behavior of a system, so that even though the cause remains the same, the effect the system produces is different. This is because the internal mechanisms and structure of the system is not fully known. Any element in the system is affected by and affects the other systems (Holland 2010) and they produce emergent effect (Edson 2010). “Emergence is, thus a different notion of causality, one that does not depend upon a blueprint or any system outside of interaction itself. In other words, emergent coherence is not due to anything above, below, behind or anywhere else. Emergence is coherence arising in the interaction itself.” (Stacey 2001); it indicates emergence of effect as well as emergence of self-organization (Prigogine & Stengers 1985). Stacey encompasses the definition of complex adaptive systems as ‘an ensemble of independent agents:

- who interact to create an ecosystem;
- whose interaction is defined by the exchange of information;
- whose individual actions are based on some system of internal rules;
- who self-organize in non-linear ways to produce emergent results;
- who exhibit characteristics of both order and chaos and who evolve over time’ (Highsmith 2014).

Are we taking in consideration these scientific and practical findings for ourselves when doing anything to influence and facilitate the complex adaptive systems towards improvement? So, how do we steer a complex adaptive system towards a purpose, a goal? We ought to address this steering with (1) simple rules, (2) creation of moderately dense connections and (3) human rules on how to detect information, how to interpret information and how to act in response (Waldrop 2013). We firmly believe that our human-modeled socio-technical CAS can be steered towards mutual goal(s) and may be motivated to co-evolve together and will be facilitated towards emergent effects by integrating proper brainpower, manpower/womanpower and heart. So far, humanity managed to stay disordered and/or prone to over-simplifying the systems and dynamic contexts, addressing them with improper managerial approaches (Snowden & Boone 2007), when in fact, we are living in complexity as “a description of the complex phenomena demonstrated in systems characterized by nonlinear interactive components, emergent phenomena, continuous and discontinuous change, and unpredictable outcomes. Complexity is usually understood in contrast to simple, linear and equilibrium-based systems.” (Zimmerman et al. 2000).

To wrap up with one more specific of the CAS we are addressing (the managed system consisted of employees, collaborates and other entities that are gathered around a purpose), is that it is a socio-technical system. This denotes that we are addressing systems composed of two deeply interconnected subsystems: a social network of actors and a physical network of technical artefacts. Together, these intertwined systems form a complex adaptive system: a multi-actor network determines the development, operation and management of the technical network, which in turn affects the behavior of the actors. At multiple hierarchical levels the technical network is shaped by the social network and vice-versa, with feedback loops running across multiple levels and time scales (Holland 2006; Kay 2002). Socio-technical systems are a class of complex adaptive systems. These are interwoven in networks of physical and social components, applying and responding to selection pressures and racing to adapt in a fast vast mega-coupled fitness landscape (Kauffman & Macready 1995). Industrial society as a whole is a collection of co-evolving, large-scale, social and technical systems, with multi-dimensional flows of physical matter and social information (Kay 2002). The extreme portrait of socio-technical systems are the Large-Scale Socio-Technical Systems (λ -systems) as a class of systems that span technical artifacts embedded in a social network, by which a large-scale, complex sociotechnical artifact emerges, such as organizations and institutions of a particular industrial system, be it a single plant, an industrial complex, a set of interconnected supply chains or an entire global enterprise (Nikolic 2009). They consist of a large number of diverse technical artifacts, such as machines, factories, pipelines and wires; but also social components, such as policies, organizations and institutions that shape the technical components and at the same time are shaped by them (Bijker et al. 1987).

1.1.2. THE EDGE OF CHAOS

The edge of chaos is a place (zone) we are experiencing or facing, willingly or not. Not that much because we (as humanity) have accomplished the best conditions for co-evolving, but because we are in anarchy and borderline chaotic, in many senses. The edge of chaos as the intermediate state between order and chaos is portrayed by ((Brown & Eisenhardt 1998), p. 14):

“... the edge of chaos lies in an intermediate zone where organizations never quite settle into a stable equilibrium but never quite fall apart, either. This intermediate zone is where systems of all types — biological, physical, economic, and social — are at their most vibrant, surprising, and flexible. The power of a few simple structures to generate enormously complex, adaptive behavior — whether flock behavior among birds, resilient government (as in democracy), or simply successful performance by major corporations — is at the heart of the edge of chaos. The edge of chaos captures the complicated, uncontrolled, unpredictable but yet adaptive (in technical terms, self-organized) behavior that occurs when there is some structure but not very much. *The critical managerial issue at the edge of chaos is to figure out what to structure, and as essential, what not to structure.*” Increased complexity has higher growth but also higher uncertainty (Boehm 1981) (McConnell 1998) (Baccarini 1996) (Lewin 1999) (NASA 2014) (Snowden 2005) (Aroonvatanaporn et al. 2010) (Stacey 1996; Stacey 2011) (Maxwell 2014) and it is where we (as individuals, organizations, socio-technical systems) reside lately.

Whether we can recognize if we are already in the zone of chaos depends on the assessment of the conditions, planning, executing and generating new ways to achieve objectives formidable or even impossible while only “being able to exist” is possible (Banerjee & Ercetin 2014)? If so, what purposive actions should we undertake, to shift towards increased order, or in the zone of the edge of chaos. Because, in the zone of the edge of chaos, in complex living system (Saul 1999):

- Cause and effect link is frequently unknown,
- The importance of planning for identity of self increases,
- Collective intelligence and adaptation of the organization can be improved by increasing connections between people and determining the flow of information,
- Leadership is distributed, dispersed and changes are contextual. Hierarchy is disabled,
- Creativity and adaptability are at the greatest extent on the edge of chaos.

1.1.3. CONCEPTS OF ADAPTIVE AND ADAPTABLE AND INCORPORATION OF PURPOSE

Adaptable VS Adaptive? Difficult distinction to make and it is not semantic. *Adaptable* is something that is responsive when being subject of actions to alter its state. *Adaptive* is something that alters its state to respond to some action. An adaptive system is a system that changes its behavior in response to its environment, and the adaptive change that occurs is often relevant to achieving a goal or objective (Bar-Yam 2008). To be adaptive is to have the property of adaptation, or improvement over time in relation to environment (Van Dam et al. 2012). CAS is adaptive – it changes itself to adapt to the environment and changes its inner and outer environment. Self-organization then makes the CAS adapt to the roles it has, and pursue a goal in appropriate manner. The capacity for self-organisation is a property of complex systems which enables them to develop or change internal structure spontaneously and adoptively in order to cope with, or manipulate, their environment (Cilliers 1998). Complex systems have to “grapple with a changing environment. Depending on the severity of these changes, great demands can be made on the resources of the system. To cope with these demands the system must have two capabilities: it must be able to store information concerning the environment for future use; and it must be able to adapt its structure when necessary. The first of these will be discussed as the *process of representation*; the second, which concerns the development and change of internal structure without the a priori necessity of an external designer, as the *process of self-organisation*” (Cilliers 1998). When comparing the biosphere and the ‘financiosphere’ (Levin & Lo 2016) consider them both as „dynamic systems in which the selfish actions of countless individuals – whether they be cells or investors – lead to unpredictable consequences at the system level. In turn, these collective actions and consequences feed back to influence individual actions in endless cycles of adaptation and evolution. This adaptive cycle is the essence of a complex system. It’s also what makes complex systems difficult to understand,

hard to predict, and tricky to manage“. Because a CAS adapts to its environment, the effect of environmental change cannot be understood just by considering its direct impact. We must also consider the indirect effects due to the adaptive response. Recognizing the way that indirect effects arise from adaptation can help us understand how to influence complex systems in a desired way. Considering the meaning of purpose has been area in which science has traditionally been evasive. Science has the traditional objective to describe natural phenomena without assigning positive or negative valuation to the description. However, the description of complex systems necessitates a notion of purpose, since the systems are generally purposeive. We have to add and identify purpose, value and valuation to our society and civilizations as complex systems, aware that it carries both dangers and opportunities (Bar-Yam 1997).

Adaptable AND Adaptive? Difficult combination to make and it is not semantic. A managerial approach should encompass a mechanism that is adaptable – to the steering actions of the manager. If the managerial method is also a system, once we populate the managerial system (adaptable) with CAS (adaptive) we will have a possible manner how to manage a CAS towards a purpose, towards producing desired effect. The manager translates the organizational or project purpose and goals in the adaptable system, while sustaining the individual and setting collective goals for the complex adaptive system.

An example: Can you take a shoal (group of fish swimming somewhat independently but staying connected) in the ocean to school (swim in the same direction in a coordinated manner)? How can you do it? You can't guide them one by one and make them understand the goal line and get there? You have to reach their inner mechanism that makes them behave in a certain way. These rules are two: stay close to your neighbor and aim to the center of the shoal regardless where you are swimming. They are a CAS. What if you take a net and place it around the shoal, and migrate them to a certain destination. They will adapt to the existence of the net, they will behave their own way by staying together orienting according their principles, and they will move where wanted. The net is our mechanism. The net is directed by the fisherman, adjusted, steered, tightened, released, ... The net is adaptable. The shoal is adaptive. We are in the quest of providing an adaptable instrument for the manager (the fisherman) to be successful in steering an adaptive organism – the CAS (the shoal) (Figure 1.1).

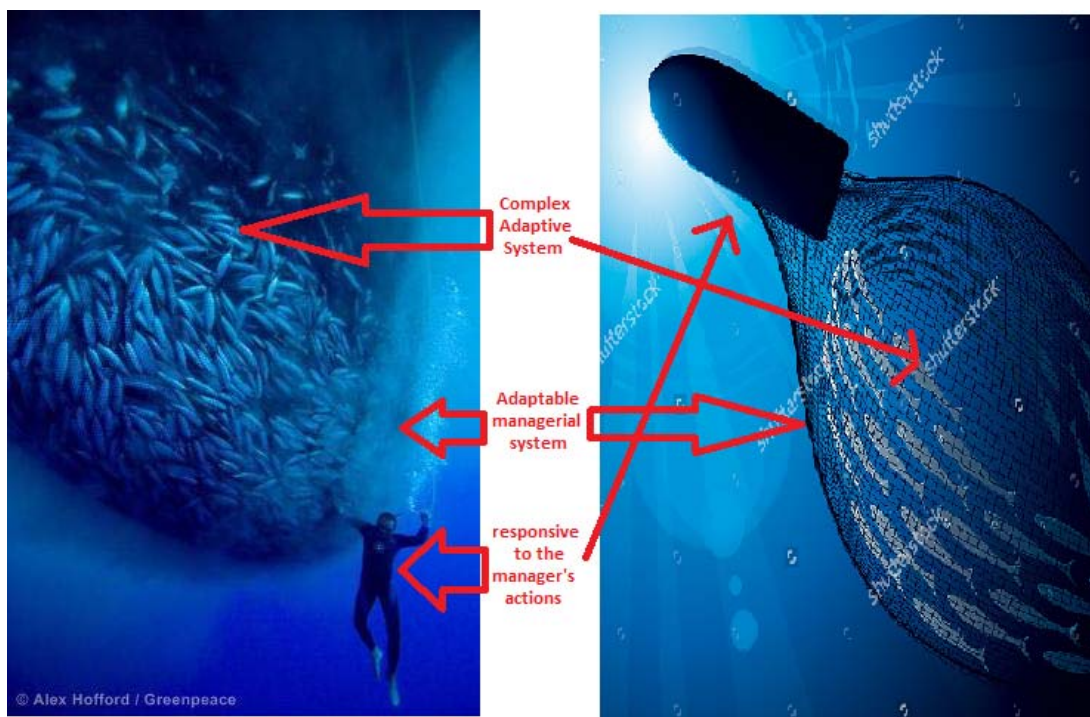


FIGURE 1.1 PRESENTATION OF MANAGERIAL SYSTEM FOR A COMPLEX ADAPTIVE SYSTEM

If we follow (Ashby 1968) – a model system can only model something to the extent that it has sufficient internal variety to represent it. Thus, to be a successful model of a complex adaptive systems, the model must also be a

complex adaptive system (Van Dam et al. 2012). Models of complex systems will have to be as complex as the systems themselves. A theory of representation is essentially a theory of meaning (Cilliers 1998). We are arguing that we need to model the roles that the agents in the CAS are populating and their interrelatedness to produce an effect as a system – such a system should have sufficient internal variety but also causal clarity, in order to be responsive to the manager’s actions – hence simple or complicated adaptability, not complex adaptiveness.

What do we need in order to be able to construct an adaptable managerial system that can steer a complex adaptive socio-technical system? It needs to consider purpose and motivate around it, share governing principles, enable freedom and guidance but not rigidity, it needs to be able to detect the environment and its changes, make sense and considerations and respond accordingly. We will next discuss the theories that guided us on how to resolve these questions in the design of our artifact.

1.1.4. MANAGING SOCIO-TECHNICAL COMPLEX ADAPTIVE SYSTEMS IN UNCERTAINTY

“What great challenges must we tackle to reinvent management and make it more relevant to a volatile world? Managers today face a new set of problems, products of a volatile and unforgiving environment. Some of the most critical: How in an age of rapid change do you create organizations that are as adaptable and resilient as they are focused and efficient?” ((Hamel 2009), p. 1) The organizational forms are evolving, but the managerial approaches and principles – not so much. The ‘modern’ management foundations, more than a century old, could be described as: stability as the objective, analysis by reduction to parts, and cause and effect mechanisms between the parts; the dominating metaphor of an organization is the hierarchical organization (Palmberg 2009a). (Senge 1990) described how managers have a language designed for simple, static problems at hand when facing the challenges of the current business environment of complex, dynamic realities and recommends an ensemble of five disciplines that should help reinvent management for complexity of the managed – shared vision, systems thinking, mental models, team learning and personal mastery. “Good managers fail because their management practices were developed to solve complicated problems, but their problems are much more than complicated; they are complex. Altering fundamental assumptions about how organizations and projects should be managed is a difficult assignment” (Highsmith 2014). The use of the theory of complex adaptive systems to help convince managers of better solutions for their problems necessitates analysis whether and how organizations are complex adaptive systems whether CAS is merely a metaphor for orienting in the space of business complexity. Rapidly changing conditions in our global community are prompting scholars to look more closely at the decision making process in environments fraught with uncertain outcomes (Moerschell & Lao 2012; Gersick 2009). Some call it ‘leadership of turbulence’ (Lane & Down 2010). All this uncertainty poses a tremendous challenge for managing the strategy, tactics, operations, projects. That’s because traditional approaches to strategy—though often seen as the answer to change and uncertainty—actually assume a relatively stable and predictable world (Reeves & Deimler 2011) (Teece et al. 1997). As we have transitioned from industrial to knowledge era, the new core commodity is now the constantly increasing and shareable knowledge – which is not the same as material commodities and competitive advantages of the traditional kind. Sustainable competitive advantage no longer arises exclusively from position, scale, and first-order capabilities in producing or delivering an offering. All those are essentially static. Increasingly, managers are finding that it stems from the “second-order” organizational capabilities that foster rapid adaptation (Reeves & Deimler 2011). Additionally, the technological revolution and globalization of business has ensured a complex, competitive and ever changing business environment and yet businesses are still performing under 20th Century leadership models, less relevant to the current and future environments (Uhl-Bien et al. 2007). Scholars and practitioners create ambitious challenges that management innovators need to tackle so that companies will be able to cope with tomorrow’s volatile world, such as: ensuring management works towards higher purpose, restructuring of management’s philosophical foundations, elimination of the pathologies of the formal hierarchy, setting of direction, democracy of information, empowerment, autonomy, management for an open world, and retraining of managerial minds (Hamel 2009; Breen & Hamel 2007). It appears that the awareness of science and practice is present, but the organizational organisms are still not catching up with feasible implementations of the management of tomorrow. At this point, we will be discussing the common lines among the theoretical contributions that use the preposition of CAS to guide managerial efforts.

One important distinction that needs to be made when discussing managerial approaches to complex systems is the one that follows the entire narrative of our research – between ‘complicated’ and ‘complex’ systems. “If a system — despite the fact that it may consist of a huge number of components — can be given a complete description in terms of its individual constituents, such a system is merely *complicated*. Things like jumbo jets or computers are complicated. In a *complex* system, on the other hand, the interaction among constituents of the system, and the interaction between the system and its environment, are of such a nature that the system as a whole cannot be fully understood simply by analysing its components. Moreover, these relationships are not fixed, but shift and change, often as a result of self-organisation. This can result in novel features, usually referred to in terms of emergent properties. The brain, natural language and social systems are complex“ ((Cilliers 1998), p. 8). As much as this notion is important for perceiving the systems properly, it is even more important for addressing them appropriately, in order to facilitate them towards something, that can be a goal, purpose, effect. Since our research considers a specific standpoint on managing complex adaptive systems, we will elaborate on different perspectives and argument the standpoint on their use.

Regarding *addressing economics and management with CAS*, there are calls that motivate it. The very existence of a common framework is reassuring, in the sense that most of the blind men at least seem to have their hands on the same elephant (Kauffman & Macready 1995) – referring to the common framework of perceiving organizational entities, even whole economies as CAS. The work of (Arthur 1999; Arthur 2011; Arthur et al. 1997) perceives the economy as a system not necessarily in equilibrium, but as one where agents constantly change their actions and strategies in response to the outcome they mutually create; a system where agents are constantly creating an “ecology” of behaviors they must mutually adapt to. Complexity science authors (Zimmerman & Hayday 1999) discuss principles of management that recognize and address organizations as CAS such as: (1) View your system through the lens of complexity (2) Build a good-enough vision (3) When life is far from certain, lead with clockware and swarmware in tandem (4) Tune your place to the edge (5) Uncover and work with paradox and tension (6) Go for multiple actions at the fringes, let direction arise (7) Listen to the shadow system (informal relationships, things to be asked not told, ...) (8) Grow complex systems by chunking (9) Mix cooperation with competition (or coopetition) (it’s not one or the other). The consideration of long-term specific outcomes in the current manner is considered as misplaced, because it is not possible to manage towards them. Aside from influencing control parameters managers still need strategic plans; however, they relate not to outcomes and actions to achieve them, but to methods of affecting anxiety, power, difference, and connectivity (Waldrop 2013). Holland describes seven basics common to all CAS, in the ECHO model: Aggregation of less-complex agents into complex interaction (property), Tagging – markers, flags for orienting the interactions (mechanism), Nonlinearity (property), Flows – of information, matter, energy (property), Diversity – of heterogeneous agents (property), Internal models – to react to stimulus (mechanism), Building blocks – that enable building internal model (mechanism) (Holland 1975b; Holland 2006; Holland 2010).

Some extensions of CAS for management have been attempted by (Palmberg 2009a) for addressing the CAS properties with approaches for managing CAS, (Edson 2010) for strategic management, resilience of project teams and adversity, organizational adaptivity through flexible internal structures that optimize learning, to be achieved in part by structures, internal boundaries, and incentives that allow some of the constraints to be ignored some of the time in the multi-peaked environment (Kauffman & Macready 1995). Haeckel’s (Haeckel 1999) Sense and Respond Framework’s key point is the support of complex adaptive social systems, in which the agents can and do make autonomous decisions about how to do things, and more importantly, about whether or not to carry out, change or ignore their assigned function. The author calls for rigorous application of system design principles to social system organization and advises strategic management on managerial adaptability. Also, the framework complies with the theoretical approaches of clarifying, communicating and sharing common purpose, mission and governing principles, that is a recommended managerial approach for complex systems, on the opposite side of control and planning.

A distinctive framework that combines leadership, context and CAS is the Complexity Leadership Theory (CLT) that enables the learning, creative, and adaptive capacity of CAS by enabling control structures appropriate for coordinating formal organizations and producing outcomes appropriate to the vision and mission of the system. This framework approaches leading CAS while sustaining their adaptive and emergent potential through administrative, adaptive and enabling leadership, making distinctions of managerial positions and leadership, leadership and leaders and the contextual constructions of the interactions and interdependencies among agents (people, ideas), hierarchical

divisions, organizations and environments (Uhl-Bien et al. 2007; Lichtenstein, Uhl-Bien, et al. 2006; Hazy et al. 2007; Livingston & Lusin 2009).

There are theories addressing the complexity and the organizational social and socio-technical complex adaptive systems, with regards to what they need in order to make the most of such systems, and also, what they don't need. In the next sub-headings, we will be referring to what we consider the most relevant ones for our positioning of the design to improve the world of tactical management: the Cynefin Framework, the Stacey Matrix and the Complexity Theory.

1.1.4.1. CYNEFIN FRAMEWORK PERSPECTIVE ON CAS, DISORDER AND MANAGERIAL APPROACHES

The Cynefin sense-making framework provides a broad categorization of the states of systems behavior as: ordered (simple, complicated) and unordered (complex and chaotic), and a specific, very frequent situation in real life, according to the authors, the state (context) of disorder (Figure 1.2, left) (Snowden 2002; Snowden 1999; Snowden 2005). Cynefin is a decision-making framework which recognizes the causal differences that exist between system types, and proposes new approaches to decision-making in complex social environments. The Cynefin model guides the managers towards making sense of complexity in order to act. The disorder as perceived in the Cynefin model, is actually in not knowing which of the domains the organization, the undertaking, the project is in (the unnamed zone in the center of Figure 1.2). The model attempts to broaden the human approach to things as determined and simple, by criticizing it – "... in this world things are deemed to be known or knowable through proper investigation and relationships between cause and effect once discovered repeat. It is the world of the mechanical metaphors of Taylor and most management theorists who came afterwards; it is the Newtonian universe of predictable relationships between cause and effect which can be calculated; the world of the five year plan and the explicit performance target; of hypothesis and empirical proof through observation and explanation of events in retrospect" (Snowden 2005). The latter approach is especially visualized in the framework as the border between simple and chaotic system states – because people tend to oversimplify and try to manage everything through processes, rigid setup and predictions, maintaining in the complacent zone, and falling into chaotic state when crisis occurs. In the Cynefin framework the data precedes the framework, and the sense-making process is actually orienting the manager, considering the data, in which behavioral state the system is in (Snowden & Boone 2007). The managerial approaches proposed by the framework differentiate between ordered and unordered states, and known, knowable, known unknowns and unknown unknowns taking in consideration the cause and effect relationships and strategic approaches to each specific context (Figure 1.2, right). The Cynefin framework "originated in the practice of knowledge management as a means of distinguishing between formal and informal communities, and as a means of talking about the interaction of both with structured processes and uncertain conditions" ((Kurtz & Snowden 2003), p. 467), but is currently disseminated in use in broad areas of strategic management, policy-making, product development, supply chain management, customer relationship management, project and operational management (e.g. agile, scrum) etc. because of its ability to assist managers to orient in the contexts of space, time, complexity and uncertainty they are working in and adjust the use of appropriate managerial methods accordingly.

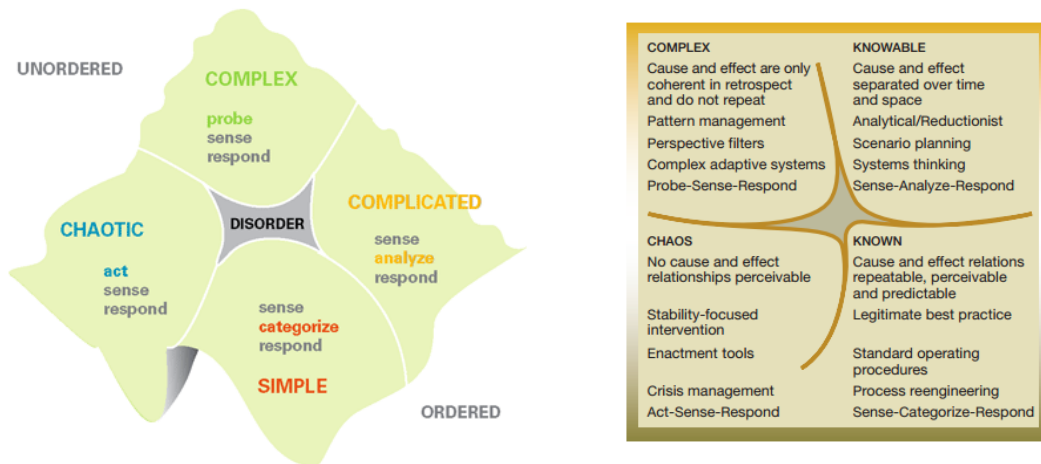


FIGURE 1.2 THE CYNEFIN FRAMEWORK AND RECOMMENDED MANAGERIAL APPROACHES (SNOWDEN & BOONE 2007), (SNOWDEN 2005)

1.1.4.2. STACEY MATRIX PERSPECTIVE ON CAS, EDGE OF CHAOS AND MANAGERIAL APPROACHES

Stacey (Stacey 1996; Stacey 2011; Stacey 2001), on the other hand, discusses the Edge of Chaos (The Zone of Complexity) taking into consideration uncertainty, ambiguity and complexity and their influence on the projects, organizations, groups and teams. His biggest accent is on how complex adaptive systems respond in different organizational group states (linear/stable, complex, chaotic) and how those responses can reinforce the environment through feedback loops (Maxwell 2014). The X-axis (Figure 1.3) denotes certainty of outcome, while the agreement on outcome is presented on the Y-axis. Stacey categorizes various management/leadership approaches that can be communicated with the involved parties in five categories: 1) technical rational decision making, 2) political decision making, 3) Judgmental decision making, 4) chaos and 5) complexity zone (Zimmerman & Hayday 1999). The biggest portion of managerial literature addresses the simple state of 1) where the certainty and agreement on outcomes is high and there exist paths, plans and predictions, and repetitively compare whereabouts with plans, aiming for efficiency and effectiveness. It is a more complicated situation with category 2) where the certainty of outcomes is high, but the agreement which ones are desirable for whom is lower – and political reasoning and negotiations need to take place. On the other side of the complicatedness is a situation 3) where there is strong agreement on the outcomes, shared mission and vision, but following plans can't be undertaken since the certainty of the outcomes is low. The situation in 4) describes chaotic stage where the levels of uncertainty and disagreement are high – and such issues should be avoided, but that can't always be the case. The 5th zone of complexity (bordering the edge of chaos) is where uncertainty is rather high and agreement on outcomes rather low. Here a diversity of approaches is needed while prediction is very rarely possible or accurate (similarly as the initial stages of the cone of uncertainty (McConnell 1998; McConnell 2006; Aroonvatanaporn et al. 2010)). In these circumstances, the managerial methods should incorporate intuition, un-programmable decision making, outcomes rather than outputs, high creativity and empowerment, breaking with the past to create new modes of operating (Zimmerman & Hayday 1999). The overall idea of the matrix is to show the essential behavior of organizational groups as systems (including complex adaptive systems) and how they can transit between states (linear stable, complex and chaotic states); and to divert from the deterministic perspective on how to manage them. The latter is the reality where managers aim for control, rationality and obvious causality, producing 'complexified' simple issues and avoiding complex issues (so called 'fake' complexity vs. real complexity) (Zimmerman & Hayday 1999). The appeal is to "abandon the urge to simplify everything, to look for formulas and easy answers" all of this in order to "begin to think multidimensionally and to appreciate the fact that life is complex." ((Peck 1998), p.14). An attempt to address the 'middle ground problems' founded on the Stacey matrix, is the process enneagram (Dalmau

& Tideman 2011) and it is purposeful enablement of various ‘conversations’ among the involved interrelated parties in a system view, through a simple or complicated (but not complex) model, depending on the problems in context. These efforts go towards the conjunction of the complex adaptive systems specificities and contextual unpredictability – again – to guideline the adjustment of the managerial approaches accordingly in order to fulfill an effect, an outcome.

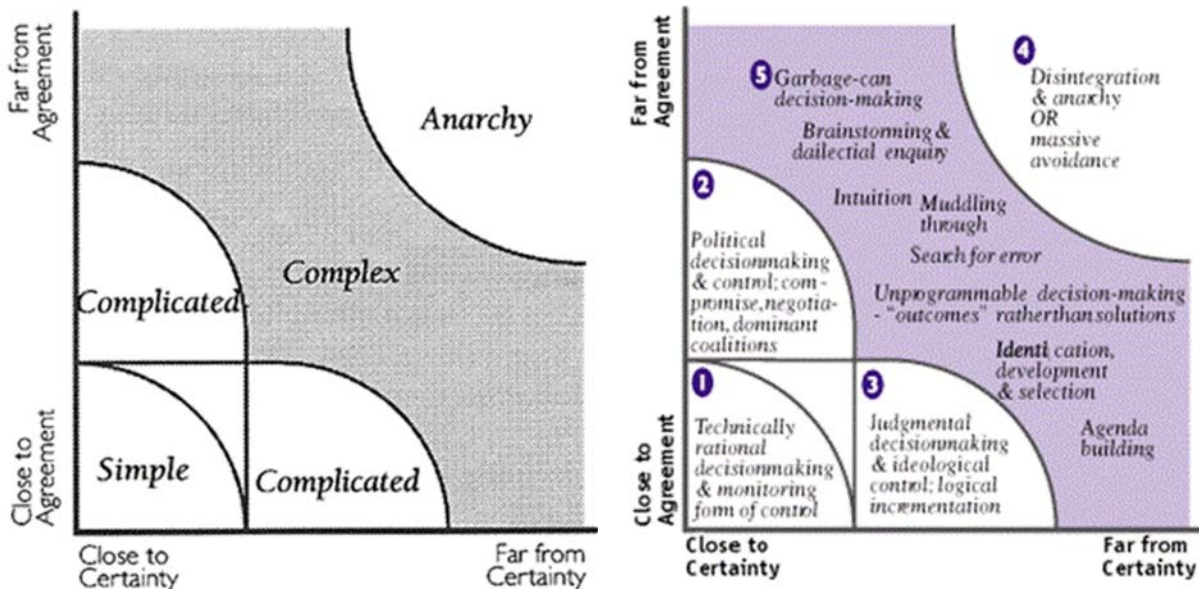


FIGURE 1.3 THE STACEY MATRIX AND RECOMMENDED MANAGERIAL APPROACHES (STACEY 1996)

1.1.4.3. COMPLEXITY THEORY PERSPECTIVE ON CAS AND MANAGERIAL APPROACHES

Holland, in his interdisciplinary pursuit for a general theory of adaptation in complex systems, reflects on the complex adaptive systems as follows: “organisms and organizations are located in networks of complex adaptive groups of agents which interact, adapt and learn. For example, organisms are the adaptive agents within the ecosystem, antibodies are the adaptive agents in the immune system, humans are the adaptive agents in the political system, and firms are the adaptive agents in the economic system. Each agent acts on its local knowledge and experience, and all agents interact together, adapting to the environment. Change and innovation are major characteristics of complex adaptive systems. Variety and change characterize complexity as opposed to simple, linear, and additive relations which are characteristic of Newtonian thinking. ‘While classical science seeks order and stability, but complexity theorists see nature as too dynamic, unstable, unpredictable, and complexly stable to be described with such simple models. Complexity science moves us away from reductionist perspectives that reduce holistic systems to isolated observations — a strategy which may simplify analysis and enable formulaic prescription but which ignores the significant influence of interactive dynamics. Instead, complexity theory encourages us to see organizations as complex adaptive systems composed of a diversity of agents who interact with one another, mutually affect one another, and in so doing generate novel behavior for the system as a whole ... and include processes for managing dynamic systems and interconnectivity’ ((Marion & Uhl-Bien 2001), p.390). This brings attention to the interconnections among the agents and not simply to an individual agent.” ((Center for the study of Healthcare Management 2003), p. 3) Complexity scientists urge for re-examining the role of leadership and management and the role of manager within complex adaptive systems towards: 1) emergence and self-organization, where the manager facilitates and helps capable employees to interact and produce something together, provides collaboration, relations, co-participation 2) the art of managing context, because where there is complexity and unpredictability planning fails, 3) learning to flow with the change, because managers have limited influence on change processes (about 15% discretionary influence, while the rest is shaped by the broader context of the

organization) and it's the manager and the organization who should adapt to it, and 4) the key role of contradiction, with which the managers shouldn't try to dismiss or avoid tensions and changes in the organizations but to leverage the best out of them. Complexity theory sees leadership as 'providing linkages to "emergent structures" within and among organizations' ((Marion & Uhl-Bien 2001), p.391). Complexity Science perceives the individual organizations as part of a connected web of interacting agents embedded in larger networks and systems, distinct from traditional top-down, linear, prescriptive, bureaucratic hierarchies (Center for the study of Healthcare Management 2003; Diment et al. 2009; Zimmerman et al. 2000). Complexity scientists position leaders as tags that influence other persons, processes being associated with action and outcomes, not necessarily with individuals or positions (Marion & Uhl-Bien 2001). "An organization must reside in the heads and hearts of its members. Thus, in the absence of an externalized bureaucratic structure, it becomes more important to have an internalized cognitive structure of what the organization stands for and where it intends to go — in short, a clear sense of the organization's identity. A sense of identity serves as a rudder for navigating difficult waters" ((Albert et al. 2000), p.13). The problems of organized complexity derive from the strong, nonlinear interactions among variables – and the science is no more addressing problems of simplicity, but of disorganized and organized complexity – because of dealing with a sizable number of factors interrelated into the organic whole (Weaver 1948). The comparison of the characteristics (left) and the managerial/leadership styles (right) for complex adaptive systems vs. the traditional systems is presented on Figure 1.4.

"Complex leaders are tags, symbols, rather than brave ship captains guiding their vessels to port. Leaders are part of a dynamic rather than being the dynamic itself. Leaders are one element of an interactive network that is far bigger than they. Complex leaders can perceive those networks; they can help enable useful behaviors, including the expansion and complexification of the networks. They cannot, however, control those networks." ((Marion & Uhl-Bien 2001), p.414)

COMPARISON OF ORGANIZATIONAL SYSTEM CHARACTERISTICS		COMPARISON OF LEADERSHIP STYLES	
Complex Adaptive Systems	Traditional Systems	Complex Adaptive Systems	Traditional Systems
Are living organisms	Are machines	Are open, responsive, catalytic	Are controlling, mechanistic
Are unpredictable	Are controlling and predictable	Offer alternatives	Repeat the past
Are adaptable, flexible, creative	Are rigid, self-preserving	Are collaborative, co-participating	Are in-charge
Tap creativity	Control behavior	Are connected	Are autonomous
Embrace complexity	Find comfort in control	Are adaptable	Are self-preserving
Evolve continuously	Recycle	Acknowledge paradoxes	Resist change, bury contradictions
		Are engaged, continuously emerging	Are disengaged, nothing ever changes
		Value persons	Value position and structures
		Are shifting as processes unfold	Hold formal position
		Prune rules	Set rules
		Help others	Make decisions
		Are listeners	Are knowers

FIGURE 1.4 COMPARISON BETWEEN THE SYSTEM CHARACTERISTICS (LEFT) AND MANAGERIAL/LEADERSHIP STYLES FOR COMPLEX ADAPTIVE SYSTEMS AND TRADITIONAL SYSTEMS (RIGHT) (CENTER FOR THE STUDY OF HEALTHCARE MANAGEMENT 2003)

1.2. TACTICAL MANAGEMENT POSTULATES FOR PURPOSEFUL ADAPTABILITY

We are reverting to the basic interest of our research – managerial and information systems support for tactical management and its adaptability (as profiled and discussed in Chapter 2). Tactical management is a managerial function concerned with ‘how to achieve what is expected by utilizing what is given and following certain governing principles in the current context of the organization and environment’ (Petrevska Nechkoska et al. 2015). These are the residual choices open to a firm by virtue of the business model that it employs (Casadesus-Masanell & Ricart 2010). Adaptability and context-capture are two essential components of this definition. Utilizing the givens and aiming for achieving expectations are other components. Employment of an appropriate business model is another issue. And last but not least – ‘how to achieve’ the goals is the most important one. Regular planning and periodical evaluations are too late and usually simply conclude discrepancies between planned and actual developments and KPIs, in a simple (or perceived as simple) environment.

A system is ‘a whole that is defined by its function(s) in one or more containing systems’. It is ‘a collection of elements that interact to produce an effect that cannot be produced by any subset of those elements’ (Ackoff 1999). The categories such as the system’s function, interaction, effect, non-redundant, elements, sub-system and containing systems are several that are specific to the systems definitions. Our pursuit is to offer systems design for adaptable managerial model that assists tactics.

Why does the mismatch of social systems and their models result in so many system failures? (Ackoff & Gharajedaghi 1996) To answer this question we must “(1) develop a clear understanding of what a system is, (2) identify the kinds of systems there are, (3) identify the kinds of mental models we often use to represent them, and (4) reveal the effects of mismatching a system and its representation?” (Ackoff & Gharajedaghi 1996). These authors analyze the mismatching systems and models of the kinds: deterministic models applied to organizations, organismic models applied to social systems, social-systemic models applied to social systems (the social-systemic organization) and find least mismatch in the third set of social-systemic models of the organizations. After setting in the first section of this chapter the preposition that the managed system is a CAS, we are in the quest of answering similar questions in the kind of system representation the manager should be given, in order to have the least mismatch of the socio-technical complex adaptive system being managed and the mental model of adaptable system representing it. We will elaborate on these issues in the next paragraphs.

To clarify the tactical management positioning in terms of pursuing a system’s purpose (not setting one), we are using the term ‘purposeful’. Namely, Ackoff’s behavioral classification of systems gives (Ackoff 1971) us the distinction between multi-goal-seeking and purposeful behavior of systems and purposeful behavior of systems.

- A *multi-goal-seeking* system is one that is goal seeking in each of two or more different (initial) external or internal states, the goal being determined by the initial state.
- A *purposeful system* is a multi-goal-seeking system the goals of which have a common property. Production of that common property is the system’s purpose. This type of system can pursue different goals but they do not select the goal to be pursued. The goal is determined by the initiating event. But such a system does choose the means by which to pursue its goals.
- A *purposeful system* is one which can change its goals ... it selects ends as well as means, and thus displays will. Human beings are the most familiar examples of such systems.

It is clear that tactical management needs to find the ways to achieve ‘given’ goals, without being in position to dictate a goal. It can also pursue different goals under a same denominator, but does not select the goal to be pursued, while is free to employ the means by which to pursue its goals. Hence, the tactical management behavioral system should be purposeful. On the other hand, the complex adaptive system to be managed is purposeful.

We are aiming to support the tactical management in unordered states of: disorder, complexity and chaos, towards the zone of the edge of chaos, zone of complexity (as discussed in Headings 1.1.4.1, 1.1.4.2, 1.1.4.3) where the complexity and uncertainty are high and agreement on outcomes is low. In this space, every significant goal necessitates a dynamic adaptability framework for managing a complex adaptive socio-technical system towards

producing an effect, which is responsive to the leader's guidance and actions. In these circumstances, every manager needs guidance on how to perceive, approach and act in order to handle the challenges appropriately and effectively.

After taking the standpoint that the nature of complex adaptive systems and the state the world is in will dictate the managerial approach to be chosen for purposive facilitation, we need to clarify the specific prerequisites that tactical management imposes to our design for adaptability. As detailed in Chapter 2, the solution requirements for the method that supports tactical management adaptability that influence the deliberations made at this point, are stated as solution requirements 2) 4) 5) and 6). In brief, they are:

- System design and system thinking (in managerial and information terms)
 - o Business ecology scoping the system boundaries
 - o Level of 'roles' and interactions
- Context capture (in managerial and information terms)
 - o Dynamic structure and content
- Effective communication and visualization (for managerial and information purposes)

We will present and discuss respective theories for each of these aspects in the following sub-headings.

1.2.1. SYSTEM DESIGN AND SYSTEM THINKING

When discussing system design and system thinking in the context of tactical management, we are referring to the following lines of thought:

- What kind of a system should be designed to assist tactical management in its adaptable purposive pursuit?
- Which are its boundaries?
- What are its parts and their relations (interactions)?
- How does that system relate and differentiate from the purposeful complex adaptive system it ought to manage?

To begin with CAS, we need to conclude what kind of system a CAS is, what are its boundaries, parts and their relations. As discussed in the previous heading, CAS is an open system of autonomous agents, networked together, with complex and non-determined processing of inputs into outputs and emergent behavior (Holland 2010). We are claiming that the department or the project team a manager is managing is CAS; but furthermore, also that the widest network of entities in and out of the company (in our case populating roles and having connections) is also a CAS that the manager needs to facilitate (without having direct influence over most of the external collaborators). Hence, the system being managed and facilitated has **external boundaries** and is an **open system**. Organizations are seen as open systems, meaning that the system can only be understood in the context of its environment (Palmberg 2009b). These issues are to some extent properly categorized in the work of (Sparrow 1991) for capturing, mapping and visualizing networks of criminal activities as: size – the networks can be huge, with thousands of nodes and edges, and vice versa; then 'incompleteness - the inevitability of missing nodes and links that the investigators will not uncover; **fuzzy boundaries** - the difficulty in deciding who to include and who not to include and **dynamic** - these networks are not static, they are always changing.' (Krebs 2002)

To conceptually differentiate system levels in the CAS, that represent the basis of the Complex Adaptive Systems framework, (Nikolic 2009) recognizes lowest level – the agent, middle level – the network and top level – the system, situated in an environment.

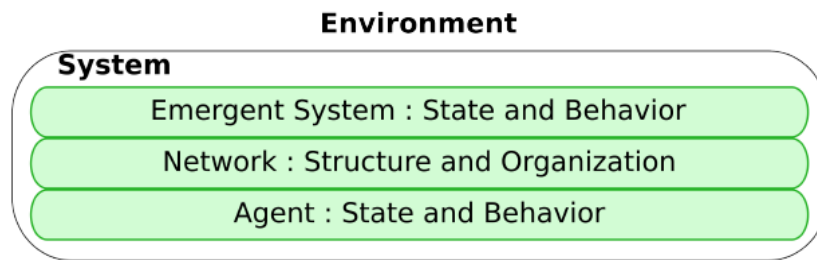


FIGURE 1.5 CONCEPTUAL LEVELS IN COMPLEX ADAPTIVE SYSTEMS (ACCORDING (NIKOLIC 2009))

One important example of a complex system is an ecosystem – with individual organisms, or entire species, being the agents from which an ecosystem is built, and whose interactions take a variety of forms (Mitchell & Newman 2002). To clarify for our question on the elements in the CAS, (Van Dam et al. 2012) consider an **agent** to be a representation of a **decision-making entity in the real world, be it an individual or an organization** (Van Dam et al. 2012) (Zimmerman & Hayday 1999). The agents in CAS **interact in a network**.

We need to cherish the people who dare to **look at “the big picture”** because organizations are not just the sum of their components (agents), but also the intricate relationship between the components (agents) (Gell-Mann 1997). We are trying to avoid problems and to dissect and isolate their parts and address them as such. “One of the most highly developed skills in contemporary Western civilization is dissection: the split-up of problems into their smallest possible components. We are good at it. So good, we often forget to put the pieces back together again.” Alvin Toffler, foreword ‘Science and Change’ in ((Prigogine & Stengers 1985), p.11) The big picture view of the systems is in order to understand the nature and the attributes of the system – it underlines the system thinking aspect of this discussion. It should assist the managers in diagnosing and correcting the adaptable behavior of the system – because of considering the big picture of agents, events, unpredictable changes, predictable changes, risks. We find support in the work of (Moore 2006) “One of the most exciting ideas in business today is that business ecosystems can be “opened up” to the entire world of potential contributions and creative participants. In order for companies to co-evolve their goods and services, they must find ways to align their visions, so that research and development investments are mutually supportive, and capital investments and operating processes are synergistic. Companies must establish interfaces and protocols for putting together their contributions. Most important they must dialogue closely with customers so that what is created is what the customer wants and is willing to pay for. Mastering these challenges, of what might be called “distributed creativity,” is the aim of the ecosystem organizational form.” ((Moore 2006), p.34). The big picture perception of the interrelated and interdependent entities stands strong also in terms of nations, societies, countries where the microeconomic macroeconomic approach to resources, including tangible and intangible ones, determines the competitive advantage and prosperity of a nation. In these cases, risks and threats should be receiving extensive focus and addressing in order to maintain at least a critical infrastructure that will persist in the protection of the nation’s economic potential (Gosselin et al. 2007). The big picture of interconnections among greenhouse gasses emissions, intermediate and underlying drivers and policies and measures is fundamentally present in the environmental research, especially climate change and its mitigation (Blanco et al. 2014). In terms of tactical management, this translates into answering the ‘how’ can this be achieved?

Organizations and collaboration forms are changing and evolving – even though the existing managerial principles not so much (Palmberg 2009a). Products and services are produced in new constellations, in **networks** of actors. The ability to use both **external and internal resources** to solve tasks has become more common. Organizations are increasingly involved in these value networks or **business ecosystems of which they have only limited control** (Hamel 2009) The ecosystem form of economic coordination has become pervasive on the business landscape (Moore 1996; Iansiti & Levien 2004). “Business ecosystems surround, permeate, and reshape markets and hierarchies. Managers establish business ecosystems to coordinate innovation across complementary contributions arising within multiple markets and hierarchies. The activities of business ecosystems set the agenda for “co-evolution” of markets and hierarchies and their outputs.” ((Moore 2006), p.32) The reference here is in terms of perceiving the business ecosystems as an important network that exists and is (or should be) actively addressed by the managers for prosperity of all the participants, considering co-evolution as core concept when studying the CAS and the economy, focusing attention on reciprocal cycles of adaptation among one or more elements of an economic

system. The direction of business ecosystems in this sense is prevalently in terms of how the new ecosystems require leaders who can work across traditional organizational and cultural lines to form a compelling vision that transcends company, industry and often national lines – resulting with organizations that are networks, perceived as networks in the internal and external structure – and a hybrid borderless organization that has hierarchy, networks and accountability (De Bruijn & Ten Heuvelhof 2008)

When we are discussing about big picture and business ecosystem having in mind tactical management – we are immediately transcending the organizational borders and trying to catch the horizon of various entities, events, processes and sub-systems that are influencing our system and the accomplishment of its purpose. If we discuss about different organizations in an industry domain for example, the business ecosystem can be defined as an economic community supported by a foundation of interacting organizations and individuals which produce goods and services of value to customers. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. The ecosystem leader enables members to move toward shared visions to align their investments, and to find mutually supportive roles (Moore 1996). This would mean that in order to sustain adaptable and purposive tactical management, a manager should think in terms of ‘roles’ and visualize how his system of interactions is spread not just within but to some extent outside of the organization, across entire business ecosystem, even the entire world. The behavior of many complex systems emerges from the activities of lower level components (that includes entities populating roles) as a result of a very powerful organizing force that can overcome a variety of changes to the lower level components (Miller & Page 2007a). Even the perception for business ecosystems has been updated and shifted over time towards recognition of CAS properties (Bohensky et al. 2015) considering complexity, uncertainty, management for resilience and adaptive capacity, management of stabilizing and amplifying feedbacks within a broader context etc. We are keeping the standpoint of sharing direction and vision, enabling leadership, roles, feedbacks and broader context – and proposing it for the use of tactical management.

Up to this point of the chapter, we are claiming that the manager is managing a CAS; furthermore, also that the widest network of entities in and out of the company is the CAS that the manager needs to facilitate (but have no direct influence over most of the external collaborators) towards a purpose. It is important to emphasize that it is our intervention that this CAS should be considered in a broad scope, not just the department a manager is heading within a company. The broadest network of entities that are gathered and/or influencing an outcome are members of CAS because they are gathered around a purpose, regardless whether the manager can or can’t influence them, even regardless how aware they are of such a role. The outcome is dependent on each of these performing what their role is in the system. Hence, the system being managed and facilitated has external boundaries and is an open system. It spreads across the world of entities and events, across the broadest business ecosystem. In order to provide adaptable system that can give structure but also freedom to the CAS populating it, the system for tactical management needs to be designed around a purpose and have **roles** (not decision-making entities as agents, not specific legal or physical persons) that interact towards the purpose. It also needs to be adaptable responding on the steering actions of the manager. A ‘role’ as defined in Encyclopaedia Britannica, is: “the behavior expected of an individual who occupies a given social position or status. A role is a comprehensive pattern of behavior that is socially recognized, providing a means of identifying and placing an individual in a society ... The term, borrowed from theatrical usage, emphasizes the distinction between the actor and the part. A role remains relatively stable even though different people occupy the position: any individual assigned the role of physician, like any actor in the role of Hamlet, is expected to behave in a particular way. An individual may have a unique style, but this is exhibited within the boundaries of the expected behavior”¹. As (Kauffman & Macready 1995) discuss about adaptive organizations, they think of each part of the entire system as ‘provider’ and the other parts of the system which it directly impacts as ‘customers’. In this sense, we perceive as interacting system components the roles and interactions among them presenting an interrelated system that ultimately serves a purpose. We are reverting to the reasoning of roles also in Heading 1.4 and in Figure 1.13.

¹Role, in sociology, the behavior expected of an individual who occupies a given social position or status. A role is a comprehensive pattern of behavior that is socially recognized, providing a means of identifying and placing an individual in a society. It also serves as a strategy for coping with recurrent situations and dealing with the roles of others (e.g., parent–child roles). The term, borrowed from theatrical usage, emphasizes the distinction between the actor and the part. A role remains relatively stable even though different people occupy the position: any individual assigned the role of physician, like any actor in the role of Hamlet, is expected to behave in a particular way. An individual may have a unique style, but this is exhibited within the boundaries of the expected behavior. Role expectations include both actions and qualities: a teacher may be expected not only to deliver lectures, assign homework, and prepare examinations but also to be dedicated, concerned, honest, and responsible. Individuals usually occupy several positions, which may or may not be compatible with one another: one person may be husband, father, artist, and patient, with each role entailing certain obligations, duties, privileges, and rights vis-à-vis other persons.

A sketched design of an adaptable system designed around a purpose, consisting of roles and interrelations, that can be used for tactical management is presented in Figure 1.6. Each two roles engaged in an interaction carry the label ‘provider’ and ‘customer’ and the connection between them is what the provider role is accountable for to the customer role (directed line with arrow). For example, the role of a ‘parent’ is a ‘provider’ role while the ‘child’ is in the ‘customer’ role are two very clear roles (and not job descriptions). The accountability from the parent to the child role is visible with the child, the parent can say all he/she did, but what he/she achieved with the child is to be judged from the child’s perspective. The primary purpose will be to ensure the child is healthy, safe, educated and independent in time. There are multiple interrelated other roles as components of a system that results with a healthy child, others with a safe one, educated one etc.

In a business example, a software implementation company can collaborate with a client on big application. The usual setup is that the provider company has own workflow to detect the requirements, work on the application and implement it with the customer. The usual output would be – we installed and the application is ‘live’ now. The measurement of the success would be – testing team says Ok and software is working with users, along with how many working hours have been billed, how much time has been spent and whether the checklist of requirements is addressed. There may even be a ‘helpdesk’ service to troubleshoot problems and issues on regular basis. When discussing roles and purpose and outcomes, things would be different. The primary purpose of engaging with a provider is to solve some problem or support some situation with the customer (not designing an application according specification). The validation whether the purpose of the implementation has been achieved should be done by the customer – by answering whether the problem has been solved or situation supported (not by receiving confirmation from the provider that the application is installed). The role of the provider would be to make sure the right information, specification and live feedback are in place so that the actual problem is detected or situation is mapped. When thinking in this manner, there will be many people or departments populating roles and communicating with broad range of others to make sure what they are accountable for is accomplished, on the contrary of employees stating their part of the job is done.

Just one more example on roles and accountabilities around a purpose – regarding the Sustainable Development Goals and the Planet we inhabit so devastatingly. The Paris agreement² stipulates global response to climate change and requires all Parties that ratified it to put forward their best efforts through “nationally determined contributions” with the guidelines of: (a) holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. This is in the regular making output mindset. When thinking about roles, achieving outcome and purpose, the customer role would be the planet, and the provider role would be the international community leaders. They ought to make sure that the levels of temperature growth aren’t reached, not only by asking countries to do their best in reducing emissions etc. but also by deploying corrective roles and other mechanisms to prevent failure from the promises. This means big picture, roles (not job descriptions), ensuring of an outcome (not dedicating just to output), and designing a system around a purpose (which is given in the SDGs and the a)b)c).

² http://unfccc.int/paris_agreement/items/9485.php

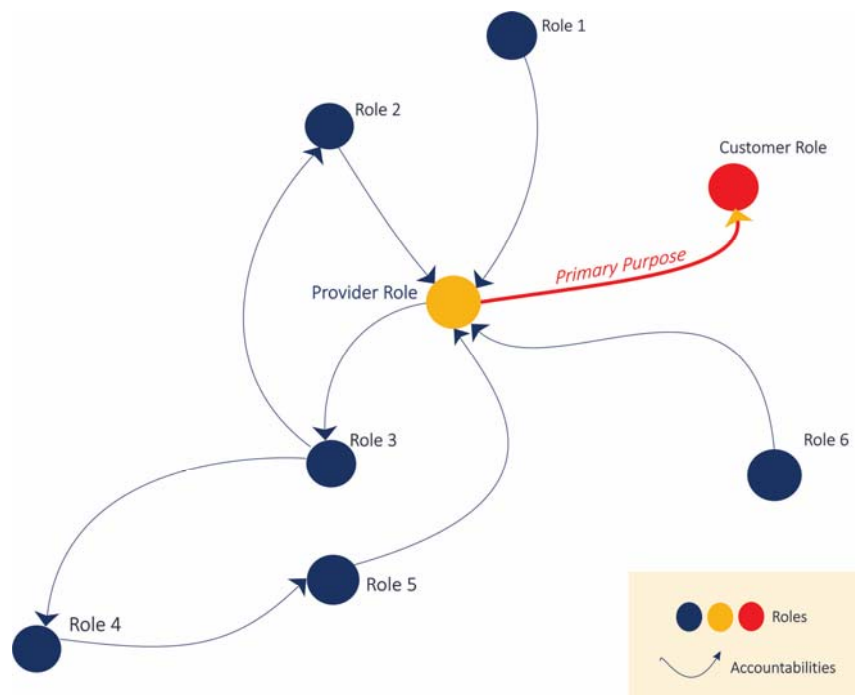


FIGURE 1.6 GENERIC TACTICAL MANAGEMENT SYSTEM OF ROLES AND THEIR INTERACTIONS IN TERMS OF ACCOUNTABILITIES DESIGNED AROUND A PURPOSE

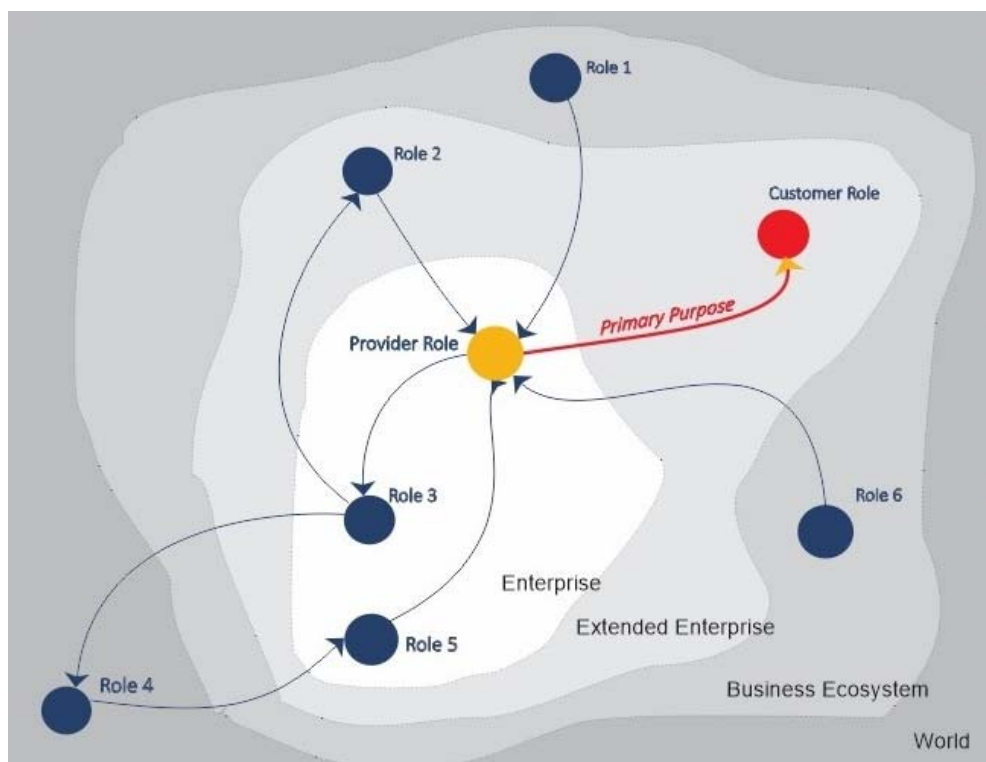


FIGURE 1.7 GENERIC TACTICAL MANAGEMENT SYSTEM OF ROLES AND THEIR INTERACTIONS DESIGNED AROUND A PURPOSE AND SPREAD ACROSS THE WIDEST BUSINESS ECOSYSTEM

Furthermore, if we try to position this system for tactical management use, across the business ecosystem, we would visualize our idea that in order for tactical management to achieve a purpose, with numerous givens, it should look at the 'big picture' and be aware of all roles populated by various agents that influence its effect. Figure 1.7 presents a theoretical spread of the roles and interactions that compose the tactical management system viewed from a 'big picture' perspective. The 'primary purpose' is usually to serve an external customer, out of the enterprise borders; but there are a number of roles that the manager maybe doesn't even control, but needs to be aware of, that compose his/her system and influence the system's behavior and outcome.

We are using again the notion of managerial system. It is a projected system, virtual interface that reflects and visualizes manager's ideas on the mechanisms, components and links that should work towards accomplishment of goal(s) and is shared and communicated with all the entities that are collaboratively interrelated towards the mutual goal(s). The managed system, on the other hand, is the interrelated entities that populate the roles and effectuate accomplishment of goal(s). In our case, the managed system is a socio-technical CAS.

How the complex adaptive system is perceived to fill the roles of the adaptable managerial system is visualized in Figure 1.8. Plane 1 (in light blue color), represents the adaptable managerial system of roles and accountabilities, designed around a purpose. Plane 2 (light green color) and Plane 3 (light purple color) represent agents (individuals and sub-systems) from the complex adaptive system, that populate the roles of the managerial system. There can be N-levels of planes between Plane 1 and the plane at the bottom level (in this case Plane 3) because they (such as Plane 2) denote sub-systems, so each role can actually be a customer role of a sub-system of roles and accountabilities; or can be populated directly by individuals or groups. These agents all have individual but also collective purposes. They ought to be steered towards desired purpose with the adaptable mechanism of the tactical management system.

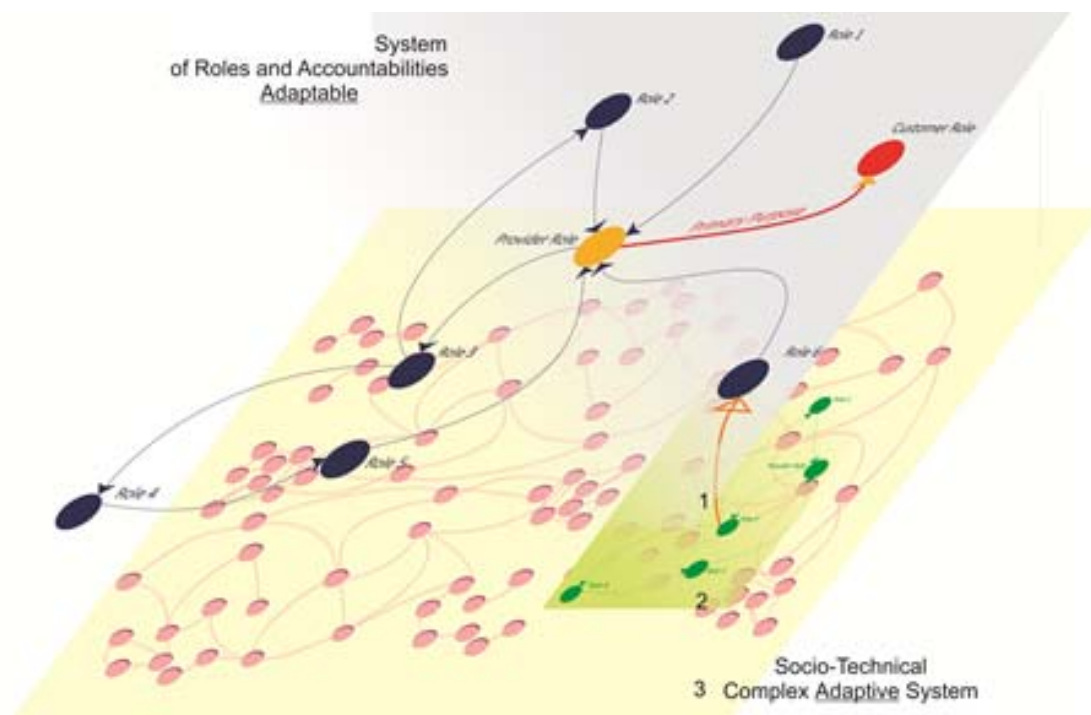


FIGURE 1.8 COMPLEX ADAPTIVE SYSTEM POPULATING ROLES AND ACCOUNTABILITIES OF TACTICAL MANAGEMENT ADAPTABLE MANAGERIAL SYSTEM

There are four main reasons why we consider tactical management in definite need of adaptability:

1. The unpredictability and dynamic nature of the environment – complex environment
2. The number of ‘givens’ the tactical management needs to work with – starting from purpose, goals, through resources, through the entities that populate the roles in the broad business ecosystem we spread the tactical management system of roles and accountabilities. Each of them are ‘given’ and out of the influence of the manager – so that the only option is to adapt to them; and almost all of them are dynamic in time.
3. The initiated changes by the manager towards goal(s) (for improvement, efficiency, etc.)
4. The main constituent it manages – a complex adaptive system – which is a great source of changes itself

It comes as a natural conclusion to us that the tactical management’s adaptability is the core characteristic that makes a difference whether the system will produce the desired effects in time or not. The set of residual choices that the manager needs to maneuver with is the competitive advantage tactical management can offer to the businesses, especially, but not exclusively, in dynamic environment. And the interactions between the managerial simple adaptable system and the complex adaptive system are expected to shape the path towards managing a complex adaptive system towards goals – in pursuit of collective purposes. It’s because of the fact that CAS communicates with the environment both changing it but also adapting to it, we would like to place the managerial adaptable system as a sort of environment for the CAS. The managerial mechanism of the managerial system should be adaptable in response to the manager’s deliberate actions in order to keep focus on the purpose, and it should represent a guiding framework to which the CAS adapts to (Figure 1.8). This relates directly to the solution requirements stated in Chapter 2. But, at that stage, we perceived the changes generated by the second and third reason discussed above, while the first (complex environment) and the fourth (the complex adaptive system populating the roles) came from this ‘rigor’ cycle discussed in this chapter.

1.2.2. CONTEXT CAPTURE AND SITUATION AWARENESS IN DYNAMIC SYSTEMS

When discussing complex natural systems, (Mittal & Zeigler 2015) are observing how adaptive agents in a resource limited environment optimize their behavior – which is by processing only the most relevant information, obtained and effectuated in action through the cycle of sensing, processing, synthesizing and actuating information. These authors argued that while attention switching occurs naturally, the focus of attention is a deliberate, top-down phenomenon guided by a goal-directed behavior. In our reflection, CAS also reads and locates the most necessary information according its purpose, and there is deliberate purposive scanning of the context according instant, medium and long-term needs to fulfill own accountability and ultimately, the system’s purpose. The brain has a remarkable feature in its ability to flexibly process information in a context-dependent manner (Harnack et al. 2013). If we observe the technical aspect of engineering and developing context-aware software applications, we would recognize the need for facilities for recognizing the context, reasoning on it and adapting accordingly. Agents must be able to sense and manage context but also to communicate and to understand each other about it (Bucur et al. 2005). If we observe the managerial aspect of engineering and developing context-aware managerial methods and models, the same need persists – to capture the context, reason on it and adapt accordingly. Out of the numerous definitions of context that incorporate the person, location, environment, identity, time, or environment, situation, ... (Bucur et al. 2005) (Brown 1998) (Vieira et al. 2007), we are considering general definitions of context and more streamlined ones for the purpose of information needs. The International Organization for Standardization (ISO), refers to context in the standard ISO 9001:2015 for Quality Management Systems, by placing a requirement for the organization to determine which issues (both internal and external) could impact its ability to meet its objectives and a requirement for the organization to identify interested parties, as well as their needs and expectations (International Organization for Standardization 2015). In this standard, the perception of context embodies internal context (as the environment in which the company aims to achieve its objectives - its approach to governance, its contractual relationships with customers, its interested parties; along with culture, beliefs, values, or principles inside the organization, as well as complexity of processes and organizational structure) and external context (issues arising from the company’s social, technological, environmental, ethical, political, legal, and economic environment, for example government regulations and changes in the law, economic shifts in the organization’s market, the organization’s competition, events that may affect corporate image, changes in technology) (9001 Academy 2016). This perception of context parallels and supports the generic positioning of the system of roles and accountabilities

in the widest business ecosystem presented in Figure 1.7 where we claim to direct and assist the manager look the big picture and the entire interrelatedness of roles they can and/or can't influence, but need to consider when managing a system towards a purpose. Through the lens of managers' information needs, we use the following definition: "context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves." ((Dey & Abowd 1999), p.3) We will be examining the following context facets device, user, task, data source, document representation, time, geographic location. Context capture incorporates answers to the questions: 'who', 'where', 'when' and 'what' is happening so that the entities in specific roles can determine the 'why' (Dey & Abowd 1999) and know 'how' to act in response. The mechanisms of 'how' to act in response (regardless of the content) are subject of our addressing with an artifact. For this reason, the artifact needs to enable positioning of the managerial view, reasoning and actions in the broadest sense and adapt or initiate adaptation while pursuing purpose(s).

1.2.2.1. COGNITION, COGNITIVE ARTIFACTS, COGNITIVE SYSTEM

The theory that will guide our artifact design with regards to the importance of context capture and its reflection on tactical management managerial and information system adaptability is the situation awareness in dynamic systems (Mica R Endsley 1995; Endsley 2000; Endsley 2015; Saner et al. 2009; Miller et al. 2005). Cognition is a conscious mental activity that incorporates the activities of thinking, understanding, learning and remembering (Merriam-Webster Dictionary 2016). Cognition is the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses (Oxford English Dictionary 2016). Cognitive artifacts are made by humans for the purpose of aiding, enhancing or improving cognition – various kinds of cognitive artifacts that support not only memory, but also reasoning about classification and comparison. Examples range from a string tied around the finger as a reminder, a calendar, a shopping list, a to-do list and a computer (Wilson & Keil 2001). By trying to assist the manager (and his/her team, collaborators, managed system) to steer towards a purpose in uncertain environment in an adaptable manner, we are to a large extent interested in improving the managerial cognition, in the first place, and the entire system's cognition, in the second. A cognitive artifact is "an artificial device designed to maintain, display, or operate upon information in order to serve a representational function." ((Norman et al. 1991), p.1) However, in (Norman 1993a) the definition is relaxed so that the cognitive artifacts include "mental as well as material elements. Rules of thumb, proverbs, mnemonics and memorized procedures are artefactual and play a similar role to objects in some cognitive processes" ((Wilson & Keil 2001), p.126). We are deliberately directing the definitions towards our support for tactical management with a cognitive artifact – a method, for the person that aides and enhances cognition in order to accomplish a goal. As secondary effect, the artifact should provide assistance to the entire team that works towards that goal. The key aspects or features that need to be explicitly taken into account by cognitive engineering and cognitive systems engineering according (Woods & Roth 1988; Endsley et al. 2007) are:

- (a) the importance of *context*, examining what people actually do given real-world situations, goals, and constraints;
- (b) the importance of the *accessibility and utilization of situation-relevant knowledge* and its impact on cognitive behavior;
- (c) the need to rely on a *systems perspective in analysis and design* that incorporates an active role for humans in shaping their environment;
- (d) the need to incorporate *complex systems and complex problems* into research paradigms to achieve useful and applicable research and design results; and
- (e) a consideration of *multiple cognitive agents, both human and machine*, that may interact as a basis for characterizing domains.

We are following this call with the research for tactical management and information system adaptability by enabling the context capture, information provision, insisting on systems perspective in the design and big-picture standpoint in the analysis, basing on complex systems and recognizing socio-technical profiling of the managed system.

1.2.2.2. DISTRIBUTED COGNITION

Hutchins perceives cognition as distributed cognition, thus interweaving context in its broadest and deepest sense with adaptability to use what is at hand to achieve the cognition needed to fulfill the goal, dynamically situating the cognitive systems: “We are all cognitive bricoleurs – opportunistic assemblers of functional systems composed of internal and external structures. In developing this argument I have been careful not to develop a class, such as cognitive artifacts, of designed external tools for thinking. The problem with that view is that it makes it difficult to see the role of internal artifacts, and difficult to see the power of the sort of situated seeing that is present in the Micronesian navigator’s images of the stars” ((Hutchins 1995), p. 172). Distributed cognition has a goal to describe how ‘distributed units are coordinated by analyzing the interactions between individuals, the representational media used, and the environment within which the activity takes place’ (Hutchins 1995). But, if we only focus on cognitive artifacts as the most important component of situated cognitive systems, it makes it difficult to see the functional roles of (a) internal artifacts and structures, and (b) of external structures that are not human-made – and all of them act as a system producing some effect (Heersmink 2013). For this reason, we are positioning a system-view and observing the effect of the overall system too when assessing the contribution of our artifact (in Chapter 4). Distributed cognition as a new branch of cognitive science is studying the representation of knowledge both inside the heads of individuals and in the world. It studies all aspects of cognition, from a cognitive, social and organizational perspective (Rogers 2006). The most well-known level of analysis is to account for complex socially distributed cognitive activities, of which a diversity of technological artifacts and other tools and representations are indispensable facts. Distributed cognition is concerned with structure – representation inside and outside the head – and the transformations these structures undergo; and it views people and things as conceptually equivalent; people and artifacts are “agents” in a system, taking a broader stance that incorporates wide collaborating set of artifacts and people rather than the narrow “man-machine” dyad of cognitive science (Nardi 1996). The fundamental assumption that cognition is information processing inside the brain is challenged, and argued that the distribution of cognitive processes happens across internal (within the bounds of the human body) and external structures and across members of a social group within a problem-solving system. The propagation of information as representation states across a series of representational media that are brought into coordination with one another is accomplished by both human and artifact components, while the human information processing as a three-stage perception-cognition-action process (Liu et al. 2008).

1.2.2.3. SITUATION AWARENESS

Situation Awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in near future (Endsley 1988). “Situation awareness, an operator’s mental representation of the world around him at any given time, forms a key construct that largely guides moment-to-moment decision making and performance in complex systems” ((Endsley et al. 2007), p.5). SA incorporates perception of the critical factors in the environment (Level 1 SA), understanding what those factors mean with regards to the goals – comprehension of the current situation (Level 2 SA) and an understanding of what will happen in the near future – projection of future status (Level 3 SA) – all these levels allow effective functioning. Up to now, the SA theory has found significant implications in the aircraft industry, air traffic control, medicine, large systems operation, tactical and strategic systems, transportation, law enforcement, emergency management, healthcare, space, education, mining, oil and gas operations and other disparate domains (Endsley 2015) where agents (people, entities, teams, ...) operate in contexts characterized by complexity, volatile, unpredictable conditions and dynamics of the systems and of the environments (Mica R Endsley 1995). “Situation awareness is adaptive, externally-directed consciousness that has as its products knowledge about a dynamic task environment and directed action within that environment ... SA is a specific brand of adaptation. Adaptation is the process by which an agent channels its knowledge and behavior to attain goals, tempered by the conditions and constraints imposed by the task environment... a dynamic concept that exists at the interface between the agent and its environment” (Smith & Hancock 1995). The model of SA is shown on Figure 1.9, representing the (1) Three levels of SA, (2) the Environment, (3) the Individual factors that influence SA (such as the processing limitations – attention and working memory, the coping mechanisms – mental models, goal-driven processing and automaticity), (4) the Task/System factors (system capacity, system design, complexity, stress and workload and automation) and (5) the interrelatedness among these components regarding the decision making process and taking action.

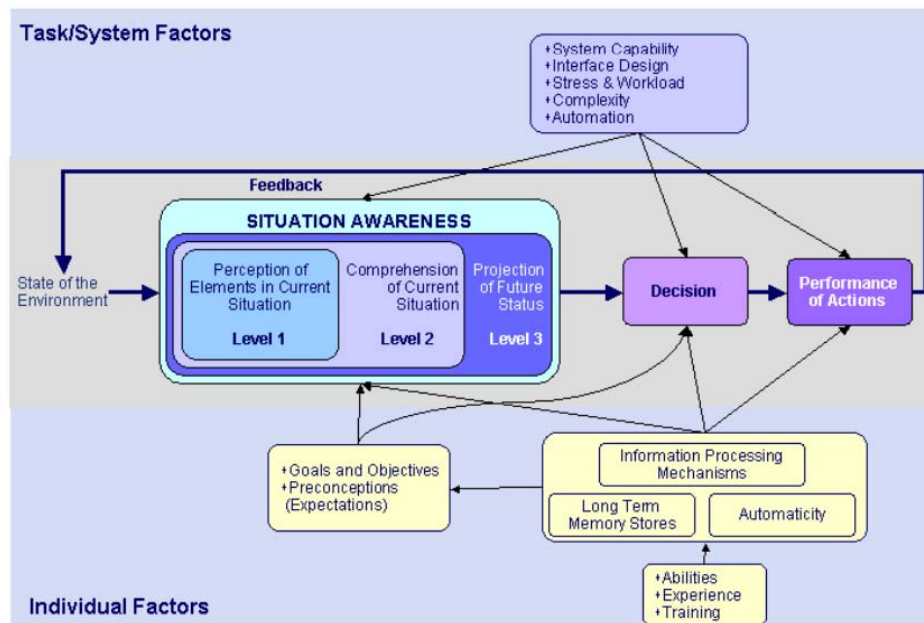


FIGURE 1.9 MODEL OF SITUATION AWARENESS (MICA R ENDSLEY 1995)

Individual Situation Awareness: According to (Endsley et al. 2007) a key means of improving decision making and performance in complex, dynamic systems lies in improving and supporting operator situation awareness. A person's situation awareness can be described as his or her state of knowledge or mental model of the surrounding situation or the environment. It is not just spatial orientation but includes an understanding of the dynamics of the situation and the actions that are expected to take place in the future. Actually, there is sub-categorization of SA introduced by (National Research Council 1997) on local and global awareness – much like we distinguish in our tactical management working definition a 'current context of the organization and the environment' (Chapter 2) Other extensions of SA include transitory, global and local (Hone et al. 2006). In the dilemma whether SA is a product or as a process (Endsley 2015) clarifies that SA is a state of knowledge, while there are situation assessment processes that enable the achieving, acquiring or maintaining SA. "In psychological terms, SA involves more than perception or pattern recognition: it doubtless requires use of all the higher cognitive functions a person can bring to a task" (Vidulich et al. 1994). Any person must have simultaneous situation awareness at more than one level – transitory, local, global (Hone et al. 2006). And the dynamic nature of the situation and context dictate that as the situation (context) is always changing, the person's situation awareness must constantly change, or be rendered outdated and thus inaccurate (Endsley 2000). This leads us to conclude that adaptability of the information flows is also necessary on a certain level, if we want to achieve functional and contributing situation awareness.

For example, in the aviation application of SA, there are factors affecting situation awareness (Hoermann et al. 2003) categorized as: attention management, information management, cognitive efficiency, automaticity, inter-personal dynamics. As visible from these categories, there are person-, task-, system- dependent abilities and factors, out of which, we are translating to the tactical manager the aim to focus the attention, acquire appropriate information, clarity on distractions, automaticity in terms of connecting with operational tasks, inter-personal dynamics in terms of getting everyone on board towards the goal, all of that in making rational decisions toward successful task accomplishment.

In military terms, the distinction of global and local SA is as presented on Figure 1.10.

Global situation awareness	Local situation awareness
location of self	target identification
location/movement of other units	target location
commands/directions from headquarters	terrain/object distance
navigation information	cueing of hostile presence

FIGURE 1.10 SITUATION AWARENESS OF INFANTRY SOLDIER

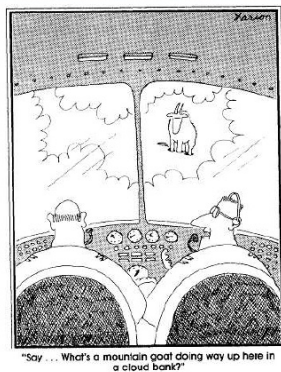
In the aviation, where research from the Australian Transportation Safety Board (ATSB) indicates that human factors is a contributing cause in around 70 percent of all incidents and accidents, while approximately 85 percent of incident reports include a mention of loss of situational awareness, there is recognition of the following SA aspects, or context capturing, perceiving, understanding and projecting viewpoints (Endsley 1999; Endsley & Rodgers 1994): *Geographical SA, Spatial/Temporal SA, System SA, Environmental SA, Tactical SA and actions of Build SA, Maintain SA, Detect loss of SA, Recover SA.*

To conclude with the medical domain where situational awareness is a term that means understanding the current situation. 'It is the ability to look at a huge variety of data, determine what is relevant, synthesize the data, and act on it ... get that right information to the right person who's prepared to receive it, who can analyze it and do something with it ... It helps us better frame data-acquisition systems and other things, where we don't have them trying to overreach and generate an automatic trigger ... The goal is not automation, but informing human decision making.' (Altevogt et al. 2010), p.31).

Regarding the information provisions that are one of the main pillars of SA and how for achieving dynamic SA there is a necessity for continuous multi-directional scanning and adaptability among the human, the information flows and the context (the situation), Endsley elaborates: "different problem framings can induce different information integration (situation comprehension), and this determines the selection of a mental model to use for solving the problem. Thus it is not only the detailed situational information (Level 1 SA) but also the way the pieces are put together (Level 2 SA) that direct decision strategy selection." ((M R Endsley 1995), p.40). We are distinguishing Individual SA from Shared SA/Team SA/Distributed SA (also presented on Figure 1.11). These approaches inspire some segments of our research.

The formal definition of SA

- ▶ "A pilot's continuous perception of self and aircraft in relation to the dynamic environment of flight, threats, and mission, and the ability to forecast, then execute tasks based on that perception"



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Shared SA then is:

- ▶ "All pilots' continuous perceptions of themselves and aircrafts in relation to the dynamic environment of flights, threats, and mission, and the ability to forecast, then execute tasks based on shared perception"
- ▶ All team members continuous perceptions of themselves and their peers in relation to the dynamic environment of business, competition, goals and the ability to predict, then execute based on shared perception.



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FIGURE 1.11 DEFINITION OF SITUATION AWARENESS AND SHARED SITUATION AWARENESS (CARROLL 1992)

Shared Situation Awareness / Team Situation Awareness / Distributed Situation Awareness: The distributed situation awareness is not a parallel of distributed cognition, where the SA is spread across humans and artificial artifacts (as according to (Stanton et al. 2006)). On the contrary, it denotes SA in teams in which members are separated by distance, time and/or obstacles and have difficulty or impossibility to share devices (non-verbal communication, shared displays, shared mental models) as collocated teams. The shared SA denotes that the

requirements, purpose, goals are shared – shared perceptions, coordinated actions; while the team SA denotes different, possibly compatible requirements, purpose(s), goal(s) (Saner et al. 2009). The team SA represents “the degree to which every team member possesses the SA required for his or her responsibilities” ((Mica R Endsley 1995), p.39) – so the success or failure of a team depends on the success or failure of each of its team members. On the contrary, shared SA is “the degree to which team members possess the same SA on shared SA requirements” (Endsley 2015). From the differences in the definitions of shared/team/distributed SA we can recognize the different information requirements relevant to each individual team member and the overlap of these requirements among the team members are both essential elements of SA in a team (Saner et al. 2009). Our primary interest, considering the fact that we are addressing the tactical manager and his/her managed system, is the shared SA that encompasses sharing mental model of the situation where team members must share their knowledge relative to: (1) the task and team goals, (2) their individual tasks, (3) team member roles and responsibilities. Of course, in order to be effective components of a system, it is necessary to provide a solid base for building team situational awareness – hence team members need to have information that will help them develop relevant expectations about the entire team task. In disaster and incident management, for example, where networked responses that include communities, instead of top-down, bureaucratic organizing is promoted, the shared SA is enforced in the cooperation among the crisis centres and/or field units (European Commission Joint Research Centre et al. 2015). In emergencies, actors with various institutional backgrounds and profiles assume roles that are their own by definition, and need to share information in various manners. Here, net-centric organizations occur, overriding the ineffective command and control, with ability to connect and ensure the cooperation of different networks by sharing common goals and combining resources, while fending off competition from other networks by setting up strategic cooperation (Wolbers & Boersma 2013; European Commission Joint Research Centre et al. 2015).

1.2.3. EFFECTIVE CONTINUOUS COMMUNICATION AND VISUALIZATION

Representing and visualizing a complex adaptive system is not an easy quest – can complexity be visualized in simple understandable manner? We discussed that a CAS can be visualized with nodes and edges in a graph – to capture the network of entities and relations among them denoting the interactions. We also discussed that the managerial mechanism that should be used to steer the CAS towards a purpose is not complex, but simple, and is not adaptive, but adaptable. Which characteristics of such simple, adaptable system need to be represented for managerial purposes of communication within a team and with all the stakeholders that should be able to contain the necessary CAS features?

When answering the question: ‘what does a manager need to improve the communication with all stakeholders and thus perform better?’ we are considering a visualization of the: system he/she is facilitating (network with nodes and directed edges) with high-level description of the purpose(s) of that system, its components and interactions among them. The visualization should be scientifically based, comprehensive yet simple and easily maintainable.

What should the visualization be useful for in our case of tactical management? (1) Communication of everyone’s role in the big picture (2) mutually agreed perception of what each one is accountable for (3) high-level (tactical, helicopter) view of how each entity is interrelated to the other one, how each change influences everyone else’s state for orchestrated action; (4) the goal the entities are headed to (individually and together) (5) mapping the information flows to easily detect changes and risks of some things to go in an unwanted direction and for taking actions for planned change towards improvement.

1.2.3.1. THE IMPORTANCE OF VISUALIZATION

Information visualization is the static or dynamic presentation of information in an external representation such that the information can be processed by efficient human visual mechanisms (Zhang et al. 2002). Psychologically the brain is getting trained for actual performance during visualization. This can enhance motivation, increase confidence and self-efficacy, improve motor performance, prime the brain for success, and increase states of flow – all relevant to achieving the goals! In terms of cognition, visuals act as a frame of reference for human cognitive

processes. Visuals reduce search for information, enhance the recognition of patterns, use perceptual attention mechanisms for monitoring and support more efficient task performance (Fekete et al. 2008). Especially small graphs with 10-15 nodes have the biggest cognitive effect.

Cognitively, the dual-coding of communicating has a boosting advantage – in the way that a combination of both thinking about an object or activity and drawing a picture of it can make us remember it better (Paivio 1991) (Wammes et al. 2016). Furthermore, this helps every entity in an organization (perceived as a system) orient itself better of its whereabouts and heading direction. “The core of the benefits provided by visuals seems to hinge upon their acting as a frame of reference or as a temporary storage area for human cognitive processes. Visuals augment human memory to provide a larger working set for thinking and analysis and thus become external cognition aids” (Fekete et al. 2008). In some cases, a diagram can replace 1 000 words (Simon 1996). Graphical visualization can support more efficient task performance by allowing substitution of rapid perceptual inferences for difficult logical inferences and by reducing the search for information required for task completion (Larkin & Simon 1987). Matching the representation used in visualization to the task it is addressing, and the goals expected to be achieved. Visuals can assist and make easier the access to information and computation (Norman 1993b).

In terms of collaboration, it is of great importance to introduce various visualizations, distributed, or co-located, especially when there are multiple participants, performing collaborative activity-centric tasks, when they need to cognitively perceive and make sense of the big picture, have multiple inputs and interactions (Isenberg et al. 2011) We are investigating whether visualizations used by management contribute towards improved information flows, communication and collaboration in the companies and in their business ecosystem.

Visualization has long history of use in different domains (finance, manufacturing, training, organizational modeling, strategic management, ...), to extract information from data, provide overview of complex data sets, identify structure, patterns, trends, anomalies, and relationships in data and assist in identifying the areas of “interest” (Tegarden 1999) However in our research and investigation, we will not argue how to visualize data in order to make sense of it – but how to visualize the system a manager is facilitating towards a goal, having a standpoint that it supports its internal and external communication and effectiveness. This is continuous communication to maintain understanding of the purpose, each participant’s role, responsibility, interrelatedness and interdependence and changes in any of these components. Business information visualization (under various names such as Data Visualization, Information Visualization – InfoViz, Business Visualization – BizViz, Visual Analytics and other names) (Bačić & Fadlalla 2016) is defined as ‘simply the use of visualization technologies to visualize business data or information’ ((Tegarden 1999), p.8); as a process ‘of creating appropriate computer-generated visual representations of large amounts of non-geometric managerial data for human problem-solving and decision-making support’ ((Zhang et al. 2002), p.4) and as ‘the use of computer-supported interactive visual representations of business data to amplify cognition, achieve better data, business, and behavior understanding to improve decision making and business impact’ ((Bačić & Fadlalla 2016), p.5).

Current examples of addressing business ecosystems in terms of managing and visualizing them enlist Value Networks and Value Network Analysis (Peppard & Rylander 2006) with prevalence in strategic management (Biem et al. 2008) contemplating the formal organizational structures, asset management, social networks and business process modeling to integrate strategy, process and technology blueprints and capture the value of each role in the organizational system; then system dynamics and system dynamics modeling (Rodrigues 1994) for project management (Lyneisa & Ford 2007), social dynamics; while workflow tools, business process reengineering and business process management are not to be mentioned in terms of business ecosystems since they are addressing the flow and time dimensions of interactions among the system elements.

Last but not least, visualizations assist the managers to properly position their information flows with regards to the roles of the involved entities, their fulfillment, collaboration and communication among the interrelated entities populating various roles and assist the overall purposive functioning of the system.

1.2.3.2. NETWORKS, SOCIAL NETWORK ANALYSIS, DYNAMIC NETWORK ANALYSIS, METRICS

Networks. We have established that CAS can be appropriately represented with a network (Watts & Strogatz 1998; Newman et al. 2001; Strogatz 1994), as one of the standard approaches (differential equations, cellular automata, evolutionary game theory, agent-based models, fractals) (Ahmed et al. 2005). Agents in the complex economy participate in sophisticated overlapping networks that allow them to compensate for having limited information and facing formidable information processing costs (Beinhocker 2006). Organizations are networks, companies and networks perceived as networks in the internal and external structure; and the business ecology is a multi-actor network (De Bruijn & Ten Heuvelhof 2008). (Gell-Mann 1994) supports the idea of designing a computer system based on ‘neural nets’ because such nets furnish a serious model of the human brain, with the units or nodes corresponding to individual neurons. In terms of functioning, the computer system resembles the neural nets while the genetic algorithms resemble evolutionary processes (Gell-Mann 1994).

Networks are “at the heart of some of the most revolutionary technologies of the 21st century, empowering everything from Google to Facebook, CISCO, and Twitter. At the end, networks permeate science, technology, and nature to a much higher degree than may be evident upon a casual inspection. Consequently, it is increasingly clear that we will never understand complex systems unless we gain a deep understanding of the networks behind them” ((Barabási 2016), p.6). Networks have appropriate application in mathematics, sociology, physics, biology, computer science, engineering and other sciences – that fit together and create emergently richer network science as practiced today (Barabási 2016). The network thinking is significant since it provides a novel language for expressing the common characteristics across complex systems in nature, which allows disparate areas to have a common ground for collaboration (Mitchell 2009). In our research, the two main domains that are combined through the use of network structures and representations are management and information systems, while the third one being foundational is the complex adaptive system.

Our idea is not to use the network to represent and better visualize the nodes and edges – but to represent a purposeful system of roles and accountabilities that is designed to produce an effect. This is the main difference and novelty of our use of SNA for managing a socio-technical system we consider to be a complex adaptive system. It is being used in order to visualize the adaptable mechanism that reacts to the managing acts of the manager and represents the vehicle that is guided and facilitated in certain direction. The CAS ‘situated’ in that vehicle adapts to the vehicle itself and to the headed direction.

Social Network Analysis. SNA encompasses the use of graphs and matrices in analyzing, modeling, visualizing and providing metrics primarily for social network structures, behavior, social interactions but also many other network-interrelated entities and structures. It is a set of analytical and statistical methods and tools that embodies techniques for collection, analysis of metrics and visualizations. There is vast freedom for application in various contexts, domains and uses because of the nature of networks that are consisted of nodes/vertices (that can represent people, systems, departments, roles, concepts, and other entities) and edges/links (that represent interactions, relationships). There are extensions of the use of networks through graphs that can be consisted of single-category nodes or multiple categories of nodes in the same graph – multipartite graphs that can be partitioned as independent sets or combined for the purpose of effective visualization, communication and analysis. On the side of the edges, links, there is the type of relationship that can vary, the option to use directed edges (in one or both directions) and undirected ones, and the property of strength each of which supports various combinations to reach the ultimate goal of truthful representation of the idea the graphs have been used for in the first place. Also, SNA offers assignment, analysis and visualization of different attributes to the nodes and edges that contribute to the overall usefulness of the method. In terms of software applications that are focused on SNA support in basic and/or detailed and distinctive features, the offer is in introductory stage. Gephi (Gephi Society 2016; Levallois 2014; Cherven 2013) in Beta-version as free software, Linkurious (Linkurious 2016) as another free extensive platform in beta-version, nVivo (QSR International 2016) offering the basic SNA functionalities and metrics in a paid option (in nVivo Plus) option, NodeXL (The social media research foundation and contributors 2016; Aldhous 2012) a free Microsoft Excel plug-in, Pajek (Mrvar 2016) as free software for large networks and others.

SNA successfully combines mathematical concepts of graph theory and social science and offers a diverse range of metrics that enable rich analysis of the relations, interactions, structure, attributes, behaviors, influences, tendencies,

and other characteristics of the networks and their interrelated entities. Among these metrics we can enlist the following: network size, network density, degree centrality, betweenness centrality, closeness centrality, network centralization, average distance, geodesic distance, distance between nodes, diameter, components, cliques, and a number of more advanced metrics.

Social Network Analysis (SNA) metrics (not visualizations) have been used in: construction (Pryke, 2013) and in supply chain management (Rodriguez-Rodriguez et al., 2016). Metrics and visualization have been used for inter-organizational networks in public administration (Bogdanoska Jovanovska 2016; Erman et al. 2010). Some beta-version tools for SNA are trying to divert the user thinking towards use in management, but not successfully. Mostly because they are going towards visualizations of Twitter, FB, NASA analysis and findings, big-data, thousands of nodes and graphs that challenge processor and processing technology in the apps. Managerial use is 10-20 nodes, no need for software stunts, regular metrics, and what most of the SNA software producers couldn't provide yet in an intuitive and user-friendly manner – the dynamic feature – to show how the graph changes over time (NodeXL, Linkurious don't have it; Gephi does – all beta versions).

During the interviews with our business collaborators, the prevalence of matrix-organizational structure resulted with existence of orga-charts that represented the affixed hierarchy, and process flowcharts guiding the sequences of actions. Their direct team or project was more a set of emails, to-do lists, posted reminders, unstructured drawings of segments of either compositions of people and their jobs or flows.

However, in the interviews, every manager that saw the SNA visualization in the poster for tactical management had the similar reaction: “Wow, this is exactly what I need to tell everyone what they need to do and how it cascades to all of us”. They would show the visualization of the system also to the clients and external collaborators. Our End-user 1 (see Chapter 4) makes one initial graph for each new project he is working on, as step 1 in the setting up of his 360° view of the project world. And immediately he communicates and sends it to his collaborators. Also when things change and the graph needs to be updated. And communication, collaboration, orientation and situation awareness are exponentially improved with the use of visualizations. The same habits have been observed with End-user 11 too. The feedback from End-user 1 for the beginning of the implementation of the artifact has been towards being confused with all the instructions and how to implement them. However, after we showed him the poster with the graph everything went smooth. To be more precise, what functioned, was a graph of nodes and directed edges that showed the interdependent components of the CAS populating roles and the system's primary purpose.

Dynamic Network Analysis. In relation to the needs of our research project, we have investigated the dynamic perspective of networks – and how various SNA techniques, metrics and visualizations can assist this pursuit – frequently referred to as Dynamic Network Analysis (DNA). This thread in the research comes naturally because of the fact that, according dynamical systems theory CAS are dynamical, meaning that they ‘exhibit complex changing behavior at the macroscopic level, emerging from the collective actions of many interacting components’ ((Mitchell 2009), p.15). Since our managerial system is represented as a network of roles as nodes and accountabilities as edges, we should be able to observe changes in that system in time regarding nodes and/or edges. In order to understand the dynamics of information in the networks, it is up to the network science to characterize networks where nodes and edges change continuously through time and in space. “Characterizing the dynamics of a complex system is only one step in understanding it. We also need to understand how these dynamics are used in living systems to process information and adapt to changing environments” ((Mitchell 2009), p.39). “Recently there have been a number of advances that extend SNA to the realm of dynamic analysis and multi-color networks. There are three key advances: 1) the metamatrix, 2) treating ties as probabilistic, and 3) combining social networks with cognitive science and multi-agent systems. These advances result in a dynamic network analysis” ((Breiger et al. 2003), p.363). (Snijders 2011) refers to the longitudinal social network data, calling it data about network dynamics. “Thinking about networks from a dynamic perspective is absolutely essential to understanding the modern world” ((Carley 2003), p.143) How structure, isolation of nodes and the overall dynamics of the network develop through time represent the network dynamics which makes the dynamic network analysis appropriate for closer view of the reality, the agent's role in terms of processes and behavior, not just position in the structure (Carley 2003; Schreiber & Carley 2006; Breiger et al. 2003). The dynamic network theory, deriving from psychology, is a multidisciplinary framework that shows how social networks influence goal pursuits in social, organizational, and international systems (Westaby 2012) and how a network motivation towards goals recognizes different roles enforcing resistance and reactance, dynamically influencing the performance. In this theory monitoring, feedback and change processes are proposed as network regulators, while the others are the flows of emotions and reactions upon goal

accomplishment/un-accomplishment. The dynamic network analysis is in its initial stages with the current applications in real-life domains because of its complicated requirements for establishing the electronic visualization and calculating appropriate metrics (McCulloh 2009) (Carley 2003) (Snijders 2011). We are interested in modeling, monitoring and visualizing the dynamic behavior of the managerial mechanism represented as a network through time, in the pursuit of accomplishment of purpose. From the static perspective, with the SNA, we will be able to capture the structure of the system of roles and interactions among them along with the primary purpose, while the dynamic perspective, the DNA, should present a foundation for analysis of behavior of the system, help to record and prove its adaptability and offer recommendations for tactical management specificity of networked roles in terms of metrics.

Metric	Meaning	Level	Risk
Average Distance	The average shortest path length between nodes, excluding infinite distances.	Graph	Communication
Centrality, Betweenness	The Betweenness Centrality of node v in a network is defined as: across all node pairs that have a shortest path containing v , the percentage that pass through v . This is defined for directed networks.	Node	Communication
Centrality, Closeness	The average closeness of a node to the other nodes in a network. Loosely, Closeness is the inverse of the average distance in the network between the node and all other nodes. This is defined for directed networks.	Node	Communication
Centrality, Total Degree	The Total Degree Centrality of a node in a square network is its normalized in plus out degree.	Node	Communication
Clustering Coefficient, Watts-Strogatz	Measures the degree of clustering in a network by averaging the clustering coefficient of each node i , defined as the ratio of the number of triangles connected to i to the number of triples centered at i .	Graph	Communication
Cognitive Load	Measures the total amount of effort expended by each agent to do its tasks.	Node	Critical Employee
Communication	Measures the communication need of agents to complete their assigned tasks.	Node	Communication
Connectedness	Measures the degree to which a square network's underlying (undirected) network is connected.	Graph	Communication
Constraint, Burt	The degree to which each node in a square network is constrained from acting because of its existing links to other nodes.	Node	Critical Employee, Redundancy, Communication
Density	The ratio of the number of edges versus the maximum possible edges for a network.	Graph	
Diameter	The maximum shortest path length between any two nodes in a unimodal network $G=(V,E)$. If there exist i,j in V such that j is not reachable from i , then $ V $ is returned.	Graph	Communication
Effective Network Size	The effective size of a node's ego network based on redundancy of ties.	Node	Critical Employee, Redundancy, Communication
Network Centralization, Betweenness	Network centralization based on the betweenness score for each node in a square network. This measure is defined for directed and undirected networks.	Graph	Communication
Network Centralization, Closeness	Network centralization based on the closeness centrality of each node in a square network. This is defined only for connected, undirected networks.	Graph	Communication
Task Completion, Knowledge Based	The percentage of tasks that can be completed by the agents assigned to them, based solely on whether the agents have the requisite knowledge to do the tasks.	Graph	Performance
Task Completion, Overall	The percentage of tasks that can be completed by the agents assigned to them, based solely on whether the agents have the requisite knowledge and resources to do the tasks.	Graph	Performance
Task Completion, Resource Based	The percentage of tasks that can be completed by the agents assigned to them, based solely on whether the agents have the requisite resources to do the tasks.	Graph	Performance

FIGURE 1.12 METRICS (DEFINITIONS, LEVELS OF ANALYSIS) FOR SOCIAL AND DYNAMIC NETWORK ANALYSIS (SELECTION USED FROM (CARLEY & REMINGA 2004))

Metrics. A brief overview of the SNA and DNA metrics, some of which are of interest in our research, is given in Figure 1.12. The tabular representation contains definitions of the metrics elaborating the meaning of the metric, level of analysis (the entire graph or node) and the influence on the organization and its risk management the specific metric shows (in terms of communication, performance etc.) (Carley & Reminga 2004)

The metrics are numerous, and can offer insight on the adaptability and behavior of a network as a whole and of individual nodes/edges, groups of nodes according various criteria, paths among them etc. For managerial purposes, we will observe several both network and entity-related metrics, such as distance, centrality, density and diameter, even though further research may reveal intriguing insights in several other metrics.

1.3. MANAGEMENT INFORMATION SYSTEMS NATURE FOR TACTICAL MANAGEMENT

Even though the information requirements, information flows and in general, information system is being discussed and reflected through the entire chapter, as being an integral part of the adaptable tactical management system, at this point we would be summarizing the management information system needs for tactical management, on a theoretical level.

Starting from the concept of adaptability, we have discussed the sources of change that tactical management is facing (elaborated in Heading 1.2.1) an information system serving a changing management system should primarily follow the behavior of the managed system. Considering that the managed system is a CAS, then the information system should be able to capture the changes and statuses of the entities, relationships and developments in the CAS.

If we are considering the aspect of the environment, which is unpredictable and dynamic, and influences our managed system as an open system, thus influencing our success, the management information system, especially for tactical management, should be capturing the environment. It does not emit prescribed, predefined or predictable information or information form, shape, frequency. On the contrary, the environment should be probed, sensed, detected and scanned with diverse and broad range of information carriers. This especially stands when we are positioning our system of roles across the entire business ecology, not just within the company. In our opinion, the manager's information system should have offer and possibility for choosing and fine-tuning options for obtaining information – be it reports, forums, phone calls, cameras, cloud services, web-site updates, ...

When taking into account the number and range of 'givens' tactical management needs to work with, that may change, need to be monitored, sometimes even maintained within certain ranges, we receive another argument why tactical management information systems should have flexible and adaptable structure, design and interface.

If we consider the CAS needs for information (discussed in Heading 1.1.1), it is rather straightforward how to address them – with simple human rules on how to detect information, how to interpret information and how to act in response (Waldrop 2013). These are both managerial and information system instructions. At this point, we will be deliberating on the communication of the simple human rules and the detection and interpretation of the information and acting in response. The CAS agents are capable to reason, they only need to be equipped with the possibility to detect information and signal that it has been acted upon or not.

When we consider the nature of tactical management (discussed in Chapter 2) we can conclude that what tactical management needs for adaptability in unpredictable complex environments is something more than rigidity in served information, automated conversions of operational data into KPIs, possibility for making and following plans with numbers and automatized scorecards or dashboards. This is important for the handling of the mismatch of incoming information with the outgoing information for results. There is intense need to investigate whether it makes sense to give the opportunity to point out the needed information from the overflow of near real-time data with the option to self-design the information flows by the manager from scratch for tactical management. Our next question would be to which extent the information flow has patterns and to which extent it is completely unpredictable and un-prescribable such as the system and the environment it represents?

The MIS effectiveness or information system success is a 'dependent variable' that should be aimed for to be high. It is a comprehensive result of several categories, such as: system quality, information quality, use, user satisfaction, individual and organizational impact (DeLone & McLean 1992; Petter et al. 2008; Delone & Mclean 2003) From this point of view, the role of context – which is a decisive component for tactical management, is reviewed and emphasized, along with a third dimension of service quality, while the individual and organizational impact are

under the common denominator net benefits (Delone & Mclean 2003). In our opinion, the tactical management information systems need improvement in each of these categories – especially due to the fact that adaptability is a missing component in them. Even though context is introduced as a clear expectation from the MIS, its capture and reflection is very hard to achieve by mechanistic and automated means that are prevailing in today's tendencies. Somehow, the human component, reasoning and intervention is being omitted and forgotten. Ackoff, in his work 'Management Misinformation Systems' (Ackoff 1967) addresses the core assumptions commonly made by the designers of management information systems which are:

- (1) *The critical deficiency under which most managers operate is the lack of relevant information* – which results with over-abundance of irrelevant information. A note that this paper is published in 1967, and the comparison of the over-abundance of information provided with nowadays technology will be overwhelming
- (2) *The manager needs the information he wants* – but in reality, many managers have some idea of what decisions they will be making, and a lot of unknowns. So most MIS designers determine what the manager needs and fixate it, enriching it with many more things, in order to play 'safe'. Analyzing the risk, uncertainty and the value of information is important as much as planning and predictability (Boehm 1981).
- (3) *Give the manager the information he needs and his decision making will improve* – but only if the manager is skillful enough of using that information in the given format. So format, structure, medium and the necessary subsequent maneuvers to be done on the data are of decisive importance to whether the manager will effectively use the information and improve the decision making
- (4) *More communication among managers means better performance* – but only if the sub-systems have no sub-optimizing behavior. Otherwise, it may lead to major problems and conflicts and the organizational design and structure need to be set up properly as a system in order to avoid this
- (5) *A manager does not have to understand how an information system works, only how to use it* – which is very current issue of separation of the IS logic and requirements from managers to specialists and consultants and from the business itself; or, placing them in one person who is not the manager, but a consultant. Ackoff's direction is that no MIS should ever be installed unless the managers for whom it is intended are trained to evaluate and hence control it rather than be controlled by it.

By addressing these issues Ackoff proposes a procedure for designing and models proper MIS and ensures avoiding the misinterpretations and assumptions. The steps are as follows:

1. **Analysis of the decision system** – which in our terms can be interpreted with analysis of the tactical management nature, profile and specificities
2. **An analysis of the information requirements** – in which stage a distinction is made among (a) decisions that can be modeled and the model can be incorporated in the IS, (b) decisions for which models can be constructed but optimal solution can't be extracted and (c) decisions for which adequate models can't be constructed (as elaborated in Heading 1.1)
3. **Aggregation of decisions** – into a single manager's task
4. **Decision of information processing** – the procedure of collecting, storing, retrieving and treating information. In this case, depending on the managerial level – operational, tactical, strategic, an extensive exception-reporting system should be included
5. **Design of control of the control system** – to compare values and outputs, and ensure mistakes, issues, omissions are either resolved or incorporated in the system, to improve its precision. It actually ensures incorporation of positive and negative feedback into the system. 'This should result in adaptive man-machine system whose precision and generality is continuously increasing with use' ((Ackoff 1967), p.155). This is what we know nowadays as IBM's Watson (IBM 2016).

We are supporting the standpoint that the managers should participate in the design of a system that is to serve them which results in their ability to evaluate its performance, and therefore improve the system and its performance (Ackoff 1967), for their own benefit, and for much broader benefits. For tactical management purposes, we position at least half of the decisions to be category (c) and (c) transforming to (b) in time, so it is important aspect to reveal, for future tactical management information systems design.

We will be addressing the MIS for tactical management at every point of discussion because the managerial adaptability dictated by the tactical management necessitates and corresponds to the informational adaptability – steering us in the direction of adaptable information system for tactical management.

1.4. SENSE-AND-RESPOND FRAMEWORK TOWARDS PROVIDING MANAGERIAL AND INFORMATIONAL ADAPTABILITY FOR TACTICS

1.4.1. BACKGROUND AND HISTORY

In our pursuit for an existing foundation that addresses managerial needs for adaptability, we consider the Sense-and-Respond (S&R) framework of (Haeckel 1999) (Haeckel 2016a) as a sole member in its own category. Of course there exist other comprehensive multidisciplinary frameworks that offer adaptability (such as the BIM, Agile, CDD, (Pine II & Gilmore 2013) (Maglio et al. 2010)). If we refer to the solution requirements outlined in Chapter 2, we would be able to make a parallel to the choice of S&R framework with most of them. Namely, the first requirement to offer a method for the person, is directly answered, since the S&R framework is designed to guide the manager (strategic and/or project predominantly). With regards to the second requirement, to incorporate the managerial and business aspects with information flows, we can observe that even though the S&R framework is mature in supporting the managerial and business aspects, but it has elementary inception of information flows in the Heads Up displays for each role. The sixth requirement of system perspective, purpose, roles and interactions is directly mapped to the S&R system of roles and accountabilities, system design around a purpose and its maintenance through time. Numerous uses of the S&R framework are present in various applications and domains with most appropriate conditions for utilization of the framework, such as international business, SMEs, military, healthcare, ... ((Crim 2014), (Office of Force Transformation, Department of Defence 2003) (Kauffman & Macready 1995)). Mr. Stephan H. Haeckel initiated managerial principles while in IBM, being Chairman of the Marketing Science Institute, and corporate futurist, Director of Advanced Market Development and Director of Strategic Studies at IBM. As part of the IBM's Advanced Business Institute, he named, developed and pioneered the Sense and Respond managerial principles (Haeckel 2016b), accompanying the development and implementation flow with various publications that continuously provided the functional link between the theory and practice, in the form of books, roadmaps, application examples, guidelines and workbooks (Carbone & Haeckel 1994; Haeckel 1997; Haeckel 1999; S.H. Haeckel 2003; Haeckel et al. 2003; Stephan H. Haeckel 2003; Haeckel 2004; Haeckel 2010; Haeckel 2016b; Haeckel 2016a). The actual implementation of the S&R framework principles is carried on by Mr. Haeckel himself and his team in Adaptive Business Designs – an executive education and coaching firm dedicated to helping executives understand and implement Sense and Respond, by creating and leading highly adaptive organizations (Haeckel 2016b).

Our research is taking the S&R foundation for the artifact design, enhances and adapts it for tactical management domain. In this chapter, by elaborating the essence of the S&R framework, we will draw parallels of its applicability for tactical management and support our motivation to select it in the first place.

1.4.2. THE BASICS OF THE S&R FRAMEWORK

The S&R framework is a set of managerial principles for business design that provides adaptability in uncertain and turbulent environments – to the (1) manager, on one side and adaptiveness of the (2) business, on the other. It is designed to be used primarily by senior management for strategic purposes in terms of strategy as a structure, giving assistance to the 'what', 'why' and 'how' goal(s) can be pursued in an adaptable and effective manner.

A sense-and-respond organization is defined as 'a collection of capabilities and assets managed as a purposeful adaptive system' ((Haeckel 1999), p.xix). Haeckel is primarily designing for supporting top managers in dealing with strategic issues, meaning the ones that select direction and organizational purpose, hence the 'purposeful' part of the definition. Tactical management, as we define it in (Chapters 1 and 2) and frame in this heading, needs purposive adaptability. Tactical management needs to consider the purpose as affixed, as a given, and find ways for achieving it – hence, the 'purposive' component in our addressing. The aim of the sense-and-respond framework is to assist attainment of the organization as adaptive system, while the actual sense-and-respond steps (perceived as an artifact) for achieving this are adaptable in response to the managerial steering and utilizing actions. Hence, the

overall result of the behavior (CAS+S&R) can be perceived as ‘adaptive system’. This is in line with Norman’s two views of artifacts – personal, where we see that the artifact is enhancing performance by changing the tasks which the person(s) perform; and system view, where the person(s), the task(s) and the artifact produce enhanced effects, and can accomplish more than without the artifact (Norman et al. 1991). Sense and Respond uses ‘roles’ and ‘accountabilities’ as constructing parts for the system design around a purpose (Figure 1.13) (Figure 1.14). If we try to situate the roles in a sort of gradation where the lowest level of genericity are actual persons (with names), the level above that would be job positions (with job descriptions), then possibly roles and capabilities, and above that level probably strategic categories of components (such as, for example dimensions). By positioning the system design’s components at the level of roles (Figure 1.14), the S&R framework integrates adaptability from the very beginning. It would be much more rigid and prone to daily changes if one makes plans and structures for action according actual personnel names, surnames because of staff fluctuation, sick-leaves etc. Also, the level of job positions is not good enough for the provision of adaptability, because it contains rigidity that poses the problem of non-flexible job descriptions and efficiency, not modularity and effectiveness. The level of strategic components is too high, and the generic system will be produced as orientation, but not as implementable and daily functional structure. The level of capabilities is another way of thinking in adaptable manner – broad but also specific enough. Business capability is the ability to deliver a certain business value continuously, while the circumstances are dynamically changing (Bērziša et al. 2015). We elaborated on ‘roles’ in Heading 1.2.1 as a term that defines expected behavior and makes a distinction from the one who populates it and what the person in the specific role is accountable for, and their use in the S&R framework fits perfectly to the needs of the research.

Most generic

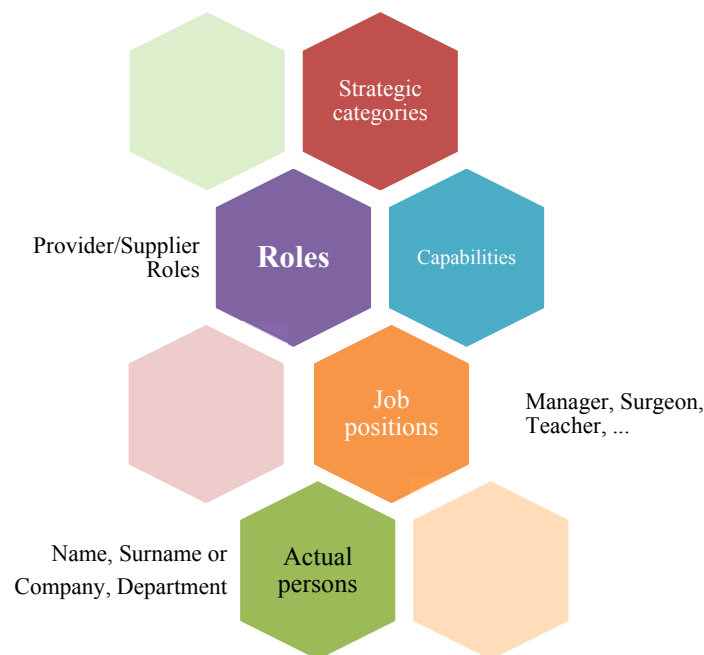


FIGURE 1.13 LEVEL OF GENERICITY OF SYSTEM/PROCESS COMPONENTS FOR ENTITIES

The main distinctions the S&R framework makes between the still very present make-and-sell thinking and the sense-and-respond thinking and acting are the following (Figure 1.14):

- **Outcome vs. Output**
 - o Outcome, being the way a thing turns out, the ultimate result while
 - o Output, is something that is being produced

This is one of the main contributions of the S&R framework, because outcome and output are two categories on opposite sides of the company-client continuum. Namely, as visualized in the upper left picture of Figure 1.14, the output gets produced, and a lot of valorization, remuneration, measurement and rewards are being given on how much a company manages to produce outputs. However, the ultimate ‘judge’ of whether what the company produces serves the purpose, the needs of the customer, is the actual customer. A software company may produce application packages to put on the shelf, and clients may purchase them. It is not to be measured only how many

packages have been produced, or even sold, but how many have satisfied the customer's needs. And the customers will reflect that with the level of satisfaction, continuation of a relationship etc. the actual focus on the implementation of the S&R is to think in terms of such outcomes, not just outputs.

- **Accountability vs. Responsibility**

- Accountability, perceived as making sure things are done according expectations of the involved parties, taking all necessary actions to fulfill the purpose. It is viewed from both: agent and system perspective, on how the stakeholders are satisfied and what are the consequences.
- Responsibility, perceived as a task, a duty one is expected to do

These two concepts go hand in hand with the 'Outcome' and 'Output' – so we will be referring to them as 'accountability for outcome' and 'responsibility for output' in order to make the distinction more plastic. For example, an educational system in traditional sense is obliged to deliver classes, lab work, testing and examination in order to make sure it provided what it is responsible for – education of students. If we perceive that through the lens of output, the educators need to hold classes, ask for homework, organize exams etc. But a class can pass even if the professor speaks for an hour and everyone listening pays no attention, or if the professor teaches, facilitates, engages, maneuvers and expands the teaching and learning efforts making sure the students have understood the main points of the lecture. The teacher is accountable for making sure the students learned the necessary points, not only responsible for giving the lecture. If we perceive this from systems perspective, through the lens of outcome, the success of the educational system should be measured by how its students are equipped with knowledge, competences and skills – a set rather correlated with the students' employability. Hence, an educational system is not only responsible for delivering classes, exercises and exams, but making sure that the student employability profile is with appropriate quality. This can only be done if the customer (the student) is well involved and addressed by the provider (educational system) and the ultimate 'judge' of the success/failure of the accomplished purpose is to which extent the students get employed according their capabilities. In this sense, perceived through the concept of accountability for outcome, the educational system is accountable for providing employable student profiles, and the involved parties are the educators, students, managers, businesses, legislators, parents.

- **Thinking and acting Customer-back vs. Firm-forward**

- Customer-back thinking and system design means that the system's purpose is situated with the customer, and how to accomplish it is a system design decomposed from the primary purpose
- Firm-forward thinking means that the company is integrating its parts to provide an offer, which is output to the customers. But there is a long way from providing the output, the offer to accomplishing the goal if it is placed externally out of the company, and with the client.

This distinction and the selection of the customer-back system design, incorporates the primary purpose and makes sure everything (every role, accountability) serve in its accomplishment. It is a recipe for interweaving the customer into the system and taking everyone on board in the same direction. It opens doors for value co-creation and it doesn't reason – how much should we sell in order to make profits, but on the contrary: how extensively should we satisfy our customers to maintain the collaboration that creates value, that eventually exchanges money and provides financial and non-financial benefits for the company and for the clients. The perception of the zero-sum game and the reductionism present in the firm-forward thinking and acting limits the perspective and the maneuvering abilities of the company, while customer-back thinking and acting naturally incorporates the main components that ensure accomplishment of a purpose. This distinction resembles the one between the 'outcome' and 'output', because it integrates them and adds system design point and logic around a primary purpose (outcome).

An example that incorporates these distinctions along with the system design of roles and accountabilities towards a primary purpose, would be, if we take a look at the global warming, and differentiate our accountability for the outcome of maintaining the global temperature increase by less than 2 Degrees Celsius by 2050 (the Paris Agreement (United Nations 2015a) (United Nation Framework Convention on Climate Change 2016)). This should be considered as outcome for all of us as stakeholders – which is actually a primary purpose of a system to be designed to accomplish this. The roles that a system needs to accomplish that outcome are diverse – even though most are framed as responsibilities mainly focused around adaptation and mitigation of the changes and their impact. Also, numerous Sustainable Development Goals (SDG) are given (United Nations 2015b). However, there is no system design of roles and accountabilities, but process flows with outputs and responsibilities. The countries are expected to act as firm-forward doing their best in delivering outputs. What we could expect is reductionist's integration of components (countries) and not decomposed system from a primary purpose.

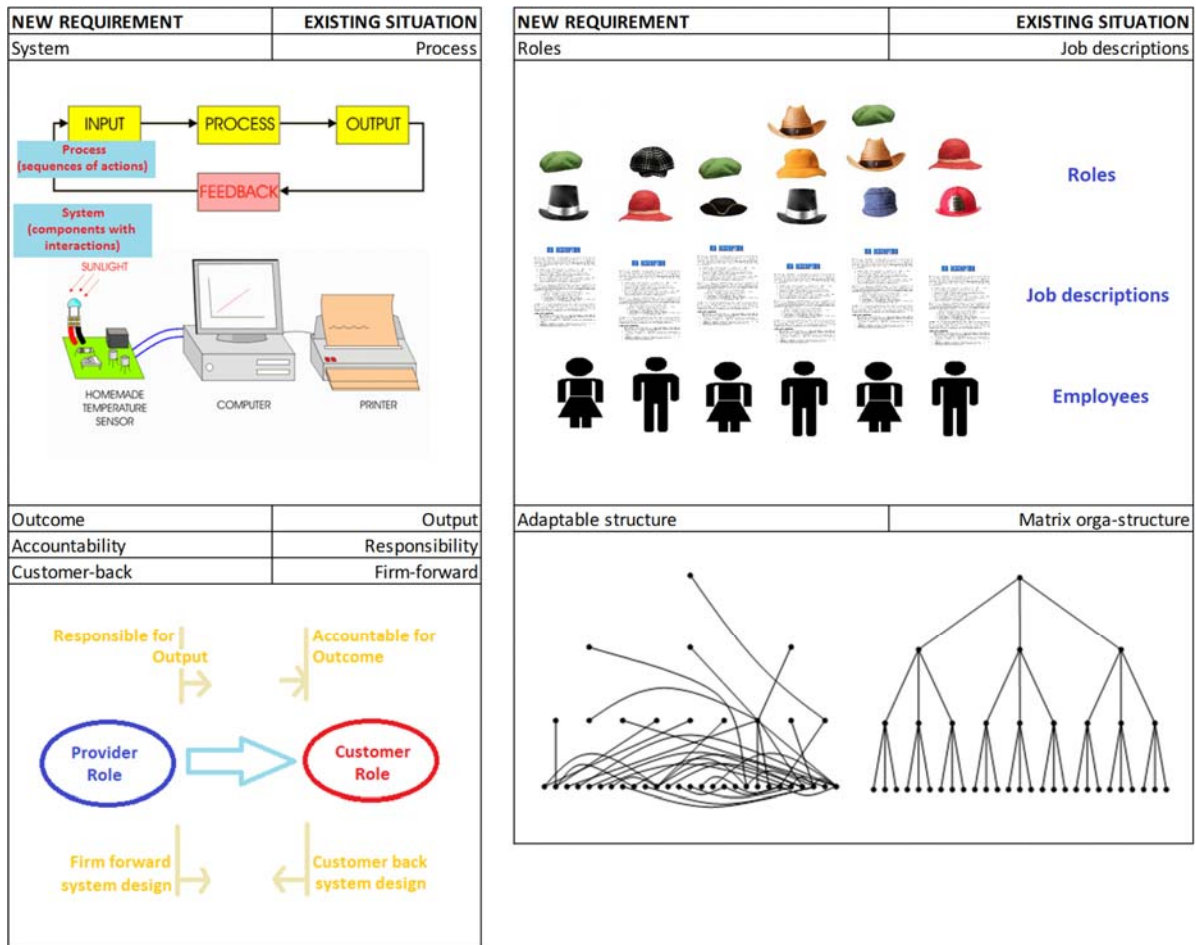


FIGURE 1.14 ESSENTIAL DIFFERENCES IN THE MINDSET AND BUSINESS APPROACH THAT NEEDED SPECIAL ATTENTION AND ENFORCEMENT IN ORDER TO PROVIDE TACTICAL MANAGEMENT ADAPTABILITY

The primary purpose introduced here is the outcome, the effect, that the managerial system is expected to produce. In an example of a car as a complicated system, the primary purpose would be to successfully transport passengers from one point to another. It is important because of the fact that every other outcome resulting from the interaction between the roles leads to successful completion of the primary outcome. It can change, but if so, the entire system changes.

The notion of primary purpose results from an exercise of identifying the key constituents (most important ‘players’ who can be named, and are the main provider and/or customer) in a project or an undertaking, and answering what is most important for them to be achieved. Haeckel proposes detection of these constituents by answering the question: Who owes What to Whom and Why this constituent values this outcome? (as presented in Figure 1.15) After this table has reached several levels, the primary purpose is selected that acts as design point for the system of roles and accountabilities.

KEY CONSTITUENT ANALYSIS



WHO ACCOUNT EXEC (NAM)

OWES

	WHAT Primary Outcome Owed This Constituent	TO WHOM Constituent Name	WHY Reason Constituent Values this Outcome
	Absence of Problems with XEROX Products 	Customer End-User	No hassle personal productivity
	Profitable customer relationship	XEROX Policy Executives	Contribution to XEROX growth and profit objectives
	Product problem feedback from current users	XEROX Product Managers	Improve competitiveness of XEROX products
	Lowest total cost of ownership	Customer Buyer of Office Products	Contribution to Customer profit objectives

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FIGURE 1.15 KEY CONSTITUENT ANALYSIS TABLE AND QUESTION (HAECKEL 2016A) TO ANSWER PRIMARY CONSTITUENTS AND PRIMARY PURPOSE

1.4.3. RECOMMENDED APPLICABILITY OF THE S&R FRAMEWORK

Haeckel places the S&R applicability in environments where change is present to a large extent; often can't be anticipated; and where companies need to depart from the plans, operational excellence and prediction through product-centric way of looking at needs towards effective response to the changes and a customer-centric approach. Nowadays the economic, business and general environment is different than the 'make-and-sell' economy – it is an 'information economy' and we should investigate "the implications of that logic for business strategy, structure and governance" ((Haeckel 1999), p.ix). The period when companies could plan, focus on efficiency, outputs, command and control structure and relative stability is followed by today's post-industrial economy, characterized by unpredictability, necessity to focus primarily on effectiveness, ensure outcomes, modular networked structure and provision of adaptability. A visual outlook on the organizational structure of a make-and-sell company vs. adaptable company is given in the lower right corner of Figure 1.14.

1.4.4. SENSE AND RESPOND MANAGERIAL PROFILE

The managerial profile leading a sense-and-respond organization is seen as provider of context and coordination (Figure 1.16), (Haeckel 2016b). Four new competences are being introduced for the post-industrial manager, which are: knowing earlier, managing by wire, dispatching capabilities from the event back and designing a business as a system. The manager is guided to 'know earlier the meaning of what is happening now' through various means: 'more and better probes, superior analysis of existing data, superior pattern recognition, faster frame-switching, and

the development of systems knowledge – knowing why’ ((Haeckel 2004), p.185). The knowing earlier principle provides appropriate information in context for the manager – being a guideline for the informational needs of the manager, regardless on strategic, tactical, operational or project level. This stage resembles to the situation awareness – Level 1 – Perception of the elements in the current situation (Figure 1.9), (M R Endsley 1995) The answer to the ‘why’ something is happening, is the Level 2 of the situation awareness – Comprehension of the current status (Figure 1.9), (M R Endsley 1995). The Level 3 situation awareness – Projection of future status (Figure 1.9), (M R Endsley 1995) completes the necessary components for a manager to reach a decision. This decision is then translated into actions by what Haeckel calls ‘managing by wire’ – denoting the mechanisms, networks, instruments and means by which the manager’s decisions are carried out in timely and appropriate actions. This aspect represents specific information needs and also shapes the information system of the manager and of the organization. Haeckel’s examples are the high-speed ‘fly-by-wire’ electronic system communication between the pilots and planes but also ‘heads up displays’ that deliver early information to the persons who needed to make decisions upon considering that specific information of interest. The dispatch of capabilities from the event back and not as planned firm-forward, is another diametrically opposite competence to practice. It means that the resource engagement should come as late as possible after being triggered by an event, which is very unusual for the practice of having price and time aspects of a project being negotiated at the very beginning, when the level of uncertainty (Aroonvatanaporn et al. 2010) is highest and the chances for making errors are highest. The last post-industrial managerial competence proposed is the design of the business as a system. “Systems designs, by their very nature, produce synergy and align every element of the system around a common purpose. Designing a business as a system means specifying the interactions among, rather than actions of, organizational capabilities. It means designing a business from the purpose down, never from the capabilities up” ((Haeckel 2004), p.188). The systems design, along with systems thinking that help problem detection, diagnosis and their handling, are in line with our necessary postulate that tactical management necessitates to be successful (details referred in chapter 2, Heading 1.2.1). All these specificities of the contemporary manager, named as ‘peripheral vision’ force us to think of designing a solution artifact that supports the manager on managing and positioning deliberate attention to weak signals, as well as to strong ones in being informed early and acting accordingly. The weak and strong signals discussed here, can be best described with an analogy of a short chest pain (a weak signal) and a heart attack (a strong signal). The person should be indicated to check a vital organ in the human body as a system even with the first chest pains (weak signals) because they may indicate a big problem with an important system component (such as the heart) coming that may disturb the entire system. A next logical question would be – how to distinguish important and relevant information with unimportant and irrelevant one? This is one of the questions our research pursues and aims to offer a direction for solution.

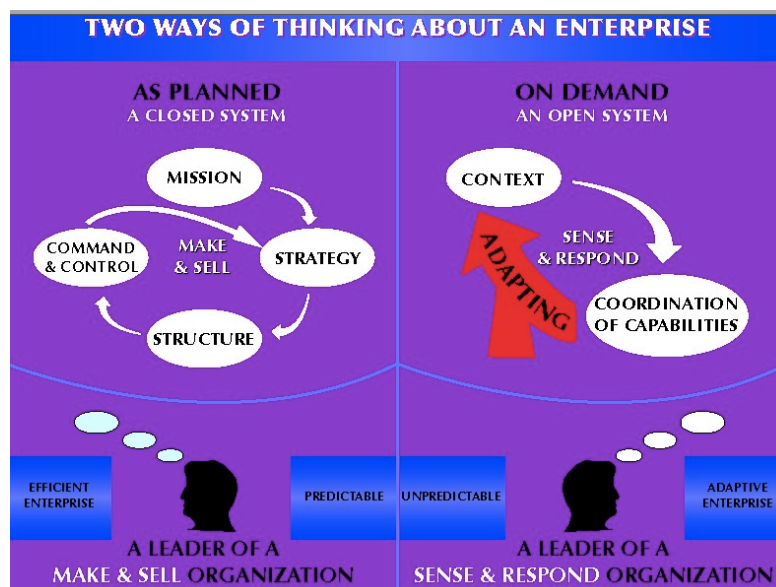


FIGURE 1.16 TWO WAYS OF THINKING ABOUT AN ENTERPRISE (HAECKEL 2016B)

1.4.5. ROLE-AND-ACCOUNTABILITY (R&A) SYSTEM DIAGRAM

The main instrument that assists managerial and organizational adaptation is the R&A system diagram (Figure 1.18). The generic outlook of two roles (provider (also called supplier role) and customer role) and the interaction between them are presented on Figure 1.17. In Sense and Respond, a role is defined as “an organizational component populated by individuals with accountabilities for negotiating and producing outcomes for other roles” (Haeckel 2016a). At this figure, there is also an outcome (in this case it is the primary outcome, but can be any outcome a supplier role is accountable for to the customer role); and examples for Conditions of Satisfaction (CoS) under which the outcome has been agreed on. If any of them changes, the roles re-negotiate the outcome, the influence on the remaining CoS and set up a new starting point. This is one of the mechanisms that provide adaptability, along with the positioning at the level of roles which can be populated by various changing persons/departments/sub-systems that are internal or external to the company.

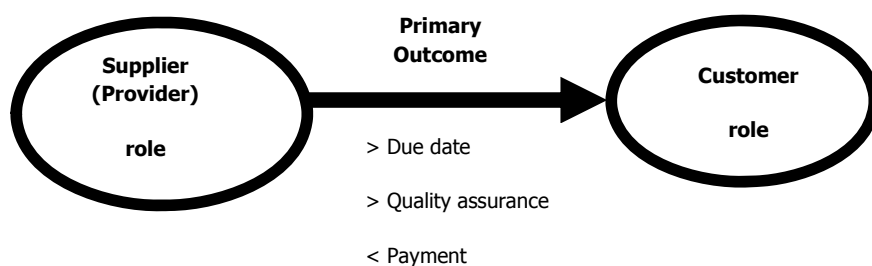


FIGURE 1.17 GENERIC ROLE AND ACCOUNTABILITY DESIGN, WITH PRIMARY OUTCOME AND CONDITIONS OF SATISFACTION (HAECKEL 1999; HAECKEL 2016A)

An example R&A diagram is the managerial system for a real project SENTINEL™ that was implemented in the company Xerox, for the purpose of designing a breakthrough customer satisfaction assurance solution. The company management wanted to achieve real proactivity and responsiveness for the clients and up to a certain point relied on a slow process of surveys, questionnaires, their gathering, analysis, categorization, reporting to management, prioritization, scheduling for a solution, while the customer were ‘stuck’ with the problem for very long time. By taking the S&R approach of detecting the primary purpose, designing the role and accountability diagram, providing necessary conditions for the people/departments that populated the roles to fulfill their outcomes, the project provided proactive, sensitive and pulling information flow and managerial responsiveness that the clients appreciated and the customer satisfaction has been improved exponentially. On the R&A diagram Figure 1.18 the primary purpose is ‘absence of problems with XEROX products and services, from the provider role ‘client exec’ to the customer role ‘customer end user’. The system is designed by decomposition of the primary purpose into roles accountable for some outcomes, and interacting among each other to produce the expected effect. There aren’t any two roles that are accountable for the same outcome. Also, there is no sub-optimization because the system is designed by decomposition from the primary purpose. Noticeable, there is a secondary goal – ‘profitable customer relationship’ and tertiary – ‘lowest cost of ownership’ that are being incorporated in the system design. In summary, out of the several key outcomes defined in the Who owes what to whom and why table, the most important one becomes a primary purpose. The others are lower level outcomes that in terms of content are being integrated into the structure of the R&A diagram. This situation describes the difference in the make-and-sell and sense-and-respond approach – the first one would have set as primary goal ‘profitable customer relationship’ but the latter asks the question: whom do we need to satisfy in order to work, make earnings and profits? The answer is – the customer. If the customer’s main problem is solved, it will inevitably bring business and profits for the provider.

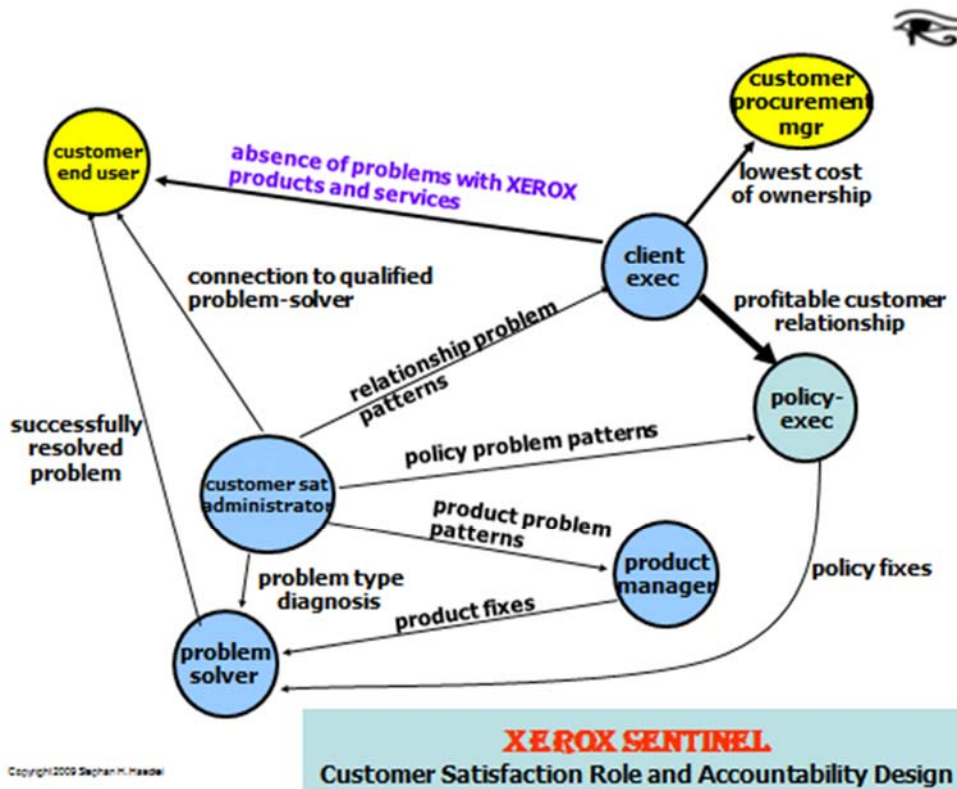


FIGURE 1.18 ROLE-AND-ACCOUNTABILITY DIAGRAM EXAMPLE (FROM (HAECKEL 2016A))

To make the contrast of the make-and-sell company more visible, the customer satisfaction process (not system) in the company, prior the introduction of the S&R approach, has been as on Figure 1.19.

typical customer satisfaction *process design*

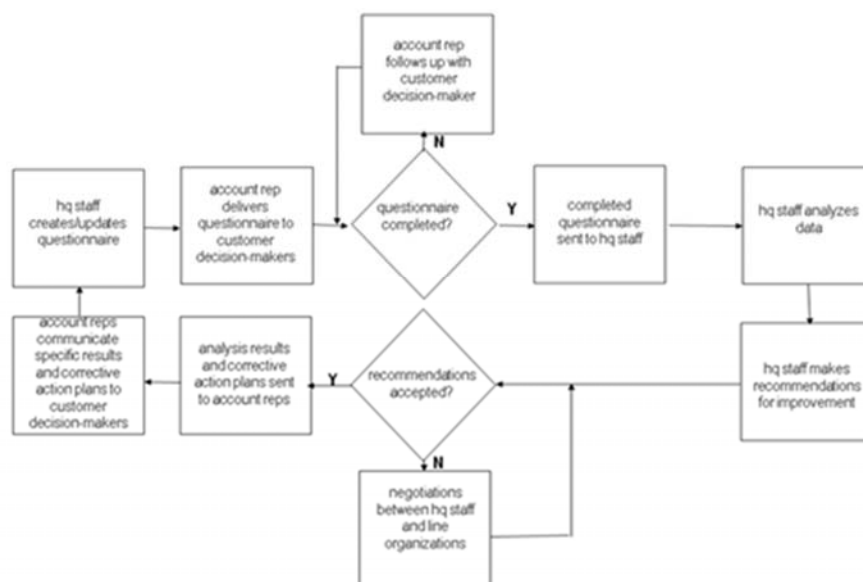


FIGURE 1.19 TYPICAL CUSTOMER SATISFACTION PROCESS DESIGN, FOR THE XEROX EXAMPLE (FROM THE ADAPTIVE ENTERPRISE: THE WORKBOOK (HAECKEL 2016A))

The S&R system for accomplishing zero problems with the company's products has achieved fast reaction and response to client's problems, which closed the communication cycle so that the company shifted from questionnaires, surveys, categorization, delayed responses and reactions and prolonged time to solve the client's problems with the equipment, to fast, reactive and even proactive. This is one of the many examples where the system design for a project is preferred before process design (Figure 1.19), and proactive behavior by sensing and responding, knowing earlier, sometimes even before the client, compared to reactive, by guessing and broadening the route for the information flows and managerial reactions. The outcomes of the project discussed here, are presented on Figure 1.20 and in the referenced book (Haeckel 2016a)



FIGURE 1.20 IMPACT OF INTRODUCING SENSE AND RESPOND PRINCIPLES IN THE XEROX'S PROJECT SENTINEL (AS ELABORATED IN (HAECKEL 2016A))

1.4.6. SENSE-INTERPRET-DECIDE-ACT (SIDA) LOOP – THE ADAPTIVE LOOP

The adaptive loop (Figure 1.21) begins to function in cyclical sense, and is fueled with data. It is importantly introduced both for adaptive individuals and adaptive organizations. They “first *sense* changes in their environments and internal states ...” (Haeckel 1999), p.14). The focused scanning of changes in the external and internal environment is of utmost importance for appropriate positioning of the sources of changes, personally, but also and especially with regards to the organization. This recommendation supports our positioning of the system of roles through the entire business ecosystem and even more broadly, the world (Figure 1.7). To continue with the quotation: “... They next *interpret* these changes in the context of their experience, aims, and capabilities, separating threats from opportunities and discarding irrelevant information. Next they *decide* how to respond and, finally, they *act* on their decisions. The progression from sensing to interpretation to decision to action becomes an iterative loop as the adaptive system monitors the results of its previous actions and picks up environmental changes that have occurred since the previous cycle” (Haeckel 1999), p.14). The phase of interpretation is the main distinguisher whether the information signals captured from the inner and outer environment are relevant for our system's behavior and achievement of purpose – after which the decision is made if and how to act in response. It makes the crossroad between the real noise – with which we are overwhelmed daily and has no meaning, just adds interference, and the apparent noise – which can be made sense of, in certain context, for which people decide upon, if captured (Haeckel 2004). It can be that there will be no action taken; it can be that there will be a positioning of a new information sensor in some direction; it can be that there are several actions undertaken as response to the interpreted significance and influence of the underlying source of that information. The scope of entities, events, agents that ‘emit’ information is very broad – from aims, capabilities, threats, opportunities etc. By ‘information sensor’ mentioned here we mean informational object that is placed to receive information about something prescribed relevant. The information sensor has attributes such as source of the information, frequency of obtaining, manner of obtaining etc. The ‘information emitters’ are also informational objects that have own attributes, and contain information that is being invoked by the user answering a question: ‘what would I like to know that is not told to me, and is relevant for certain outcome?’ (both elaborated in Chapter 4). For tactical management this scope is as broad as possible, too (Chapter 1). The adaptive loop is performed by adaptive organism continuously,

iteratively and simultaneously – it senses even as it acts, decides as it senses something else and so on (Haeckel 1999). Ultimately, this research aims to outline the content of the SIDA Loop for the role of tactical manager, which is mostly on a helicopter level above the system of roles and accountabilities.

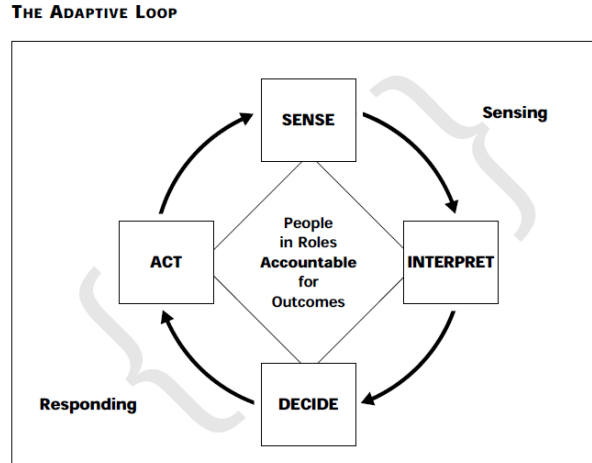


FIGURE 1.21 THE ADAPTIVE LOOP – THE SENSE-INTERPRET-DECIDE-ACT (SIDA) LOOP ((HAECKEL 1999), P.76)

1.4.7. MANAGEMENT INFORMATION FLOWS IN THE S&R FRAMEWORK

“No organization, of course, can interpret, let alone respond to, more than a fraction of the flood of signals that pours in from the environment. *Where* organizations choose to place their sensory probes and *how* they distinguish meaningful signals from random ‘noise’ determines whether they will be sufficiently aware of what is happening ‘out there’. Once aware, they must dispatch capabilities from their repertoire. Although information technology plays an essential role in this process, human skills in recognizing patterns and thinking creatively about unanticipated challenges will continue to mark the difference between successful firms and unsuccessful ones.” ((Haeckel 1999), p.15) This reasoning inspires us in the attempt to capture and structure the information needs for tactical management – by answering where and which information should be sensed, how it should be revised and updated, how it can be structured in a comprehensive manner embodying information that is necessary to ensure the tactical manager that the people/sub-systems populating roles will deliver what they are accountable for, that they have the necessary preconditions to do so, whether the interactions are properly set and functional, which risks and threats may occur and how to respond to them, and ultimately, how to improve each component further more. Since one of the core properties of complex adaptive systems is the property of signaling and information processing (Mitchell 2009), it makes sense to use this characteristic in designing the information flows for tactical management through information sensors, emitters and to point out their possible content. The general concepts concerning information needs of the entities populating the roles are prescribed in S&R Heads up displays with early information flows – and in the concept of managing by wire and responding faster, where the commands should flow. Haeckel’s (Haeckel 2016a) idea once the organization has been created as system of roles and accountabilities, has become modular, and can be reconfigured rapidly is that there must be a way for them to link, unlink and relink rapidly into effective responses to the challenge at hand. This idea is translated into his definition of “commitment management protocol” with which the persons/sub-systems populating the roles can negotiate, create, and track inter-role commitments, as well as the organization’s governing principles and the conditions of satisfaction.

1.4.8. SENSE AND RESPOND IMPLEMENTATION ROADMAP

After providing the main S&R components, and reasoning behind their introduction and preference, what is left for enabling a fully functional S&R application in real environment is the S&R implementation roadmap.

In brief, the S&R implementation roadmap (Haeckel 1999) consists of the following:

- A. Identification of the Primary constituents** – at this stage the team of managers reasons upon which are the key primary constituents that are involved for successful project
- B. Clarification of the Primary purpose and levels of desired effects** - the Primary purpose or the Reason for Being is selected and the design of a managerial system of roles and accountabilities starts from there
- C. Framing of the Governing Principles** – deciding on the governance by expressing ‘always’ and ‘never’ statements the entities populating the roles should follow
- D. Designing the Role-and-Accountability system diagram around the primary purpose** – as a starting point, a plan of action, as structure that addresses strategy
- E. Setting up the initial Conditions of Satisfaction** – making sure each entity populating the roles has the necessary preconditions to fulfill the expected outcome
- F. Addressing the information needs through the Heads up-displays and the Commitment protocol** – designing the information flows according to the needs of the entities populating roles
- G. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and effectuating adaptability to changes through the R&A diagram** – providing starting basis that is subject to changes initiated by the SIDA loop

This roadmap can be implemented into real environments to observe its applicability for tactical management, as well as how it should be adapted, enhanced and modified to provide tactical management adaptability incorporating information needs (elaborated in Chapter 4).

1.5. MAPPING COMPLEX ADAPTIVE SYSTEMS, SENSE AND RESPOND FRAMEWORK AND SOCIAL NETWORK ANALYSIS

In this chapter we attempted to point out the importance of considering the true nature of the managed entities (in our case CAS) when addressing them with a managerial framework (in our case S&R) and enhancing communication through visualization (in our case SNA/DNA). In Figure 1.22, we are pointing out the most important compatibility points that present a stabile foundation that supports the match among these three scientific approaches.

Regarding the relationship between the Sense and Respond Framework and Complex Adaptive Systems, Haeckel addresses complex adaptive systems in the observation that, neither ‘strategy-as-plan’ works in today’s information economy with high unpredictability, nor ‘strategy-as-emergent-behavior’ that assumes leaving the systems behave without a plan, and expect strategy to emerge from the interactions in time (Haeckel 1999). Our standpoint regarding the first is that planning works in very specific ways for tactics – through the structure of roles and accountabilities and through the smaller improvements translated to the operational level. Regarding the second kind of ‘strategy-as-emergent-behavior’, our approach is to actually consider the specificities of the CAS in order to address them properly – while facilitating CAS’s guidance towards primary purpose that should combine both individual and collective purposes of the CAS agents. The Sense-and-Respond Framework is able to resonate with CAS because of the recognition of Purpose (in both cases) and Governing Principles (non-extensive set of rules, usually referred to with ‘always’ or ‘never’) in S&R that apply to the CAS’s specificity that it needs simple rules to be addressed with.

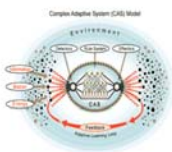
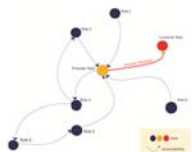
Complex Adaptive Systems	Social/Dynamic Network Analysis	Sense-and-Respond Framework
		
Autonomous Agents	Nodes (for Agents, Roles, Entities)	Non-redundant Roles
Networked together	<i>Network visualization in graphs with nodes and links</i>	<i>System of roles and accountabilities as directed graph</i>
Non-linear Dynamics	<i>Assists the detection of patterns through metrics (in static and dynamic analysis)</i>	<i>Attempts to address the non-linear dynamics with the system design</i>
- Complex and Non-determined processing of Inputs into Outputs and Patterns		
Sensitively dependent on Initial Conditions	<i>Can visualise Nodes (Agents, Entities, Roles, ...) and show them through time (dynamic graph feature)</i>	<i>Starts with the current Context and Givens and revises them constantly – the initial R&A design - starting plan & context</i>
Emergent behavior	<i>Visualisation (dynamic) helps perceive emergence</i>	<i>Guides towards Primary purpose as system effect</i>
Edge of Chaos	<i>Can track and compare metrics and make conclusions and recommendations</i>	<i>Following the governing principles and the adaptability components</i>
- Unpredictable behavior		
- But still structured enough to keep on going		
- Not chaotic		
Some rules of getting to the Edge of Chaos:	<i>Assists in visualizing the Infostructure, bipartite graph enables visualization of the IS entities along with the roles and accountabilities</i>	<i>Some rules for the system to work properly:</i>
I Simple rules		I Governing Principles
II Create moderately dense connections	<i>(bipartite network visualization – two categories of nodes: roles and IS entities)</i>	II Accountabilities, Negotiations as interactions
III Human rules		III Human rules
- How to detect information		- The Heads up displays
- How to interpret information		- Governing Principles
- How to act in response		- SIDA Loop, Accountabilities
Adaptive	<i>View of the system statics and dynamics</i>	Adaptable
- Change own behavior		- Change own behavior -> Negotiations, Re-populating roles,
- Change external entities		- Our setting to visualize the business ecology network
Attractor	<i>System stability can be assessed by metrics</i>	System Design around Purpose
Sources of Unpredictability in CAS	<i>View of the system statics and dynamics</i>	<i>Attempted to be solved by knowing earlier and responding adaptively</i>
- Open Systems		
- Any change in one affects another		
- Non-linear Interactions		

FIGURE 1.22 MAPPING THE COMPATIBILITY AMONG CAS, S&R AND SNA/DNA FOR PROPER MANAGERIAL APPROACH FOR TACTICAL MANAGEMENT ADAPTABILITY

Namely, the CAS consists of autonomous agents, which in SNA/DNA are represented with nodes and in S&R are populating roles. The autonomous agents in CAS are networked together, which can be fairly visualized with the graphs of SNA/DNA, while the system of Roles and Accountabilities in S&R can be perceived as a graph with nodes (roles) and directed links (accountabilities, interactions). The non-linear dynamics that is a CAS characteristic means complex and non-determined processing of inputs into outputs and behavioral patterns, to whose detection SNA/DNA offers metrics (in static and dynamic analysis), while S&R attempts to facilitate the non-linear dynamics with the system design of roles and accountabilities towards effect. CAS are sensitively dependent on initial conditions, SNA/DNA can visualize nodes (agents, entities, roles, ...) and show them through time (dynamic graph feature) while S&R starts with the current context and givens and revises them constantly – the initial R&A design is the starting plan and context upon which the further actions are taken. CAS exhibits emergent behavior whose visualization (especially SNA/DNA dynamic one) helps perceive emergence, while S&R guides towards primary purpose as system effect, trying to position it as one of the expected collective purposes of the CAS. The edge of chaos as a condition of CAS denotes unpredictable behavior that is still structured enough to keep on going and is not chaotic, SNA/DNA can track and compare metrics for us to make conclusions and recommendations for future managerial actions, while S&R is recommending following of the governing principles and the adaptability components to maintain in the state on the edge of chaos. Some rules of getting to the edge of chaos for CAS are to have: I Simple rules, II Create moderately dense connections, and to have III Human rules on how to detect information, how to interpret information and how to act in response; SNA/DNA assists in visualizing the inf-structure and even assists the mapping of the information flows, and the bipartite graph enables visualization of the information system entities along with the roles and accountabilities; while in S&R, some rules of getting the system to work properly are: I Governing Principles, II Accountabilities, Negotiations as interactions and III Human rules (the heads-up displays, the governing principles and the SIDA Loop and accountabilities). The characteristic of CAS of being adaptive recognizes that the systems either change their own behavior or change the environment, the SNA/DNA offers a view of the system statics and dynamics while the S&R ought to provide an adaptable mechanism that facilitates the CAS to change its own behavior through negotiations and re-populating of roles, and our initial setup to visualize the business ecology network so external entities are included enables perception on how the adaptive CAS influences and interacts with the environment. The CAS attractor in S&R is the system design around a Purpose, and this can be assessed by the visualizations and metrics of the SNA/DNA. The sources of unpredictability in CAS are because they are open systems where any change in one affects another with non-linear interactions; SNA/DNA provides a view of the system statics and dynamics while the S&R solution for unpredictability is through knowing earlier and responding adaptively, performing the SIDA loop and our big-picture business ecology view. The organized complexity for CAS is recommended to be achieved by flat hierarchy, high modularity and loose coupling; complexity is scientifically addressed by graph theory, Social Network Analysis and Dynamic Network Analysis while S&R is helping to organize complexity in order to manage it by giving proper authority for the role and conditions of satisfaction, providing modularity through the genericity of roles, and loose coupling of the interacting roles that can be re-coupled and made responsive to changes.

These are the main connection points that inspired us to use the S&R framework for addressing CAS for adaptability, and choosing SNA/DNA for visualizing it and improving the communication flows and effectiveness of the managerial and the managed system efforts. Hopefully, they will be a setup, a foundation, a construction for other managerial artifacts designs since recognizing what we are dealing with (CAS) and addressing a CAS appropriately will lead to better results in any domain. A CAS consists of autonomous agents, who have their own purposes and can be steered towards a collective purpose, and exhibit emergent effects along the way. We, as humanity, are adding complicated and even complex instructions to already complex systems, and use very little opportunities to visualize them. These mistakes bring out even bigger confusion, lack of purpose, little coherence and collaboration – resulting in bad or no effects. An adaptive organism needs to be managed through adaptability, not rigidity. Especially when the goals are set, the resources are given, and one needs to guide by maneuvering all those givens, in a dynamic and unpredictable context in time. This research will attempt to offer one solution built on this theoretical foundation, and evaluate its success and usefulness.

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CHAPTER IV

ARTIFACT DEVELOPMENT

AND

EVALUATION

THE ACTION DESIGN RESEARCH

This chapter encompasses the Design Science Research (DSR) stages of developing, building, justifying and evaluating the research artifact while continuously consulting the knowledge base for rigor and the real-life environment for relevance (A. Hevner & Chatterjee 2010; Gregor & Hevner 2013; Hevner 2007). The spirit of the research, researcher profile and the outcome to be achieved by the research lead to the Action Design Research (ADR) (Sein, Henfridsson & Rossi 2011), which presents an implementable crossroad for the DSR core ideas, as the most appropriate method for conducting the building and evaluation of the artifact. Continuing to follow Wieringa's nested problem solving (Wieringa 2009) we have performed the regulative ADR cycle by altering knowledge questions and practical problems through designing an artifact and performing in-depth interventions for four practical problems in real-life contexts. All research was performed according to the ADR specifics, including evaluation, reflection and generalization to a class of problems, design principles, and class of solutions. The research design reflected the Context-Intervention-Mechanism-Outcome (CIMO) logic (Denyer et al. 2008; Van Aken & Romme 2012; Van Aken 2007) and realist evaluation type (Pawson & Tilley 1997). The structure of the chapter is as follows:

- Elaboration on the ADR as a research method and explanation on how it has been applied for the research in four companies and with eleven managers in Macedonia and Belgium (Section 1 - Action Design Research for Tactical Management Information Systems and Adaptability)
- Description of the business collaborators (the Context(s) from the CIMO logic) (Section 2 - Description of the business collaborators in the ADR)
- Elaboration of the ADR stages in their proposed order, even though there is evidence of multidirectional interconnectedness and mutual influence throughout time and in terms of simultaneous stages (Section 3 - ADR Stages)
 - o The problem formulation from generic to instantiated tactical management issues is described as the first stage, completing the view of the four contexts.
 - o Building-Intervention-Evaluation (BIE) as second stage is explained for the four contexts, in static and dynamic terms; and special retrospect is given to the formative and summative evaluation. At that point, the Intervention(s), Mechanism(s) and Outcome(s) for the four contexts (from the CIMO logic) are addressed in depth.
 - o The reflection and learning is performed in the third stage of the ADR, reflecting on the design and re-design during the ADR, evaluating adherence to principles and analyzing intervention results according to the stated goals
 - o The formalization of the learning as fourth stage of the ADR, is done through generalization to a class of problems, design principles, and class of solutions

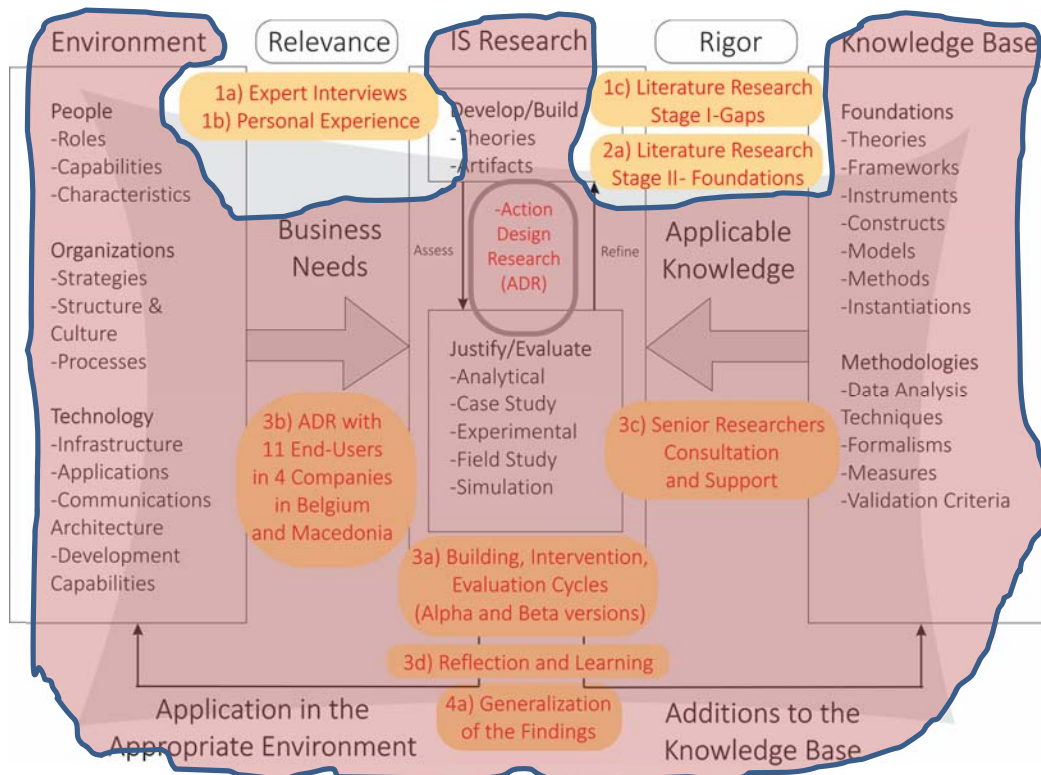


FIGURE 1.1 TACTICAL MANAGEMENT IN DESIGN SCIENCE RESEARCH FRAMEWORK (HEVNER ET AL. 2004)

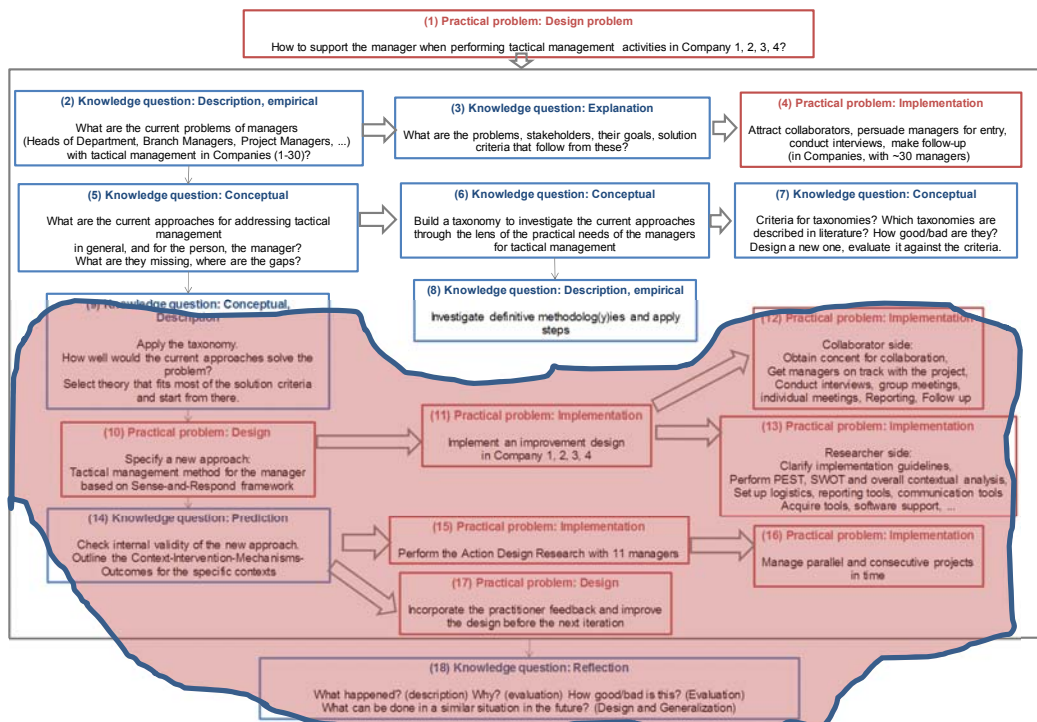


FIGURE 1.2 NESTED PROBLEM SOLVING OF TACTICAL MANAGEMENT RESEARCH (WIERINGA 2009)

1. ACTION DESIGN RESEARCH FOR TACTICAL MANAGEMENT INFORMATION SYSTEMS AND ADAPTABILITY

1.1. ACTION DESIGN RESEARCH AS METHOD

The research design for the Design Science Research (DSR) methodology (Hevner et al. 2004) (Gregor & Hevner 2013) (Hevner 2007) (Wieringa 2009) (Vaishnavi & Kuechler 2004) (Peppers et al. 2007) is a complex variety of methods, tools and techniques that enable contemplation of the research idea, motivation and goals; the researcher(s) profile, competences and strengths – both in the research domain(s) and in the research. Recently, Action Design Research (ADR) has been introduced by (Sein, Henfridsson, Rossi, et al. 2011) (Rossi & Purao 2012) (Purao et al. 2013) with strong efforts to facilitate DSR's sustainability by means of an effective research method. Its idea of incorporating organizational context and its influence to the information systems artifact design and utility together with the traced pathway to enable the emergence of the artifact design from the interaction of the researchers, practitioners and the real-life organizational and broader context is of immense importance for young researchers, but also for successfully bridging academia and business.

ADR is a research method for generating prescriptive design knowledge through building and evaluating ensemble IT artifacts in an organizational setting (Sein, Henfridsson, Rossi, et al. 2011). The most important features of the ADR method are the incorporation of Action and Design meaning:

- Addressing a specific issue, problem or challenge in an actual organizational context by means of intervention and continuous evaluation
- Designing and evaluating an artifact that should be solving a class of problems generalizable from the organizational problem instance

Our research aims at designing a method for the manager to improve the performance of the tactical management function through the self-design of the tactical manager's information system that supports the tactical management system and its adaptability. Tactics in its essence means capturing dynamic context and adapting to it, and/or purposefully changing the context. Tactical management requires adaptability to changes that can be sensed in an actual organizational ecosystem and the information system requirements for this specific managerial function necessitate mapping of the information flows that relevantly reflect the 'living nature' of the business and environment. All previously said orients tactical management in the pursuit of accomplishment of goal(s) – for which the manager is causing changes to the managed system and the environment, as we will see next, through the managed system. The boundaries of tactical management are numerous – there are 'given' variables at every step of the way. The entities in the broadest business ecosystem are out of the manager's influence, the other entities' actions are a 'given', the resources are 'given' the ends, goals, governing principles are 'given'. All these 'givens' are dynamic and to some extent unpredictable variables. Still, tactical management is the function that should find a way for steering and facilitating the managed system towards fulfilment of the expected outcomes in the given circumstances and context. We are assisting the manager to accomplish the effect from the tactical management function with managerial and information system adaptability (elaborated in Chapter 2). Our research was conducted in different organizational contexts, to facilitate making conclusions on the categories and patterns of information entities and generalizing on the adaptability and information system requirements and needs for tactical management. This is just a non-exhaustive list of reasons (also discussed in Chapter 1) why we chose the ADR method for artifact building, implementation and evaluation and we will elaborate further how it proved to be a good match for our purpose.

The stages and principles that are the core of ADR are presented on Figure 1.1. In Section 3 each of the stages and enforcement of the principles and how we applied these will be elaborated in detail.

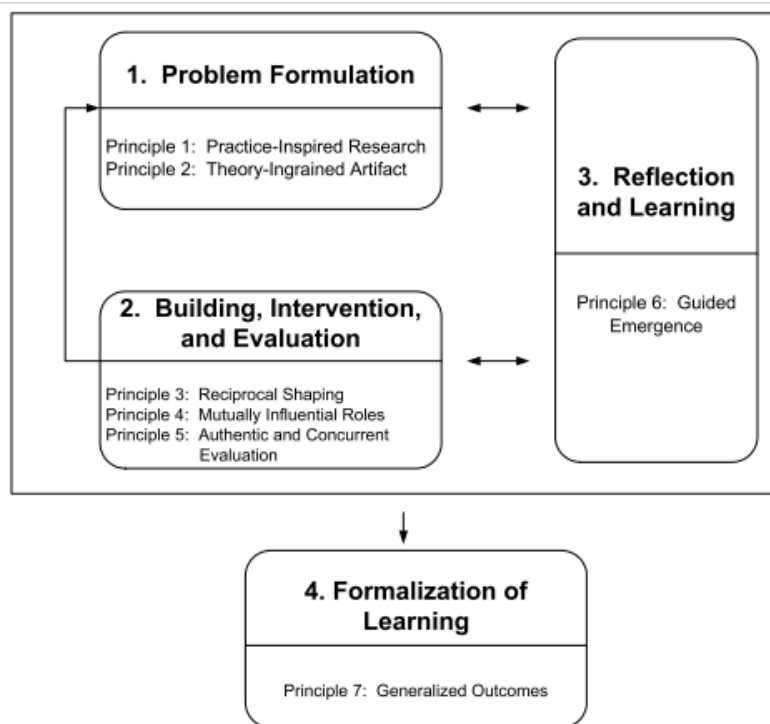


FIGURE 1.1 ADR METHOD: STAGES AND PRINCIPLES (SEIN, HENFRIDSSON, ROSSI, ET AL. 2011)

The design artifact – a method for the manager that supports tactical management, its adaptability and information systems is named “DENICA” (to be read de-ni-tsa). In Cyrillic: “ДЕНИЦА” It means the 'Morning star' usually associated with Venus. It is not the Northern star (Polaris) which the sailors used for absolute orientation, because that would denote the strategy in our research. Denica it is the one lit by the Sun and it announces the coming of the day. It is sometimes very hard to see and find and it is changing its position on the sky. It resembles like tactics, lighting up a solution, uncovering the right path, changing routes while still helping orient the sailor (in our case the manager) and his/her crew. Further in the text, the method will also be referred to as the DENICA method.

1.2. PERFORMING ACTION DESIGN RESEARCH WITH COMPANIES AND MANAGERS IN BELGIUM AND MACEDONIA

Following the exploratory communication with practitioners and academics (Figure 1.1 – Labels 3a, 3b, 3c, 3d and Figure 1.2), (as elaborated in the introductory chapter) we continued the development (building), justification and evaluation of the design artifact through Action Design Research in four companies (labeled A, B, C, D) in Belgium and Macedonia:

- Company A is big consultancy firm with headquarters in Belgium, operating mostly in Belgium, Netherlands and France. A senior manager and 8 project managers and team leads have been our end-users 1-9.
- Company B is a small software implementation and consultancy company, serving few clients with international staff. The owner/manager of the company has been our end-user 1. It is important to note that end-user 1 has been previously employed in Company A, and then started his own business. This is the only user that has been our collaborator in two contexts, and has been involved in two alpha and extensive beta-version of the artifact (for details refer to Appendix A and B).
- Company C is a small geodesic and engineering bureau with nationally scoped business in Macedonia. The owner/manager of the company is our end-user 10.

- Company D is a big production company with headquarters in Macedonia and international business on several continents. The director of the development department is our end-user 11.

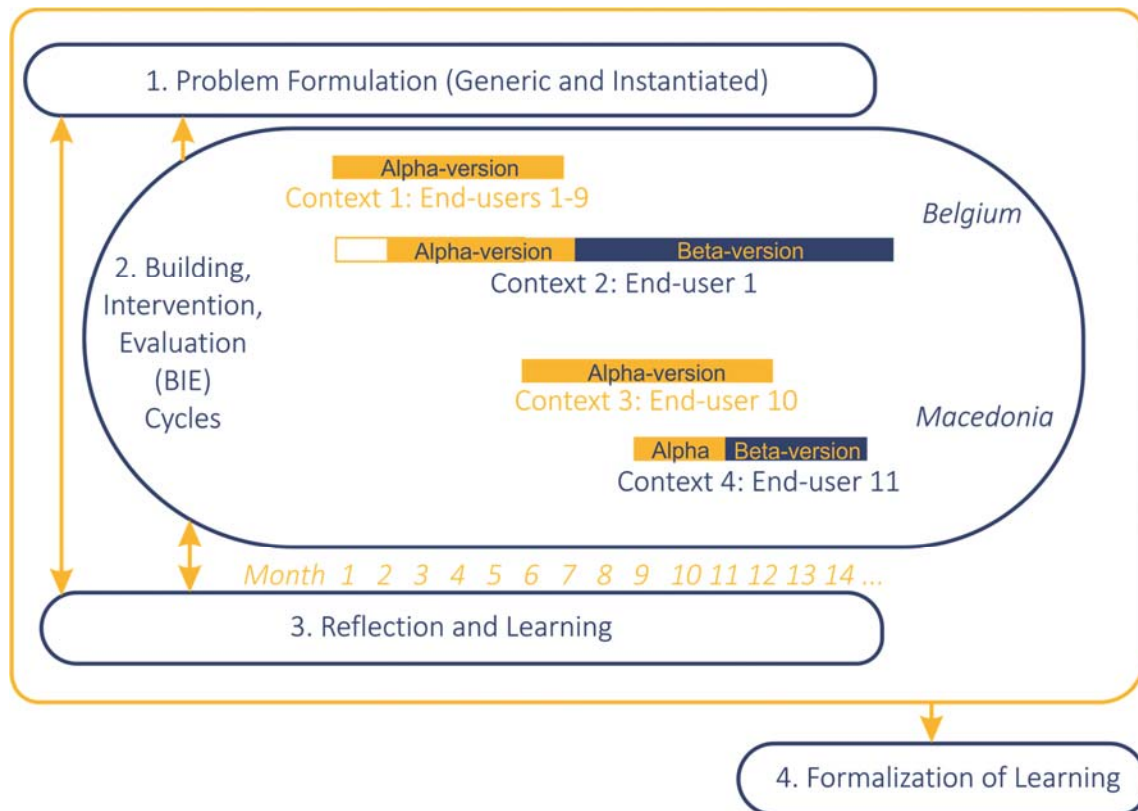


FIGURE 1.2 ACTION DESIGN RESEARCH – PRACTICAL IMPLEMENTATION IN COMPANIES (ACCORDING TO (SEIN, HENFRIDSSON, ROSSI, ET AL. 2011))

The Problem Formulation stage in ADR passes through generic and instantiated sub-stages. We spent the first few months in each company investigating a real tactical management problem for that specific company, which was formulated as an instance of a generic problem formulation. The problem statement for this PhD research is how to provide adaptability for tactical management; while the generic problem – what is a tactical management problem and the instantiated problem – which tactical management problem is going to be addressed, are subject to the problem formulation stage in the ADR. Working with an instantiated problem enables the subject company to benefit from the research involvement and investment in time and human resources, while providing us with a tangible instantiated setting to investigate a generic problem and its proposed solution in a real life environment.

In the four companies, the BIE cycles stage of ADR has been:

In Company A in Belgium and Company C in Macedonia we have investigated a tactical management issue – and proposed a Sense-and-Respond solution for the management to follow. When tracking in the generic schema for the Organization-Dominant BIE (Sein, Henfridsson, Rossi, et al. 2011), we consider this to be the **Alpha-version** in the artifact design.

- Company A – Belgium – Optimizing staff utilization across projects (Microsoft Dynamic implementations and consultancy)
- Company C – Macedonia – Shifting the customer perception for the Company (from only geodesic services to engineering, geodesic and consultancy services)

In Company B in Belgium and Company D in Macedonia we have also investigated a tactical management issue – and proposed a Sense-and-Respond solution for the management to follow – and the involved manager in the

companies carried on the usage of the designed artifact throughout the next months to register all the information needs (Information Sensors, Emitters, Risks), changes as well as all system re-design needs. In the generic schema for the Organization-Dominant BIE we consider this to be the **Beta-version** in the artifact design.

- Company B – Belgium – Enable customer's management to spend the least time possible on remote communication with geographically scattered staff members
- Company D – Macedonia – Provide the earliest possible information for status and discrepancies to management in a new factory construction and equipment alignment project

In each different organization, we followed the CIMO (Context-Intervention-Mechanism-Outcome) research logic (Figure 1.3) (Denyer et al. 2008) to evidence-based management in design science. The CIMO logic lays foundations for important aspects of the research design and evaluation stages (Van Aken & Romme 2012). The logic of applying the solution concept is the design proposition (also called technological rule). The design proposition puts the solution concept into its application context. The design science approach to organizational development is resulting in some new perspectives about how organizational development interventions might support more effective organizational change (Van Aken 2007). CIMO logic is one way organizational changes are analyzed (Ropes et al. 2014). CIMO has been used in various research projects but also program implementations (Pelcher-Herring 2014). "It runs like: if you want to achieve a given outcome for this generic problem-in-context, then use this generic intervention" (Van Aken 2007), p.146. This choice has been made in line with Wieringa's value claim for effect (E) "E is a claim about the effect of the solution in a context; Different contexts of the same solution may lead to different effects. The value claim then compares the effects with criteria derived from stakeholder goals" (Wieringa 2009). We steered the research in the companies, firstly by getting acquainted with the company, its business, mission, vision, goals, strategy, current systems, tactical management approach, expectations, by performing a variety of contextual analyses and a SWOT analysis, employing interviews, group discussions with end-users and cross-discussions with management. With this elaborate approach, at least four contextual layers, i.e., the individual, the interpersonal relationships, the institutional setting, and the wider infrastructural system (Pawson & Tilley 1997), have been investigated towards understanding, in order to properly address the specific context with appropriate intervention. These activities were a prerequisite to properly identify the real tactical management issue to be addressed, and to communicate it accordingly with the managers responsible for the specific outcome. We tried to point out the usefulness of the ADR in their company both for the researchers and for the company. Also, in this way, we utilized their expert opinion and constructive criticism which was valuable for the outcome. Almost immediately after start, we trained the end-users with the primitive concepts and roadmap of the Sense-and-Respond framework, in order to have them thinking in terms of the research.

In order to best describe the objective and systematic experiential social learning through developing and testing in context (Van Aken 2007) throughout the series of four cases, we will argue that our ADR has enabled us, throughout the timeline of 14+ months of work with the end-users, to go through advancing the Alpha- and Beta- versions of the design artifact. We approached each manager and company with the same initially designed version of the initial artifact, but we informed each newly involved manager with the benefits of the use from the previous cases. It is certain to say that the 'learning' on the side of the researchers, has been communicated with the end-users back and forth. The contexts (C1, C2, C3, C4), the mechanisms (M1, M2, M3, M4, M5, M6, M7, M8, M9) and the expected outcomes (O1, O2) with our solution interventions (I1, I2, I3, I4, I5, I6, I7, I8) as outlined in Figure 1.3 will be elaborated in detail through the ADR cases and stages in Section 3. Figure 1.4 contains the detailed transposed findings of every context intervention (Ic1, Ic2, Ic3, Ic4), context mechanism (Mc1, Mc2, Mc3, Mc4) and context outcome (Oc1, Oc2, Oc3, Oc4).

CONTEXT(S)	INTERVENTION(S)		MECHANISM(S)		OUTCOME(S)	
C1, C2, C3, C4	Ic1, Ic2, Ic3, Ic4		Mc1, Mc2, Mc3, Mc4		Oc1, Oc2, Oc3, Oc4	
End-users Company profile Industry Organizational structure Tactical issue/problem Managerial structure Problem type Artifact version	I1	Tactical authority level	M1	Personalized IS self-design	O1	Personalized IS self-design and adaptability
	I2	Big picture overview (Business ecology), Scope	M2	Simplicity of the artifact use	O2	Adaptability of the managed system
	I3	System design of Roles and Accountabilities	M3	Multifaceted Context-capture		
	I4	Clarity of Purpose and Governing Principles	M4	Maintaining the system till purpose is reached		
	I5	Guidelines to the manager on reasoning and acting for informing and translating decisions on business and information level	M5	Double loop organizational learning		
	I6	Sense-Interpret-Decide-Act Loop for adaptability	M6	Effective communication		
	I7	Plan-Do-Check-Act Loop for improvements	M7	Empowerment of the entities in Roles		
	I8	Incorporating Risk in parallel with Outcomes	M8	Situation awareness		
	I9	Visualizations				

CONTENTS							INTERVENTIONS										MECHANISMS							OUTCOMES			
E1	E2	E3	E4	E5	E6	E7	E8	E9	M1	M2	M3	M4	M5	M6	M7	M8	O1	O2									
End users	Company profile	Industry	Organizational structure	Tactical issue/problem	Managerial structure	Problem type	Artifact version	Tactical authority level	Big picture overview (Business essence, Scope)	System design of Roles and Accountabilitys	Clarity of Purpose and Design Principles	Guidelines to the manager on reasoning and acting for informing and translating decisions on business and information level	Sense-Interpret-Design-Act Loop for adaptability	Plan-Do-Check-Act Loop for improvements	Integrating Risk together with outcomes	Visualizations	Personalized self-design	Simplicity of the artifact use	Multifaceted Context capture	Maintaining the system till project is reached	Double loop organizational learning	Effective communication	Empowerment of the system in Rules	Situation awareness	Personalized self-design and adaptability	Adaptability of managed system	
Company A: Project Manager/Team Leads (18)	Existing big company	Software and hardware consultancy	Mature	Tactical issue: Project and Middle (Team and Managerial) managers	Managerial structure	Existing situation: Project manager is existing organization	Alpha: Sense-and-Respond application for TM user/Project	E1	Developer attitude: Self to be achieved	Estimated of primary importance	Need to think in terms of Rules - not in terms of Descriptions	Helped remove ambiguity and achieve clarity and proper communication within the company	Instruction that is always kept in mind and enforced intentionally on individual level	Not utilized during the study on any individual	Making use of accountabilitys either fulfilled or not	Clear, easy to use, extremely useful and of primary importance for everyone	M1	Considering the holistic important not just the project focus	For complex issues it was complicated to use and not user friendly	Enabling use of the structure of information flows and manager's propriety use adaptively	To enable common goal, synergy and emergent effect	Only single loop organizational learning has been achieved	Setting the communication foundation and removing barriers	The main manager had the responsibility to build the system - People had the responsibilities but not the power to fulfill them	Level 1 achieved	Investigated and formulated, through the observations and theoretical elaborated but not experienced in the managerial and technical aspects of the Alpha version	Only initially set up and theoretical elaborated but not experienced in the managerial and technical aspects of the Alpha version
Company B: Owner of the company (12)	Startup with experienced company	Software and management consultancy	Prostent	Stable customer's management to spend least time possible on management with geographically scattered staff members	Manager/Owner	New project support for new organization	Data: Meta's artifact to get a name for the artifact	E2	Strategic attitude	Estimated of strategic importance	Thinking in terms within the company is difficult	Helped remove ambiguity and achieve clarity and proper communication within the company	Instruction that is always kept in mind and enforced intentionally on company level	Introduced and practiced to improve each other's fulfilled or not	Making use of accountabilitys either fulfilled or not	Clear, easy to use, extremely useful and of primary importance for everyone	M2	Looking for IT and business processes and dynamic changes for managed and communication needs	Enabling use of the structure of information flows and manager's propriety use adaptively	To enable common goal, synergy and emergent effect	Adapting as well as learning with the system and rapid system change	Setting the communication foundation and removing barriers	Manager with the authority to manage the system - Managing the system in the AAR sense, facilitating the system to accomplish the system's goals and responsibilities	Level 1, Level 2, Level 3 achieved	Complete implementation and recognition of the system's benefits and continuous use of the system's Design	Complete implementation and recognition of the system's benefits and continuous use of the system's Design	
Company C: Owner of the company (11)	Existing small company	Geodesic and engineering service	Functional	Shifting the Customer Perception for the Company from only geodesic services to engineering, geodesic and consultation services	Manager/Owner and Operational managers	New project support for existing organization	Alpha: Sense-and-Respond application for TM user/Problem	E3	Strategic attitude	Estimated of primary importance	Thinking in terms of communication within the company	Helped remove ambiguity and achieve clarity and proper communication within the company	Instruction that is always kept in mind and enforced intentionally on individual level	Not utilized during the study on any individual	Making use of accountabilitys either fulfilled or not	Clear, easy to use, extremely useful and of primary importance for everyone	M3	The inception was with big effort from researcher side, for information flows and manager's propriety use	Enabling use of the structure of information flows and manager's propriety use adaptively	To enable common goal, synergy and emergent effect	Only single loop organizational learning has been achieved	Setting the communication foundation and removing barriers	Empowerment to a certain extent: Because of the system's ability to fill the role	Level 1 achieved	Investigated and formulated, through the observations and theoretical elaborated but not experienced in the managerial and technical aspects of the Alpha version	Only initially set up and theoretical elaborated but not experienced in the managerial and technical aspects of the Alpha version	
Company D: Project Manager/Team/Manager (10)	Existing big company	Food production	Mature	Provide earliest information for data and discrepancies to management in a new Factory construction and equipment alignment	Managers/Directors, Middle (Team and Project) and Operational managers	Building project support for existing company	Data: Meta's artifact	E4	Developer attitude: Self to be achieved	Estimated of primary importance	Thinking in terms of Rules is not within the client's scope	Helped remove ambiguity and achieve clarity and proper communication within the client's scope	Instruction that is always kept in mind and enforced intentionally on company level	Practiced on managerial level	Making use of accountabilitys either fulfilled or not	Clear, easy to use, extremely useful and of primary importance for everyone	M4	Related to the current situation of the information needs for use in a relevant but not a scheduled manner	Enabling use of the structure of information flows and manager's propriety use adaptively	To enable common goal, synergy and emergent effect	Only single loop organizational learning has been achieved	Setting the communication foundation and removing barriers	Empowerment to a certain extent: The method helped clarify which collaborator needs additional information to be provided to them	Level 1, Level 2, Level 3 achieved	Complete implementation and recognition of the system's benefits and limitations perceived, contributed to the system's awareness and adaptability	Complete implementation and recognition of the system's benefits and limitations perceived, contributed to the system's awareness and adaptability	

2. DESCRIPTION OF THE BUSINESS COLLABORATORS IN THE ADR – CONTEXT(S)

CONTEXT(S)

The entire combination of the company, end-users, organizational structure, managerial structure and other important aspects that describe the specific context in which the research is taking place, will be further on referred to as C(ontext)1, C(ontext)2, C(ontext)3, C(ontext)4 (as shown in Figure 2.1). This should enable reader fluency of the CIMO logic throughout the research and easier, simpler reference to the different business collaborators of the ADR research within the text.

CONTEXT(S)					
	End-users	Company profile	Industry	Organizational structure	Managerial structure
C1	Company A: Project Managers/Team Leads (9)	Existing big company	Software and management consultancy	Matrix	Top, Middle (Team and Project), Operational managers
C2	Company B: Owner of the company (1)	Startup with experienced owner	Software and management consultancy	Project	Manager/Owner
C3	Company C: Owner of the company (1)	Existing small company	Geodesic and engineering bureau	Functional	Manager/Owner and Operational managers
C4	Company D: Project Manager/Team Lead (1)	Existing big company	Food production	Matrix	Managers/Owners, Middle (Team and Project) and Operational managers

FIGURE 2.1 CONTEXTS (FROM THE CIMO-LOGIC) IN WHICH THE RESEARCH TOOK PLACE

2.1. CONTEXT 1: COMPANY A, END-USERS 1-9

Company A (Ad Ultima Group, Kortrijk Belgium, France, Netherlands; <http://www.adultimagroup.com/en>) is a big software consultancy firm with headquarters in Belgium, operating mostly in Belgium, The Netherlands and France. Founded in 2000, it now employs over 200 people, with an annual turnover of over 22 million EUR. A senior manager and 8 project managers and team leads have been our end-users 1-9. The execution of tactical management relies on personal inputs from the manager as well as inputs from organizational factors. On the side of the personal inputs that influence the tactical management performance, very important are the personal qualifications, skills and competences obtained through education, experience (tenure, area) and training. The ADR has been carried out with experienced project managers. Their experience ranked from 5 to over 10 years in this domain with over 200 international customers and integrated systems for the company as a whole. The educational backgrounds of the managers involved varied from engineering, human resources, economics to political sciences and IT. The specific skills and competences have been acquired throughout their professional experience in various companies, such as: software project management in terms of methodology (SureStep, Agile) and products (Microsoft Dynamics, Microsoft CRM, Microsoft Nav). The management of the company had invested vastly in providing various organizational support as well as training and soft-skills development for its project managers. Each of the middle managers involved in the research has been leading 10+ employees (consultants, developers, domain specialists, ...). The company had a complicated organizational structure – matrix but in the background of the projects, there was invisible functional structure too. Consequently, the project managers had to steer projects across various departments, interfering with other projects, having continuous challenges to intermediate and negotiate with peers, clients, management, employees in order to run the projects. Over-time, over-budget and/or with changed functionalities were frequently observed in all the projects.

2.2. CONTEXT 2: COMPANY B, END-USER 1

Company B (Suelto GCV, Halle, Belgium) was founded in 2014. Through the course of our ADR research, in month 1, one specific manager we collaborated with, was employed in Company A, performing duties and activities on specific projects managing his own team. However, in month 3, this professional left that company and started his own business, in the same domain – software and management consultancy. The owner-manager of the company B is thus our end-user 1 as he was referred to in Context 1. This SME owner is an experienced project manager in software consultancy and implementations, with proficiency practiced over 11 years in this domain with over 100 international customers and integrated systems. The educational background of the manager is in Human Resource Management and the specific capabilities and knowledge are gained in the software project management domain in terms of methodology (SureStep, Prince 2, SCRUM, Six Sigma, Agile) and products (Microsoft Dynamics, Microsoft CRM, Microsoft Nav). The consultancy has collaborated with several big clients 2014-present and has several successful implementations of the design artifact in new contexts for new projects – disseminating and verifying its applicability.

2.3. CONTEXT 3: COMPANY C, END-USER 10

Company C (GeoBalkan Bitola, Macedonia; <http://geobalkan.mk/index.php/en/>) is a small geodesic and engineering bureau with nationally scoped business in Macedonia. Founded in 2009, it records organic growth and currently employs 10 persons, while the owner/manager attempts to cope with micro-management, project management, strategy and tactics because of the growing business. The company's business is realized through tenders of state institutions and complete offer in geodesic, cadastral, construction and real-estate services for legal and private entities in the country. The owner/manager of the company is our end-user 10. He has an engineering educational background and has managed the company completely, while now facing increased business and lack of managerial support.

2.4. CONTEXT 4: COMPANY D, END-USER 11

Company D (Vitaminka AD, Prilep, Macedonia; <http://www.vitaminka.com.mk/en>) is a big production company with headquarters in Macedonia and international business on several continents. It is a food-production company with over 30 categories of food and over 350 different types of packaging. The company exists for over 60 years and has international markets placing over 45% of its production in over 30 countries around the world. It employs 600 people, with an annual turnover of over 28 million EUR. It has certification and standardization for its processes. The director of the development department is our end-user 11. His educational background is in engineering. The

company has shareholders with a management board and matrix organizational structure. However, the delegation of authority is in top management and to a certain extent in very few middle managers.

3. ADR STAGES

3.1. ADR STAGE 1: PROBLEM FORMULATION

We have executed the stage of problem formulation four times in the different companies. It differentiated in two sub-stages of (1) generic and (2) instantiated problem formulation. The pursuit for a generic problem formulation was with regards to communicating and detecting the category of problems that can be considered as tactical management issues related to adaptability and information needs and requirements, since this was the focus of our research. The companies have an array of different problems or challenges to be solved. It is of primary importance for the researcher to communicate broadly and in-depth with senior, middle and project managers as well as explore various documents, web-content, reports and other sources in order to identify a tactical management problem in scope of the PhD research, that the company faces and is struggling to solve. The problem needs to be in need of a solution and should be contributing to several entities and/or business lines in the company, so that the participants are motivated to collaborate. The instantiated problem implies the actual implementation of the research artifact (as the solution that is needed), the basis for researcher-practitioner collaboration, and the ADR purpose in a specific, real, living business activity that is implemented, shaped and monitored by the researchers and the practitioners. The selection of similar organizational entities and managerial profiles as two per country (Belgium and Macedonia) has been purposeful, in order to be able to draw conclusions about country differences in terms of conducting and effectuating research of this kind. A brief summary of the different contexts (part of which has already been elaborated in the description of the business collaborators in section 2) and the problem type and specific artifact versions implemented in each of them is presented on Figure 3.1. The detailed elaboration follows in the next sub-sections.

CONTEXT(S)								
	End-users	Company profile	Industry	Organizational structure	Tactical issue/problem	Managerial structure	Problem type	Artifact version
C1	Company A: Project Managers/Team Leads (9)	Existing big company	Software and management consultancy	Matrix	Optimizing staff utilization across projects	Top, Middle (Team and Project), Operational managers	Existing situation improvement for existing organization	Alpha: Sense-and-Respond application for TM issue/problem
C2	Company B: Owner of the company (1)	Startup with experienced owner	Software and management consultancy	Project	Enable customer's management to spend least time possible on remote communication with geographically scattered staff members	Manager/Owner	New project support for new organization	Beta: the DENICA method and tool as an artifact
C3	Company C: Owner of the company (1)	Existing small company	Geodesic and engineering bureau	Functional	Shifting the Customer Perception for the Company (from only geodesic services to engineering, geodesic and consultancy services)	Manager/Owner and Operational managers	New project support for existing organization	Alpha: Sense-and-Respond application for TM issue/problem
C4	Company D: Project Manager/Team Lead (1)	Existing big company	Food production	Matrix	Provide earliest information for status and discrepancies to management in a new factory construction and equipment alignment project	Managers/Owners, Middle (Team and Project) and Operational managers	Existing project support for existing organization	Beta: the DENICA method and tool as an artifact

FIGURE 3.1 SUMMARY OF MOST IMPORTANT ASPECTS IN TERMS OF PROBLEM FORMULATION AND ARTIFACT VERSION OF CONTEXT(S) FOR THE ADR

The elaboration on each problem type, along with all contextual factors and risks, per company, is presented in the Appendix (Appendix A and the respective subheadings)

3.2. ADR STAGE 2: BUILDING – INTERVENTION – EVALUATION

The Building-Intervention-Evaluation (BIE) cycles in our research have taken place in the four organizational contexts and with 11 managers as end-users. Our generic schema was selected to be Organization-Dominant BIE (Figure 3.2) where the organizational intervention and collaborator effective behavior have the primate with the artifact use. The researchers and end-users have been the main collaborators. The role of the practitioners has been fluctuating between the ADR team and the end-users. This is because in a PhD research the researcher is the one bridging the worlds of the knowledge base and practice and in that intermediary role he/she translates the signals and insights towards the research flow. The sub-sections in this heading will be elaborating in more details the BIE cycles in the various organizational contexts and the end-user participation translating adherence to design principles, contribution to the specific ensemble that is being designed and the utility for the users – and pave the ground for concluding the contributions of the BIE cycles. In organization-dominant BIE, the artifact building can be distinguished from intervention and evaluation only through retrospection and analysis (Sein, Henfridsson, Rossi, et al. 2011) as we are doing with the following elaboration.

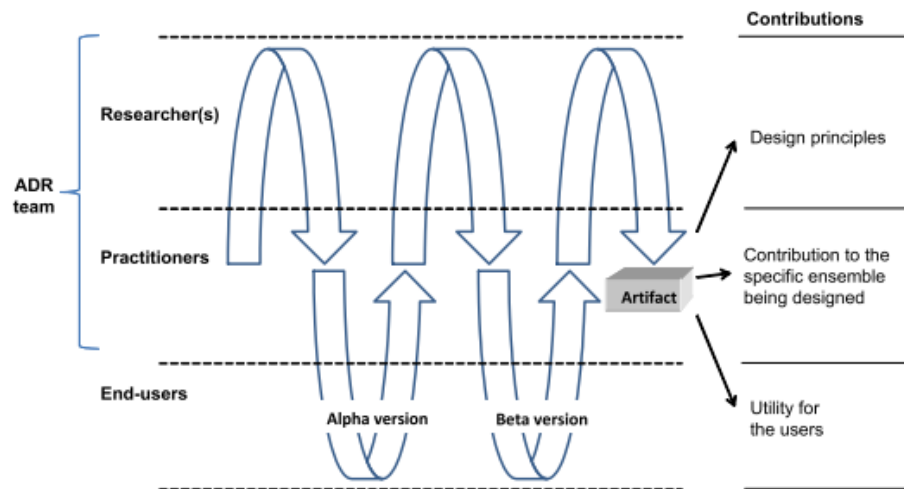


FIGURE 3.2 THE GENERIC SCHEMA FOR ORGANIZATION-DOMINANT BIE (SEIN, HENFRIDSSON, ROSSI, ET AL. 2011)

Appendix B (in the respective headings B.1, B.2, B.3 and B.4) contains details on the building and intervention in the artifact in each of the four contexts, while the evaluation is in the next heading in this chapter. By enhancing the existing roadmap of the Sense-and-Respond framework, adjusting some of the components for tactical management needs, and by introducing new components and sequences for tactical management use, we have been able to offer a composition and roadmap for the DENICA artifact (method and tool).

After the instantiated problem exploration took place in each of the four contexts, and all investigative activities of the S&R applicability in the specific tactical management issue along with mutual agreement on what and how to pursue as a goal between the researcher and the business collaborators took place, we moved forward to the BIE stage that denoted construction and use of the alpha- version of the artifact. The new and the enhanced steps and components are referred to with the prim (') sign – A', B', C' or with new letter – X.

Namely, both the alpha- and beta- versions of the artifact have passed the similar S&R implementation roadmap with the distinction that the alpha- version has been developed in each of the four contexts through the steps A-E, while the step F, G, and the introduction of a new step X (as elaborated in the DENICA (Heading 3.4.2-A) have been introduced and sustained through the beta-version of the artifact building-intervention-evaluation cycle.

In brief, the S&R implementation roadmap (Haeckel 1999) consists of the following (see Chapter 3):

- A. Identification of the Primary constituents
- B. Clarification of the Reason for Being and levels of desired effects
- C. Framing of the Governing Principles
- D. Designing the Role-and-Accountability system diagram around the primary purpose
- E. Setting up the initial Conditions of Satisfaction
- F. Addressing the information needs through the Heads up-displays and the Commitment protocol
- G. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and effectuating adaptability to changes through the R&A diagram

The Alpha-version (Appendix B – B.1, B.2, B.3, B.4)

Through the identification of the key, primary constituents (step A), the managers have been able to position the primary purpose (also called reason for being) as the effect which their system is expected to produce, or, in other words, as an outcome they would like to achieve and consider themselves accountable for (step B). It is important to mention once again, that this outcome is positioned 'customer back'. It is not an output to be delivered but it is evaluated by the primary customer role and it answers the question: 'has the customer's problem been solved with our system's activity?' The next step of framing the governing principles meant discussion and clarification on

several most important principles through which strategic management would like to effectuate strategy (step C). When all these ‘givens’ are in place and clearly communicated between strategic and tactical managers, the next step is the design of the initial Role-and-Accountability system diagram around the primary purpose (step D). This system is the initial structure that should start effectuating strategy. It clarifies roles, accountabilities, interactions among them and helps the manager perceive what is in place, what is needed or missing in order to achieve the purpose. For each of these roles and interactions, detailed attention is paid to set and enable Conditions of Satisfaction (step E) that each of the people populating a role should have at hand in order to achieve what he/she is accountable for. Again, the reasoning of accountability is placed ‘customer back’ so that each interaction has two roles (a provider and customer role) with outcome expected to be achieved by the provider role and evaluated upon customer role criteria and satisfaction. It is important to mention that the manager who facilitates this system to reach an effect should have the proper authority level in order to be able to populate, re-populate the roles with resources (individuals, other systems, sub-systems); but also the proper helicopter view to introduce or remove roles and negotiate and re-negotiate accountabilities and outcomes. In Context 1 and 3 we reached the collaboration maturity up to this step and have placed the instantiated problem solution at disposal to the business collaborators. The R&A diagrams, the recommendations for helicopter view and authority, and the clear system design immediately visualized to the managers what was missing that resulted with the problems in the first place. In the Contexts 2 and 4 the artifact has lived through the complete roadmap and we were able to receive practitioner input on its improvement, alteration and modification that resulted with its beta-version.

The Beta-version (Appendix B – B.2.1, B.4.1)

The beta-version is a continuation of the alpha-version in the following direction. Since the S&R framework has been primarily intended for strategic management, its enhancement through alterations in the roadmap and components has been taking place in each step. Respectively, the problem identification needed to be performed in the tactical management function in purposive terms (not purposefully – by defining and setting a purpose, but identifying and treating the purpose as a given), which is subject to changes, but not primarily of tactical manager’s own actions. Hence, the steps A, B, C have been labeled as A’, B’, C’ in the DENICA method (Heading 3.4.2-A). The step of R&A system diagram design has its specificity when adapted for tactical management with regards to the necessity to consider and create and maintain functional bridges among the strategic, tactical and operational levels – hence labeled as D’ in the DENICA roadmap. The only step that has resided unchanged has been step E, because of the nature of conditions of satisfaction as a concept that is relatively similar for strategic and tactical management. In Contexts 2 and 4 the manager’s information needs have been addressed through setting Information Sensors, Emitters and Risks around each role and its accountability, through discussions between the researcher and the manager and incorporation of these information requirements in a simple to use Excel workbook (step F). The same as the R&A diagram, these have been the initial information needs, not static nor definite ones. Appropriate visualizations have been provided of the system, with clear distinction of the primary purpose, roles, accountabilities and information requirements. The managers have been instructed to start and continuously perform the Sense-Interpret-Decide-Act loop and record changes both in the managerial system (the R&A diagram) and in the management information system requirements (in the Excel workbook with sheets on the diagram, information sensors, information emitters and risks). This is the first instance where the S&R roadmap is altered with the incorporation of risks. The reasoning behind is that the manager needs to have information structure of: what he/she needs to know about his managerial system, components and resources, and idea on how to obtain that information – all positioned in the Information sensors; what the manager would like to know but it is most probably not going to be reported to him/her in proactive manner (such as problems, staff issues, fraud, competitor advances, ...) – reflected in the Information emitters; and what are the risks for anyone populating a role not to be able to accomplish what he/she is accountable for – reflected in the risks that invoke the manager to identify risks, think about risk management and constantly perceive the optimistic and the pessimistic side of the coin for his managerial system. This reasoning helps achieve continuous link between the business aspects and the informational aspects of a system on personal level (the person being the tactical manager) that invokes changes from one to the other and vice versa. The introduction of the risk aspect is labeled as Step X in the DENICA method implementation roadmap (Heading 3.4.2-A). Another occurrence that modified the alpha-version of the artifact has been initiated from practitioner’s side. Namely, after the first month of using the method and the Excel tool, the practitioner started recording Plan-Do-Check-Act content to each of the Information Sensors explicitly, and through the contingency plans in the risk management approach in the Risks worksheet. The content of this addition have been activities and measures to be taken to improve something – a role, accountability, resources, ... and the manager started monitoring the status of these intended improvements, along with the rest of the developments. This version of the

artifact containing the PDCA loop next to the SIDA loop has been given at hand to the manager in Context 4 and implemented in practice accordingly. The addition of the PDCA loop to the SIDA loop has been the other alteration of the regular S&R roadmap, presented in the DENICA method as step G' (Heading 3.4.2-A). The activation of the SIDA & PDCA loops has enabled the researchers capture the true behavior of the managerial and of the management information system in time, and wrap the artifact properly with regards to visualizations, user experience, communication flows in dynamic

3.2.1. THE EVALUATION IN ADR/DSR AND ITS SPECIFICS – INTERVENTION(S), MECHANISM(S) AND OUTCOME(S)

Evaluation is a crucial component in the design science research process. The designed artifact is a socio-technical entity that exists within an environment (business or social) which lays out the requirements for its evaluation (A. R. Hevner & Chatterjee 2010). The designed artifacts can be evaluated in terms of functionality, completeness, consistency, accuracy, performance, reliability, usability, fit with the organization, and other relevant quality attributes (Hevner et al. 2004). The ADR is “a method that focuses on the building, intervention, and evaluation of an artifact that reflects not only the theoretical precursors and intent of the researchers but also the influence of users and ongoing use in context” (Sein, Henfridsson, Rossi, et al. 2011), p.40, which directs formative evaluation throughout the Building-Intervention-Evaluation stages that consists of process and product evaluations and summative evaluation at the end of the process, having in mind that evaluation opportunities should be sought following natural controls where possible. The construction of formative evaluation in ADR is in line with the ‘reflection-in-action’ (Van Aken & Romme 2012) and ‘participatory evaluation’ (Campilan 2000) (McAllister & Vernooy 1999). On the other hand, regarding the summative evaluation for impact-driven problem investigation, S (solution), D (domain), E (effects) (Wieringa 2009) there is “argument precisely in the structure of realist (non-positivist) evaluation, in which outcomes are identified and attributed to the interaction between solution and problem domain, and then evaluated against stakeholder goals (Pawson & Tilley 1997) (Pawson 2004). The realist evaluator is interested in the mechanisms that make the interaction between S and D that create effects E”. While for problem-driven, goal-driven or solution-driven investigations, part of the argument may be omitted (Wieringa 2009), p.6.

We perceive our problem investigation as solution- and impact-driven, and as a result, at this point we will deploy realist evaluation. The realist evaluations don't ask, ‘What works?’ or, ‘Does this work?’ but instead, ‘What works for whom in what circumstances and in what respects, and how?’ These questions drive the evaluator to inspect the reasoning of artifact interventions stakeholders in a procession of intervention contexts. According to realist evaluation we are discussing about ‘theories’ incarnated, that are ‘embedded’ in social systems, that are ‘active’ with regards to engagement of individuals, and that are parts of ‘open systems’ subject to unanticipated events, changes and externalities (Pawson 2004). Answers for the six questions – What? Why? When? How? Where? Who? (Kipling 1902) (Mackrell & McDonald 2014) will be searched by going through the Context-Intervention-Mechanism-Outcome logic (CIMO logic) (Van Aken & Romme 2012; Denyer et al. 2008), in our case transcending over four real-life contexts: Context(s)-Intervention(s)-Mechanism(s)-Outcome(s) (Figure 1.3). Such construction deals with both overall design principles as well as more detailed variables, giving the set a multilevel and possibly nested structure. But a special characteristic of design propositions lies in their combinational nature, which will be conveyed in this manuscript.

The early evaluation throughout the research process and the timely adjustments of the activities of all participants are the distinctive measures that ADR provides to the researchers who deploy it as research method. This trait ensures better contributions to knowledge and to practice. In our tactical management information systems and adaptability research, there have been ongoing ‘sensors’ and corrective actions with regards to the most important interventions (I1 through I9 of the CIMO logic, Figure 1.3, Figure 3.3) for the different contexts (Ic1, Ic2, Ic3, Ic4), that were expected to be functional, effective, and in some cases efficient. The mechanisms (M1 through M8 of the CIMO logic, Figure 1.3, Figure 3.7) that are triggered by the interventions in the specific contexts will be analyzed at this point too. In short, we approached the formative evaluation through multi-directional communication channels in order to make sure the interventions that trigger mechanisms will produce the desired outcomes.

On the other hand, the summative evaluation revolves around the Outcomes (O1 and O2) and how they are satisfying the evaluation criteria of adaptability of the managerial and information system in time. These two

outcomes (O1-Personalized IS self-design, O2-Managed system) recognize different adaptability characteristics. The adaptability in O1 records changes in information flows (sensors and emitters) and the risks, while adaptability in O2 captures changes in purpose, roles and accountabilities (R&A diagram), Conditions of Satisfaction. The summative evaluation will be discussed for satisfying the solution criteria set up in Chapter 2.

INTERVENTION(S)

The realist's goal is to understand how interventions or systems work in various types of contexts. Realism operates at middle range, using concepts that describe interventions at a level between the big policy ideas and the day-to-day realities of implementation (Pawson 2004). The interventions (I1 through I9) that have been set in contexts (Ic1, Ic2, Ic3, Ic4) have triggered the mechanisms in context to activate the system's function towards expected outcomes have been presented on Figure 3.3. Each of them will be elaborated and referred to with the most important observations that could be done for evaluating research during the formation of the artifact.

INTERVENTION(S)									
	I1	I2	I3	I4	I5	I6	I7	I8	I9
	Tactical authority level	Big picture overview (Business ecology), Scope	System design of Roles and Accountabilities	Clarity of Purpose and Governing Principles	Guidelines to the manager on reasoning and acting for informing and translating decisions on business and information level	Sense-Interpret- Decide-Act Loop for adaptability	Plan-Do-Check-Act Loop for improvements	Incorporating Risk in parallel with Outcomes	Visualizations
Ic1	Helicopter altitude had to be achieved	Estimated of primary importance	Hard to think in terms of Roles - instead as job descriptions	Helped remove ambiguity and achieve clarity and proper communication within the company	Takes time to get used to it, then convince others, then accelerate	Instruction that is always kept in mind and enforced intentionally - on individual level	Not utilized during the study on collective level - only individually	Making sure accountabilities are either fulfilled or adapted	Clear, easy to use, extremely useful and of primary importance for everyone
Ic2	Strategic altitude	Estimated of primary importance	Thinking in terms of Roles is difficult	Helped remove ambiguity and achieve clarity and proper communication within the company	Welcome for orienting the actions of the manager and getting all on-board	Instruction that is always kept in mind and enforced intentionally - completely	Introduced and practiced to improve each role/accountability and outcome	Making sure accountabilities are either fulfilled or adapted	Clear, easy to use, extremely useful and of primary importance for everyone
Ic3	Strategic altitude	Estimated of primary importance	Thinking in terms of Roles is easy - put yourself as 'client'	Helped remove ambiguity and achieve clarity and proper communication within the company	Used for clarifying things to employees	Instruction that is always kept in mind and enforced intentionally - on individual level	Not utilized during the study on collective level - only individually	Making sure accountabilities are either fulfilled or adapted	Clear, easy to use, extremely useful and of primary importance for everyone
Ic4	Helicopter altitude had to be achieved	Estimated of primary importance	Thinking in terms of Roles is easy - when the client is the management	Helped remove ambiguity and achieve clarity and proper communication within the company	Helping the personal moves and what to do next	Instruction that is always kept in mind and enforced intentionally - completely	Practiced on superficial level	Making sure accountabilities are either fulfilled or adapted	Clear, easy to use, extremely useful and of primary importance for everyone

FIGURE 3.3 INTERVENTIONS (FROM THE CIMO-LOGIC) THAT HAVE BEEN EVALUATED IN THE BIE STAGE

I1: The intervention with the **tactical authority level** has to take place in order to design the tactical system of Roles-and-Accountabilities from a **helicopter view**. It regards establishment of appropriate strategic altitude (Strategy Management Group 2016), or in our case, **tactical altitude**. This is of utmost importance to be introduced and to function properly because of the possibility of utilization of resources and management of the complex adaptive system (CAS). If not enforced, any effort to provide a tactical management system that produces effect will be futile, because the manager and any other entity that populates any role will not have the proper empowerment to fulfill its accountability. In Context 1, helicopter altitude that had to be achieved necessitated involvement of a strategic manager in the BIE cycle that confirmed the feasibility of the proposed solution. Otherwise, the efforts would be futile. In Context 2 and Context 3, the strategic altitude has been achieved straightforward because the strategic and the tactical manager has been our end-user – the owner of the company. In Context 4 there has been very close collaboration and delegation of the authority from strategic to tactical manager (in other words, from top to middle manager) and the helicopter altitude was appropriately in the hands of the tactical manager (at least for the specific collaboration project). This intervention is very important to realize and must be fully functional for the entire future of the use of the artifact – because it overrides a number of problems that occur with sub-optimization and incoherent sub-system goals and actions. What is usually done in practice, after outlining a project, is assignment of a manager who should steer towards successful project who has altitude of vision and influence from his/her standpoint below. For this reason managers are able to perceive only what they can influence, but any endeavor's destiny is dependent on much broader scope of entities, events, stakeholders that are usually out of the manager's view.

I2: The **big picture overview** of the entire business ecology in terms of **scope** of business and information entities (subjects, roles, activities, relations, interactions) has been estimated of primary importance – and the researcher ensured very early that the big picture overview is incorporated in the Role-and-Accountability system design, and is maintained throughout the project. The confirmation for this can be found in all the R&A systems and respective diagrams (Appendix B, Figures B.2, B.6, B.20, B.21, B.22, B.24, B.26, B.27, B.35, B.36). In conclusion, the scope of the positioned entities was widest possible, which, according the feedback from the practitioners, was of immediate benefit for being aware what a manager is dealing with and how to see it and sense it earliest. Also, the practitioners experienced clarity in the understanding that some things they can influence and manage and on some they are simply just dependent on and need to monitor closely and adapt to. Figure 3.4 visualizes a R&A diagram that presents numerous roles populated by out-of-the-company entities that managers didn't pay focused attention to (Role 1, Role 2, Role 4, Role 5, Role 6), before the use of the artifact for tactical management adaptability and information systems. With the usual firm-forward thinking and client service, they focused on the client and the own departments or project members within the company. But a company's purpose pursuit is not an isolated system. This is one of the most important connections with the complex adaptive systems characteristics we have elaborated in (Chapter3) – that the companies are open socio-technical systems (McGrath et al. 2000) (Beinhocker 1997) and that they are interacting with the environment in a broad manner – hence, we need to pay proper attention to diverse and wide scope of world entities that we are interacting with in order to fulfil a purpose. If we reflect to the concept of 'entropy', as a measure of disorder in organizational systems (Martinez-Berumen et al. 2014), to a certain extent, we are pursuing the standpoint, that the formula of information is exactly equal to the entropy formula, only with the sign changed: Information = -entropy or Information = negentropy (Shannon 1948) (Wiener 1949) (Brillouin 1961). This discussion adds on Norbert Wiener (Wiener 1949), the pioneer in cybernetics, who determined the equality between information and the "level of organization" (or negative entropy) of a cybernetic system; O'Connor's (O'Connor 1991) reference of system's "organization" by implying the existence of information, since this is a necessary condition for the definition and characterization of a system, emphasizing that the entropy changes are intrinsically related to changes in structure, i.e., changes in the organization of the system (Martinez-Berumen et al. 2014) and others. In our standpoint, the artifact should provide broad system setting that is the foundation for information structure in order to reduce the entropy (i.e. to relevantly inform the system, its organization and the manager). Interestingly, the manager's personalized self-positioning of the roles and accountabilities in all four contexts when using the artifact, has been as big picture as instructed – 24% of information sensors, emitters and risks has been placed on roles within the enterprise, 38% in the extended enterprise (what we usually refer to supply net), 19% in the wide business ecosystem (the business domains, also competition, innovation, ...) and 19% in worldwide categories that may directly or indirectly influence the effectiveness of the managed and the managerial system (Figure 3.5). For example, in Context 1, Microsoft was an entity populating a role in the broadest business ecosystem, because of the Microsoft Dynamics Navision as the core product in implementations, but also because of the dependence on new versions Microsoft deployed to clients (who are company's clients too), which caused problems, and the clients called and asked Ad Ultima to resolve them, not Microsoft. So Ad Ultima tactical

managers needed early info on the behavior, issues, bugs, patches on the latest releases – not quarterly summarized reports. If having proper information, they could react with the clients with appropriate solutions, deploy appropriate resources and not act to each new release as a ‘burning fire’. In the Context 2, the clients of clients were populating a role important for the tactical manager. On one side because of inexperienced client management our end-user 1 had, but also because of clear detection of problems and issues when being in touch with the actual end-users of the test-modules and the final ‘live version’ of the software solution.

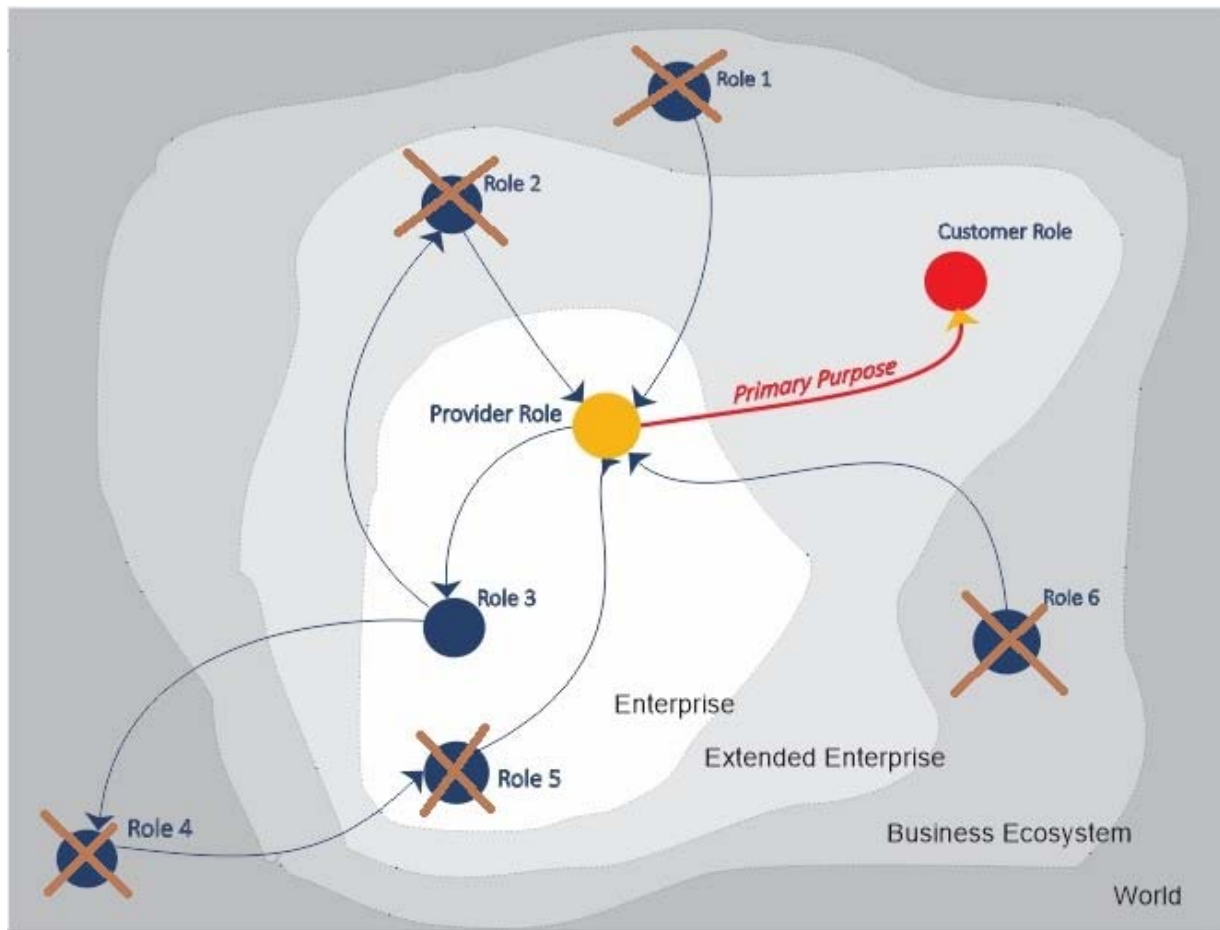


FIGURE 3.4 BIG-PICTURE OVERVIEW AND SCOPE OF ENTITIES (SUBJECTS, ROLES, ACTIVITIES, RELATIONS, INTERACTIONS) MANAGERS PAID ATTENTION TO FOR THEIR TACTICAL MANAGEMENT ISSUES BEFORE THE USE OF THE ARTIFACT FOR TACTICAL MANAGEMENT ADAPTABILITY AND INFORMATION SYSTEMS

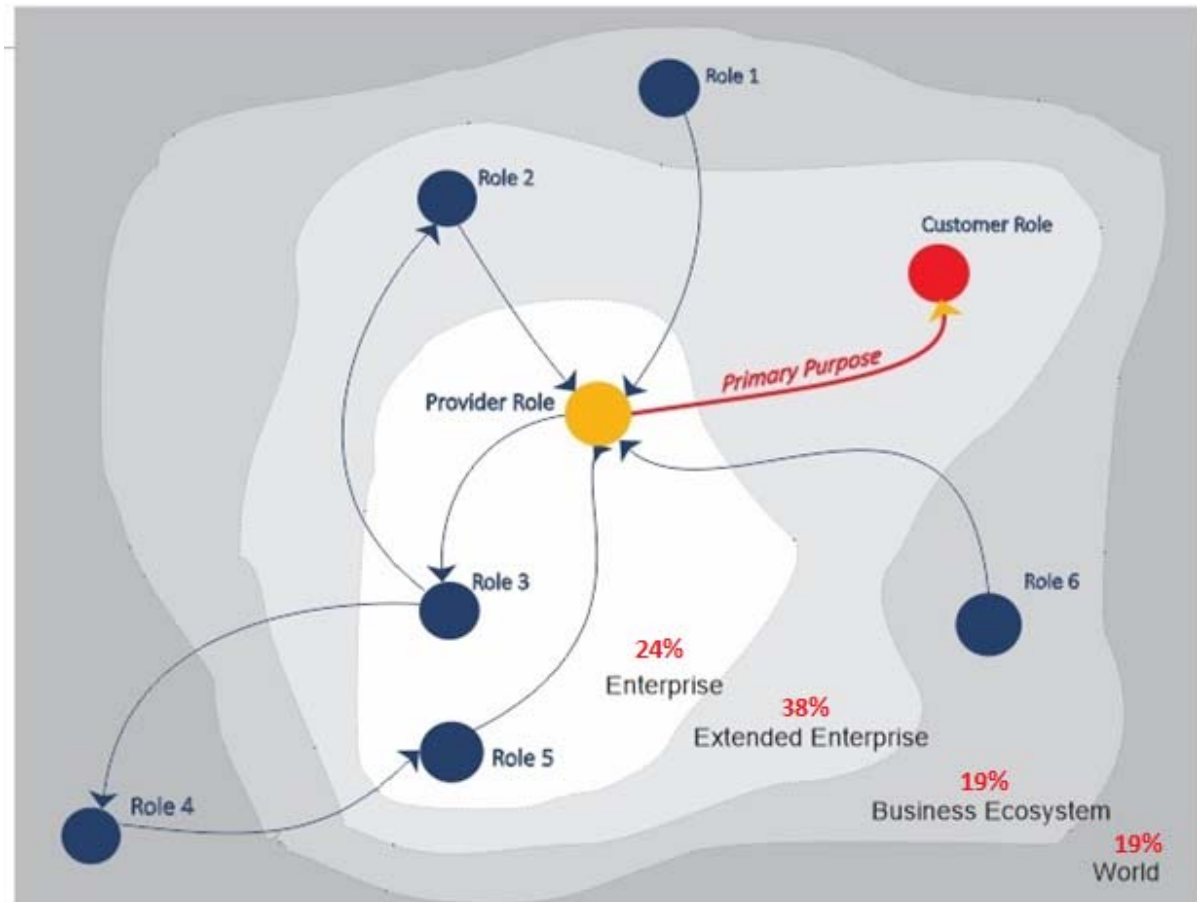


FIGURE 3.5 BIG-PICTURE OVERVIEW AND SCOPE OF ENTITIES (SUBJECTS, ROLES, ACTIVITIES, RELATIONS, INTERACTIONS) MANAGERS PAID ATTENTION TO FOR THEIR TACTICAL MANAGEMENT ISSUES WITH THE USE OF THE ARTIFACT FOR TACTICAL MANAGEMENT ADAPTABILITY AND INFORMATION SYSTEMS

I3: The **system design of Roles and Accountabilities** as basic premise of the Sense and Respond framework and of DENICA has been a special challenge to overcome, in the early stages. It is layered in several constituents that are interdependent:

- 3.3. Designing a **system** for the project or tactical issue. Not a process, but a system.
- 3.4. Designing the system **customer-back**, by decomposition from its *primary purpose*. Not by integrating current resources towards a goal with a process flow, firm-forward, as usual.
- 3.5. Thinking in terms of **roles**. Not through job descriptions or requirement specifications that employees get used to and follow somehow, as usual.
- 3.6. Thinking in terms of **accountabilities and outcomes**. Not in terms of outputs and responsibilities.
- 3.7. **Adaptable managerial structure** instead of matrix organizational structure, for example.

The managers we collaborated with have found it hard, difficult to think in terms of roles - instead of job descriptions. Roles are at a higher level of abstraction and need to be thought of in proper words, meanings and elaboration what the specific role encompasses. (Weick 1993) argues that individuals can be capable of changing their roles very quickly. The researcher had hard time explaining and elaborating, but also enforcing this way of thinking and acting in terms of roles and accountabilities. Useful input came from end-user 10 that suggested that customer-back system design and thinking in terms of roles and accountabilities is easier if you 'put yourself in the shoes of the client' and design the ovals and arrows with what the client would need from you. The client doesn't care if you have a job position software architect, tester, developer, ... but the client expects reliability (name for accountability and/or role), early warnings (a name for accountability and/or role), proactive offer of new improvements (name for accountability and/or role).' Somewhat similar feedback was given by end-user 11

(Context 4), but the situation was a more traditional one because the customers of the system was the management, which is familiar situation in the companies, the employees' efforts to have the 'management' as their client). The early awareness of the problematic nature of this essential intervention gave the researcher argumentation to allow some inconsistencies with the S&R framework prescriptions in early stages and allowing imperfect names of the role and the accountabilities that made sense only for the involved parties (elaborated in Figure 3.33). The tuning of the level of roles and detail as an issue has occurred in Context 4 where the initially designed system of Roles-and-Accountabilities (Appendix B, Figure B.35) was too generic so the researcher and manager had to re-do the discussion and the system design in order to achieve a level of genericity that corresponded with the needs of the manager and the managed system (Appendix B, Figure B.36).

14: Another intervention that enforces proper use of S&R framework is the **clarity of purpose and governing principles**. This effort helped removing ambiguity and achieving clarity and proper communication within the company. The evaluation whether this intervention worked has been straightforward – without clear purpose interwoven in the role-and-accountability system design and method utilization the outcome of the entire ADR would have been insignificant. The governing principles have been hard to (1) establish and (2) negotiate for two reasons: when the top and middle managers were different people (Context 1, Context 4) there has been little precision or even transparency for governing principles on organization level; while when the top and middle manager is the same person (the owner), the governing principles have been changing throughout time. For tactical management needs, the governing principles received secondary emphasis, especially because their actual enforcement happens in time, after certain period of use of the artifact, not immediately.

15: Guidelines to the manager on reasoning and acting for informing and translating decisions on business level and information level has been the underlying motivation of this research. This support and intervention was evaluated on ongoing basis through the interviews and the various communication channels, with the practitioners and their supervisors. The artifact is a method, guidelines that assist the manager to shape his world and follow it, while steering the managerial system towards its goals in a dynamic environment.

The artifact guides the manager to set up own **Information Sensors** – what the tactical manager would need to have as information (regardless of the current supply with reports) in order to have overview of his system; **Information Emitters** – what the tactical manager would like to have been told by the other roles in order to be aware on time for possible issues disturbing the agreed outcomes and **Risk Management** (Risk positioning and Information flows). All these aspects have been set up, **continuously revised (with the SIDA loop) and continuously improved (with the PDCA loop)** in uncertain dynamic real-life environments. These instruments that were given at hand of the managers, aimed to stabilize, shape the view and assist the person, the manager through the management of a Complex Adaptive System towards a purpose. The manager **transfers the decisions** for adjusting, changing, intervening in the **Role and Accountability system** (in the content or population of roles, accountabilities, conditions of satisfaction, negotiations) **and communicates** with the stakeholders in order to translate the decisions to the business level and effectuate it in reality.

The end-user experiences were that the artifact, the method 'takes time to get used to, then convince others, and then its valueness exponentially accelerates.' The method was 'welcome for orienting the actions of the manager and getting everyone from my team and the management on-board, used for clarifying things to employees and describing issues to management.' The end-users evaluated the artifact suitability in helping the personal moves and what to do next, especially through the components of SIDA and PDCA loops that capture early issues to adapt to and planning improvements to enforce. The idea behind this intervention was to provide the managers a personalized method that is responsive to their actions to guide a system of roles and accountabilities towards a purpose, while the system itself is adapting to those roles and accountabilities, being a complex adaptive system.

16: The incorporation of **Sense-Interpret-Decide-Act (SIDA) Loop for adaptability on continuous basis** has been one of the few instructions in the artifact for the manager to follow. The managers reported that it was always kept in mind and enforced intentionally - on individual level (Context 1, Context 3) and completely throughout the project and time (Context 2, Context 4). The SIDA loop is a continuous engine that scans the horizon and forces the manager to consider and decide, which can be towards taking action to change something in the system or keep it as it is (which is again conscious decision). Nowadays, in the information environments that have high frequency and low latency of data, such a loop would require the manager to spend all his/her time revising incoming data and information. We are opposing that 'hive' with the proper self-positioning of information entities (through the Information Sensors, Emitters, Risks and the Roles and Accountabilities) to selected dynamic structure of

information requirements that are relevant for the manager. In this way, the SIDA loop will purposefully scan the horizon and trigger or invoke action to change or adapt to change and successfully steer a system towards goal(s).

17: Similar situation can be concluded with the Plan-Do-Check-Act (PDCA) Loop for enforcing improvements on continuous basis. The SIDA loop has been inherited from the S&R framework, however the introduction of PDCA loop has come from end-user side, in the reciprocal shaping of the artifact. It has been end-user 1 (in context 2) that has incorporated the PDCA Loop in the first month follow-up workbook that inspired the researcher to integrate it in the artifact for the next BIE cycles in Context 4. The combination of SIDA & PDCA loop aligns with double-loop organizational learning (Argyris 1977) and sheds light to important knowledge question of the role of middle managers in the organizational learning and unambiguous information and knowledge circulation in the organizations, or in our case, the system of entities populating roles. Percentage of proactively invoked improvement changes is visualized on Figure 3.6. Context 2 has experienced 44% of proactive changes to improve the system (business and information wise) entities and interactions, while Context 4 50%. The changes that invoke radical revision of the entire system because of change of purpose have been recorded in Context 2 (Appendix B, Figure B.21). This support the artifact gives to the behavior of the system-designer and the system entities is in line with the desired adaptability and effectiveness in the outcomes generated with artifact implementation.

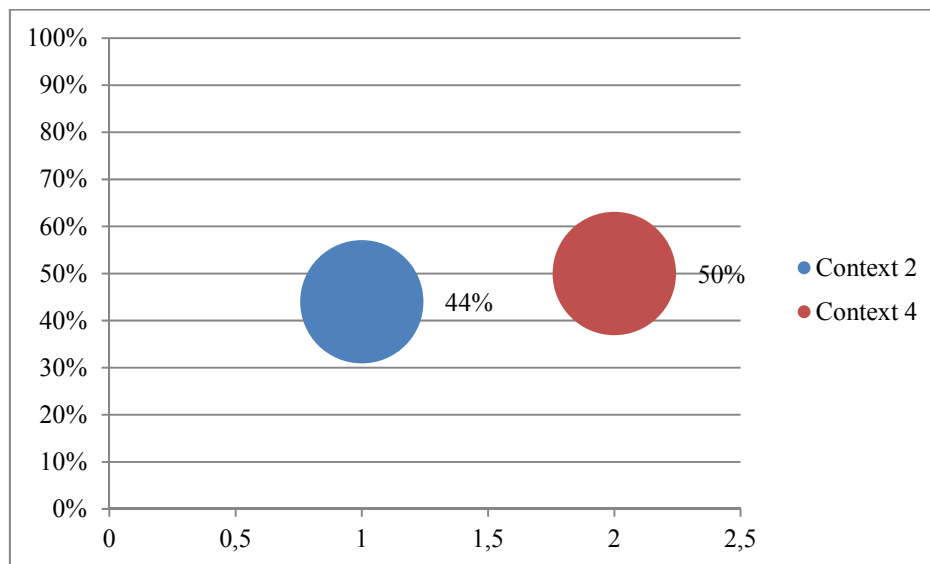


FIGURE 3.6 PERCENTAGE OF PROACTIVE IMPROVEMENT CHANGES ENVOCKED BY THE MANAGER WHEN USING THE PLAN-DO-CHECK-ACT LOOP IN THE ARTIFACT IMPLEMENTATION FOR CONTEXT 2 AND CONTEXT 4

18: Incorporating risk in parallel with outcomes making sure they don't sabotage any accountability or the system's primary purpose has been mostly segregated managerial functions or have existed in separate tables, charts, graphs with separate information flows. The extensive project risk management support has driven complex and specialized risk approach that floats away from the eyes of the manager (Project Management Institute 2004) (National Safety Council 2014) (Oracle 2009). Among the few contributions that have attempted combining the risk and the benefits at the same moment in time when making decisions, is Domain-specific Risk-attitude Scale - DOSPERT Scale (Weber et al. 2002). It is a psychometric scale that assesses risk taking in five content domains: financial decisions, health/safety, recreational, ethical, and social decisions, considering perceptions of the magnitude of the risks and expected benefits of the activities. Our artifact places risks in the forefront immediately combining them with their influence on some accountability not to be fulfilled or some role not being in position to accomplish the negotiated. Cognitively, when risks are placed along with the accountability, there is similar platform to perceive and scale the positive and the risky aspects for something to be accomplished which regulates some cognitive biases people have when estimating and managing risks and benefits separately. This intervention is one of the main components of the artifact, and the researcher made sure it is properly understood and used, in the initial setting and in the follow-up documentation.

The risk management efforts that interacted both with the business system of roles and accountabilities and with the information flows prescribed by the artifact have been in direction of: setting up the risk entities, revising them and acting on improvement of the risk management. The structured guidelines for the manager included reasoning for the risks that prevent the roles for producing the desired effect and their mutual interactions; and reasoning by considering: interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system), sensor (the actual Role or Entity or Business Process or general place where the tactical manager needs to point the 'radar' to in order to receive that signal), risk type (experience of management, lack of knowledge for cross-checking, ...), probability to happen (1 (low) through 5 (high)), impact on the business (1 (low) through 5 (high)), risk management approach (accept, avoid, transfer, mitigate, contingency plans). This artifact component provided simple and straightforward, yet comprehensive support for risk management that reflects to the business system effectiveness and to the adaptability of the manager and the managed system.

19: Visualizations are an intervention of immense importance for the entire research and its applicability in practice. Throughout the research process the researcher and the Beta-version end-users have pursued various graph visualization options and dynamic graph visualization features in different, mostly Beta-version software solutions. As one of the artifact's core components for successful implementation, appropriate visualizations for the entire approach regarding the S&R, CAS and SNA characteristics (as elaborated in Chapter3) have been thoroughly and carefully selected. But, in combination with the question 'what is the best representation for the system of roles and accountabilities?' where the answer was graphs and Social Network Analysis as tool; we pursued the quest of 'which software offers most appropriate support for the needed graph visualizations?' where the answer is still not perfect. The dissertation figures (Appendix B, Figures B.2, B.6, B.20, B.21, B.22, B.24, B.26, B.27, B.35, B.36) are presenting the exact visualizations used by the researchers and practitioners at the time of occurrence, in order to illustrate the evolution in seeking most appropriate graph visualization that is: (i) easy to use by managers and researchers, (ii) easy to share for collaboration and communication, (iii) easy to maintain and modify, (iv) straightforward to implement in technical terms (desktop app, cloud service, plug-in, integrated, ...). With regards to the easiness of use, the user evaluation has been on the 'excellent' level, providing straightforward algorithm (nodes for roles, directed edges for accountabilities, matrices behind the visualization). The purpose of the visualizations, evaluated by the aspect of effective communication and collaborative information flows, the end-users and the other stakeholders (the employees, clients, collaborators, management) have reacted with highest grades on how the visualizations assist the clarification of roles, accountabilities, the big picture, the 'what may go wrong' and the dynamics and the 'living nature' of the system. The easiness of maintenance and modifications on the visualizations has been rather simple – with guidelines that encouraged the users to sketch and chart their needs and wishes, and communication with the researcher on how to best enforce it on the visualization. As guided modeling process, the maintenance and modifications of the visualizations have been supportive and not ambiguous. The technical implementation was the hardest to achieve, but was necessary for the research because the aim of the artifact was to equip the person with a comprehensive method for supporting adaptability and IS requirements design. In the collaboration timeline, both the researcher and the end-users experimented with various tools for the Social Network Analysis technique in terms of software support. As mentioned before, and as visible through this manuscript, the applications used have been alpha and beta software versions such as Gephi, NodeXL, LikurioUs, CorelDraw, Paint, Word/Excel/PowerPoint, nVivo, ... End-users 1 and 11 both wrapped the research with NodeXL with Paint interventions. The end-user experiences with the visualizations, recognized through the interviews and reflections, have been of remarkable assurance that for them the first most useful and straightforward difference-maker have been the visualizations with graphs and Social Network Analysis tools, especially of the Role-and-Accountability system diagram that meant getting every stakeholder on board in a clear understandable manner.

MECHANISM(S)

The underlying mechanisms can be expected to generate a range of different outcomes (O) when implemented in a series of different contexts. Mechanisms are underlying entities, processes, or structures which operate in particular contexts to generate outcomes of interest. These mechanisms are triggered by the interventions discussed before. There are three essential clues located in a "realist" reading of mechanisms – that mechanisms are usually hidden, sensitive to variations in context, and mechanisms generate outcomes (Denyer et al. 2008). The generative mechanisms (M1 through M8) that were provided by the interventions in context (Mc1, Mc2, Mc3, Mc4) function towards expected outcomes have been presented on Figure 3.7. Each of them will be elaborated and referred to with the most important interventions that made its functioning possible and appropriate for the research.

MECHANISM(S)								
	M1	M2	M3	M4	M5	M6	M7	M8
	Personalized IS self-design	Simplicity of the artifact use	Multifaceted Context-capture	Maintaining the system till purpose is reached	Double loop organizational learning	Effective communication	Empowerment of the entities in Roles	Situation awareness
Mc1	Considering the horizon of important-not urgent issues and proper focus	For complex issues it seemed complicated to achieve, afterwards commonground	Enabling see the structure of information flows and maneuver properly and adaptively	To enable common goal, synergy and emergent effect	Only single loop organizational learning has been achieved	Setting the communication foundation and removing barriers	The main conclusion after designing the S&R system - People had the responsibilities but not the power to fulfill them	Level 1 achieved
Mc2	Looking for IS and business response and dynamic information needs fulfilling differently	Encouraged complete use for managerial and communication needs	Enabling see the structure of information flows and maneuver properly and adaptively	To enable common goal, synergy and emergent effect	Adaptability and Planning as well as improvements within the system and radical system change	Setting the communication foundation and removing barriers	Manager with facilitator role - managing the environment to facilitate entities in roles to accomplish their accountabilities	Level 1, Level 2, Level 3 achieved
Mc3	Educated support for positioning own IS requirements	The inception was with big effort from researcher side, for the manager to be served straightforward	Enabling see the structure of information flows and maneuver properly and adaptively	To enable common goal, synergy and emergent effect	Only single loop organizational learning has been achieved	Setting the communication foundation and removing barriers	Empowerment to a certain extent - because of lack of internal staff to fill the roles	Level 1 achieved
Mc4	Related to the current situation of handling own information needs on different ways	Was of primary importance for use in reluctant busy manager's schedule	Enabling see the structure of information flows and maneuver properly and adaptively	To enable common goal, synergy and emergent effect	Only single loop organizational learning has been experienced	Setting the communication foundation and removing barriers	Empowerment to a certain extent - the method helped clarify which collaborator needs additional resources/information/... to be held accountable	Level 1, Level 2, Level 3 achieved

FIGURE 3.7 MECHANISMS (FROM THE CIMO-LOGIC) THAT HAVE BEEN EVALUATED IN THE BIE STAGE

M1: The **personalized IS and IS self-design** mechanism is one of the artifact's underlining ideas of its possible usefulness for the practitioners in terms of the tactical management system being personalized, self-designed and having the quality of adaptability. The ability to adapt to changes is crucial for business organizations and the support of business processes by information systems plays a crucial part (Andresen & Gronau 2006). By 'personalized' we are referring to specific information system needs for a specific person (in our case in the role of tactical manager). By 'self-design' we are referring to the action of someone mapping the information needs on his/her own and then finding various ways how to fulfill them. By adaptable IS we are referring to the IS ability to change or be changed in order to fit transformed circumstances (Andresen & Gronau 2005). The main emphasis in the aimed contribution of the research artifact is that it should be assisting the person, the manager directly, through guidelines, in a method, implemented and used by the manager, not via an intermediary expert, not by a consultant that bridges worlds, and not organization-wide. In order to reduce the discrepancies of understanding the business, goals, issues and information system concepts, we are placing the focus on the person as end-user and designing a method for him/her, so this is one of the first mechanisms to work in order to produce the desired effect, outcome (O1, O2). In the Contexts 1 and 3 this intervention couldn't be enforced to the full extent, but only in an initial stage, because they have incorporated the Alpha-version of the artifact which denoted building, implementation and evaluation of the artifact for the identified tactical management issue and identifying features and components of the artifact for tactical use. But, in Context 2 and 4 the full monitoring of the personalized IS self-design took place. Nevertheless, whether in initial or more evolved stages of use, the personalized IS self-design has been established and was functional in all four contexts. In a formative sense, the researcher confirmed continuously that this deliberate guideline is functional, through the communication with the managers, and through the follow-ups. Representative static snapshots of the personalized IS self-design can be viewed as tables of information sensors

(Appendix B, Figures: B.8, B.37), information emitters (Appendix B, Figures: B.10, B.38) and risk information (Appendix B, Figures: B.12, B.39). Observations of the dynamics of the personalized IS self-design being reflected from the Role-and-Accountability system diagram, can be viewed as evolution in the information sensors (Appendix B, Figures: B.15, B.37), information emitters (Appendix B, Figures: B.16, B.38) and risk information (Appendix B, Figures: B.17, B.39). The adaptability of the information system in terms of context capture facets has been presented in the context-capture mechanisms discussion further in this section (i.e., mechanism M3).

M2: Simplicity of the artifact use is a feature of utmost importance for the artifact – directed both from the exploratory practitioner interviews and from the **complex adaptive systems guideline that they should be addressed with simple, human rules on how to detect information, how to interpret information and how to act in response** (Waldrop 2013). For this reason, a special accent was placed on the simplicity of the artifact use for the managers. Their ongoing evaluation of this principle has resulted in several adjustments and improvements to achieve it. Initially as first step, the introduction to the Sense-and-Respond framework principles consisted of elaborate presentations, discussions and examples in order for the managers to understand and try to implement them in practice. Afterwards, as second step followed the tactical management method and third development of the specific instance for the specific issue and specific manager. In the next iterations, the first and second step have been combined in one, resulting with optimized workflow for S&R and tactical management method introduction. Also, the Excel Workbook that served as a tool to contain, visualize, type-in and register the artifact use and changes through time, has received modifications in terms of simplification of the contained information, positioning of the elements etc. The subsequent and continuous formative evaluation moments regarding this feature that have been invoked by the practitioners and fulfilled by the end-users have been of great importance to refine and improve the artifact in the desired direction in the earliest possible stage of building and intervention.

M3: One important point this research aims to generate as mechanism that will lead to tactical management adaptability and information system effectiveness is the **multifaceted context-capture**. This focal point enabled to see the structure of information flows and maneuver them properly and adaptively. Since being of great importance for the research, the researchers assured that the multifaceted context-capture is a factual practice in the initial and in each of the follow-ups, through the exchange of the Excel Workbooks with monthly/quarterly updates. The multiple facets or dimensions of context in information sense can be described through: device, user, task, data source, document representation, time, geographic location. Our ideas for capturing the contextual changes are interwoven in several of the artifact components, and are referring to widest context – throughout the business ecology and in details, across operations through strategy and goals and between employees, clients, collaborators through information about the entities populating the roles and having accountabilities.

The ‘devices’ that have been used for context capture have been diverse – so have been the channels of communicating the information: oral, written, visualized, phone, reports, meetings, informal meetings, face-to-face communication, reports, memos, ... (Lengel & Daft 1988)

The ‘user’ in our case is as system designer – the manager dealing with tactical issues.

The content of the information is broader than ‘task’ – it consists of information about: (1) roles, (2) accountabilities, who (3) populates the roles, (4) what are the negotiated terms and conditions to fulfill the accountability, (5) the goals, (6) the purpose of the system, the (7) risks for things that may go wrong and influence the business and (8) the plans that make improvements to the business. The content of the information is detailed according the tactical management needs for the current undertaking – recognized as: R&A system, Information Sensors, Information Emitters and Risk information – capturing attributes such as interested party, the entity where the tactical manager is placing the Information Sensor with the type of information to be obtained (Progress feedback, Results, Issues, ...), the manner of obtaining the information (On demand or Event driven), the type of content (Qualitative or Quantitative information), frequency of obtaining the information (Hourly, Daily, Monthly, Quarterly, ...).

The ‘sources’ of information have been diverse and variable too – entities, collaborators, systems, software, external and internal sources of structured and unstructured information, ...

The ‘document representations’ have been diverse – the event-driven prescribed reports had some organized elements and structure, but that was only the case in 20%-40% of the information. All other information was unstructured and multi-shaped that needed to be additionally handled, organized and recorded for multiple users.

The ‘time’ dimension of capturing the context has been approached with a combination of – changeable frequency to obtain the information and continuous SIDA loop to scan the horizon for important changes (important according to the system-designer). The end-users were encouraged to continuously perform the SIDA loop and capture the changes in the context that were of significance to them and their system effects and record the changes in the follow-up reports in the Excel Workbooks.

The geographic location of the information was maybe the most interesting change for context capture for the end-users, compared to what they practiced before. Namely, since the artifact facilitated positioning of information sensors and initiating information emitters through the entire business ecosystem, the geographic location of the source information for capturing widest context has been very broad (Figure 3.5).

M4: The mechanism of **maintaining the system (of roles and accountabilities designed around a purpose) till purpose is reached** has been enforced to enable common goal, synergy and emergent effect. In the Contexts 1 and 3 this mechanism couldn’t be triggered because they have implemented only the Alpha-version of the artifact which denoted building, implementation and evaluation of the artifact for the identified tactical management issue and identifying features and components of the artifact for tactical use. But, in Context 2 and 4 the full monitoring of the maintenance of the system towards purpose throughout time took place. In Context 2 the complete lifecycle of the system has been witnessed. Namely, the initial tactical management issue for which the artifact has been used (Appendix B, Figure B.18) has been sustained and recorded adaptability through months until the purpose has been fulfilled and a new purpose requiring completely new system design took place (Appendix B, Figure B.21).

M5: The mechanism of **double-loop organizational learning** (Argyris 1977) is yet another appropriate response to the CAS nature. Namely, in our research it has been fulfilled throughout the combined SIDA & PDCA Loops with their intentional enforcement by the managers using the artifact. It relates to the CAS specificities as being open systems networked together as autonomous agents interacting towards own and collective purposes (Gell-Mann 1992; Gell-mann 2002; Gell-Mann 1997; Gell-Man 1995)(Garcia 1999)(Holland 2010)(Lichtenstein et al. 2006)(Banathy 1996) (Higgs 1999). These two characteristics – autonomous agents and open systems in our case indicate the significance that our system design of roles and accountabilities and its adaptability to changes provides an environment for the agents populating the roles to be autonomous in their accountability, interacting with the environment and the other roles and influencing the environment in purposeful manner. That is one of the loops of organizational learning – changing within a given designed system. However, the artifact enables also radical system change when there is no more space or need for the system to adapt to changes, but needs to change itself. Throughout the research timeline, this situation occurred in Context 2, when there has been a punctuation in the equilibrium and the system had to pursue a new purpose – hence resulting in a new system design. We were in possibility to observe the functioning of this mechanism because the Context 2 collaboration lasted much longer than the other contexts, so the system produced effect and eventually its purpose ended – in conclusion, the observation of artifact implementation was in duration of 8+ months.

M6: Effective communication is a kind of higher-level mechanism that all discussed interventions in specific contexts and mechanisms contribute to throughout the research. “Organizational success is based on the organization's ability to process information of appropriate richness to, reduce uncertainty and clarify ambiguity” (Daft & Lengel 1984), p. 5. It is important to select the appropriate communication channel with the appropriate information richness so that the parties in the communication process achieve effective communication. A manager’s job is to a great extent creating, opening, modifying and facilitating effective communication channels. The selection of communication media and its characteristics and achieving effective communication is one of the important skills executives should have (Lengel & Daft 1988). In our case, the manager was given at hand a way to personalize and case-by-case appoint and select the appropriate communication and the appropriate channel, medium, source, ... that carried along various information richness for ensuring two-way effective communication. In Context 2 and Context 4 the experienced communication has gone through diverse and various communication channels, with richness ranging from low to high – all appointed according to the user’s needs.

We perceive the effective communication mechanism (Means 2010) successfully working because of the following reasons:

- 3.8. The CAS specificity requiring simple rules on how to detect information has been enabled to the full extent with the proper functioning of this mechanism.

- 3.9. Another implicit issue with regards to the communication channels is the two-way positioning and shaping of the Information Sensors – meaning the information one needs, the Information Emitters – the reverse question of ‘unspoken’ information one would like to receive if something goes wrong, and the Risk information – the information signaling that something goes wrong.
- 3.10. The variety of information richness supported by the artifact influences the formal, unformal, structured, unstructured, proactive and reactive information sharing which enables the tactical manager facilitate the system appropriately towards the purpose. These IS components open not just one-way information flows that a manager needs to obtain, but two-way information flows and channels that assure the communication and feedback are a closed circuit and effective.
- 3.11. The improvements towards effective communication have been integrated in the artifact design, directly addressing the barriers for effective communication (Guffey 2012) (Gould 1969) to a large extent. Namely, the semantic barriers are to be overcome by clear expression of the messages, visual aids to clarify roles and accountabilities, clarity in the negotiations and various channels to avoid drawbacks of only reporting and written communication. The Organizational barriers are addressed by insisting on clarity for the purpose, mission, governing principles and their appropriate communication. Also the complexity of the organization is attempted to be simplified with system design that has no duplications or overlaps, has straightforward rules, few in numbers. With regards to the personal barriers, the artifact insists on rewarding accountabilities and outcomes (not only outputs) and gives incentives to emergent effects in pursuing the purpose.

M7: Empowerment of the entities in roles – is a simple – yet necessary mechanism for any system to produce an effect. In a mechanistic system of a car, for example, it would be as expecting the wheels to do their job without tires. Even though the car may move few meters, it will break. So will the system of Roles and Accountabilities, if the entities populating the roles are not given all necessary resources and power to do what they are accountable for, when performing that role; or to ask and re-negotiate for changes, if impossible to be given. This also stands for the role of the manager as a system designer with the authority level discussed in intervention I1. ‘Empowerment is the process of enhancing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes. Central to this process are actions which both build individual and collective assets, and improve the efficiency and fairness of the organizational and institutional context which govern the use of these assets.’ (World Bank 2016) Its main characteristics are: (i) access to information, (ii) inclusion (participation) (iii) accountability and (iv) local organizational capacity (Narayan-Parker 2002).

This mechanism transfers the functionality of the artifact in two ways – because it is addressing the CAS nature of autonomous agents networked together towards a purpose – giving autonomy to the ones populating the roles, providing network and accountabilities; and because the artifact supports this mechanism to take place with the information support and open channels for information sharing. In Context 1 the main conclusion after designing the S&R system has been signaled by this exact mechanism: when higher management (system designer from helicopter view) populated the roles with employees and/or departments and/or subcontractors, they realized that they hadn’t given them the appropriate ‘powers’ to fulfill their accountabilities. The Context 2 recorded a manager – facilitator ‘of emancipatory dialogue, a discourse among parties that can lead to mutual learning, deep understanding and insight, and collaborative consciousness and action’ (Raelin 2013). This role promotes managing of the environment to facilitate the entities in roles to accomplish their accountabilities. Context 3 and Context 4 resulted with empowerment to a certain extent: because of lack of internal staff to fill the roles and because the method helped clarifying which collaborator needs additional resources/information/... to be held accountable but the choice to empower the existing entities has been on top manager’s discretion, respectively. The empowerment, combined with the effective communication channels and the individual and collective insight increase the employee motivation, morale, engagement and commitment to the purpose.

M8: Achieving situation awareness is the higher-level mechanism that interweaves the artifact’s essential components of management and information systems. In various contexts that are characterized with high unpredictability and intense changes, especially transportation, health care, space, and oil and gas operations military, medicine, crisis management situations, aviation, ... there is mature incorporation of the theory of situation awareness and its characteristics. In military, commanders are requiring data to be processed into information to gain better Situational Awareness (SA) for decision making (Saarelainen & Timonen 2011) (Giles 1910). In general, decision making connected with situation awareness uses John Boyd’s Observe-Orient-Decide-Act (OODA) loop (Hammond 2012) which is the twin of our Sense-Interpret-Decide-Act (SIDA) loop. In our artifact, we are reflecting

both to the process and the product of situation awareness, through the multifaceted context capture, the personalized IS design, the SIDA and the PDCA loops, the big picture overview, the risk incorporation, the visualizations and virtually most of the interventions and mechanisms that are functioning when implementing the artifact in real-life. According to (Mica R Endsley 1995; Endsley 2000; M R Endsley 1995; Endsley et al. 2007; Endsley 2015), the process of acquiring and maintaining SA is cyclical and adaptive and influenced by numerous factors. One group of factors enlists the individual's cognitive abilities, which are affected by abilities, experience, trainings, own objectives, perception and interpretation of the environment (Hutchins 1995). Also, the SA is a function of the system design with regards to the information provision degree and format. Finally, the task environment (stress, complexity, workload) etc. also influence SA.

SA is a dynamic construct that involves temporal and spatial components, and its states combine among awareness of objects in the world and their status, frames of what is going on, implications as awareness of objects within frames, each of these within a time and space event horizon. Relating to this, our entire personalized IS self-design is capturing the components mentioned here. With regard to the SA phases, there are: perception, comprehension and projection – level 1, 2, 3 respectively. Level 1 SA recognizes attributes, status, dynamics of the elements in the environment we deem relevant for our purpose. The Level 2 SA synthesizes the Level 1 elements to provide comprehension of the situation, considering the goals and objectives in the information integration – again for the relevant part of the world for the individual/team. The Level 3 SA is the highest and aims to achieve ability to project the future actions/states/dynamics of the elements of the world we are interested in and influence us and our system and purpose. In this instance, the mental models play a fundamental role (Endsley 2015) (Chapter 3). In our research and with our artifact, we directed the situational awareness through the three levels, by positioning the information sensors, emitters and risk information and the instruction for setting up the sensing mechanism with the goal in mind (Level 1), offering the Role-and-Accountability system diagram with specification of primary purpose, roles, conditions of satisfaction and negotiations for reasoning and understanding and comprehending the situation (Level 2); and continuously offering the SIDA loop as adaptability and scanning engine that senses, observes (Level 1); interprets (Level 2); decides (Level 3) and acts – translating the action into business move or into information mapping (Endsley 2015).

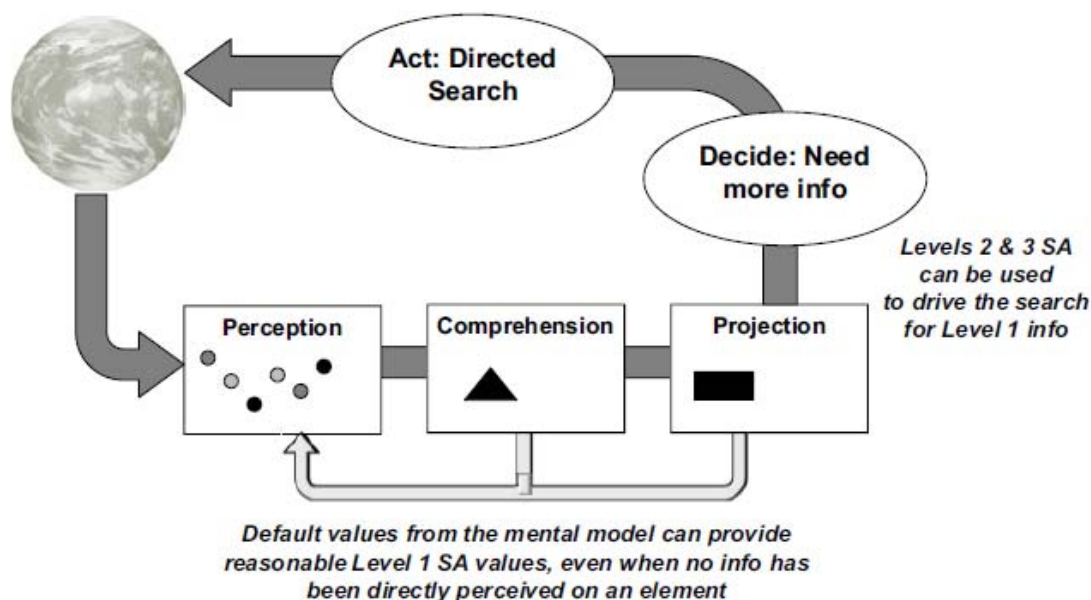


FIGURE 3.8 HIGHER LEVEL SA CAN BE USED TO DRIVE THE SEARCH FOR DATA AND TO PROVIDE DEFAULT VALUES WHEN INFORMATION IS NOT AVAILABLE (ENDSLEY 2015)

The argumentation why we are focusing on situation awareness, and not sensemaking for example, is because the latter is more strategy-oriented, backward looking, for past events and diagnosis of causalities in observations of

errors, and conclusions. Of course, for tactical and adaptability needs sensemaking integrates in the reasoning and acting, but we are putting it in the ‘back office’ not in the front, of the artifact roadmap. SA is more a combination of pattern-matching, conscious analysis, story building, mental simulation, and meta-cognitive processes all may be used by operators at various times to form SA, focusing on the ‘how’ instead of the strategic ‘what’ and operational ‘why’ (Endsley 2000). Finally, the SA measurement can be performed among others, with subjective techniques such as self-rating and observer-rating (M R Endsley 1995; Endsley 2000), which have been evaluation methods in our research too. Our end-user 1 evaluated the before and after experience without and with using the artifact assessing the situational awareness as follows. In the ‘before’ situation there has been management by "gut feeling", unpleasant surprises, never the feeling that I'm "in control", lot of issues "floating around" so I sometimes drop the ball, no overview of all the forces that influence my job, directly or indirectly. The ‘after’ situation has been rated as: ‘still management by gut feeling but now with insight and facts to support this, being able to predict where the next problem is going to occur, unpleasant surprises regarding projects - Reduced to almost 0, by updating and refining the process you get more and more control and understand better why on some points you don't have the control. When using the method it is really surprising the amount of insight you gain by making the different drawings and writing down the connections and their meaning (referring to the R&A system diagram with SNA graph). With the artifact use, I felt as having a 360 degree view and sense of the world of my project.’

To wrap up the interventions and mechanisms and their interrelatedness denoting how much each intervention triggered and influenced each of the mechanisms in place, in order to achieve the desired outcomes, Figure 3.9 visualizes the relationships and their strength. The ranking from 1 – 5 are done according researcher’s perception and observation. For example the intervention I2 – Big picture overview of the entire business ecology influences to the maximal extent (5) the mechanisms M3 – Multifaceted context capture and M8 – Situation awareness. These relations are color-coded with dark green. I2 influences M4 – Maintaining the system till purpose is reached, M5 – Double loop organizational learning and M7 – Empowerment of the entities in roles with high extent (4) which is color-coded in lighter green. The influence of I2 to M1 – Personalized IS self-design and M6 – Effective communication is moderate and ranked 3, color-coded with lightest green. The influence of I2 to M2 – Simplicity of the artifact use is rather low (2) and color coded white.

	MECHANISMS	M1	M2	M3	M4	M5	M6	M7	M8
		Personalized IS self-design	Simplicity of the artifact use	Multifaceted Context-capture	Maintaining the system till purpose is reached	Double loop organizational learning	Effective communication	Empowerment of the entities in Roles	Situation awareness
INTERVENTIONS									
11	Tactical authority level	2	2	2	5	5	3	5	4
12	Big picture overview (Business ecology), Scope	3	2	5	4	4	3	4	5
13	System design of Roles and Accountabilities	5	5	4	5	5	5	5	4
14	Clarity of Purpose and Governing Principles	3	4	4	5	3	4	3	3
15	Guidelines for informing/translating decisions on business/information level	5	5	2	4	5	5	4	4
16	Sense-Interpret-Decide-Act Loop for adaptability	5	5	5	4	5	5	4	5
17	Plan-Do-Check-Act Loop for improvements	5	5	4	4	5	4	5	3
18	Incorporating Risk in parallel with Outcomes	4	5	5	5	5	4	4	5
19	Visualizations	5	5	4	3	4	5	3	5

FIGURE 3.9 MATRIX OF RELATIONS AND HEAT MAP OF INFLUENCES OF INTERVENTIONS TO MECHANISMS LEADING TO THE DESIRED OUTCOMES (1(LIGHTEST COLOR)-LOW INFLUENCE, 5(DARKEST COLOR)-VERY HIGH INFLUENCE)

OUTCOME(S)

According to (Sein, Henfridsson, Rossi, et al. 2011) the evaluation cycles for the alpha version are formative, in order to refine the artifact, along with ongoing solving of problems and unanticipated events. The later evaluation of the beta versions is summative, assessing value and utility outcomes. The school of theory-based evaluation (Chen 2012), of which realist evaluation is an affiliate, has always described its appointed task as ‘enlightenment’ as opposed to ‘political arithmetic’. By analyzing the Alpha and Beta version of the artifact, and addressing the

Interventions and Mechanisms, we tangled the formative and summative evaluation simultaneously. By addressing the value and the utility outcomes of the complete endeavor of the research in real-life as ADR through analyzing and evaluating the Outcome(s), we will be wrapping up the evaluation component of the BIE stage (Figure 1.1).

OUTCOME(S)		
	O1	O2
	Personalized IS self-design and adaptability	Adaptability of the managed system
Oc1	Investigated and formulated, through the Interventions and Mechanisms, resulting with managerial method introduction and inception	Only initially set-up and theoretically elaborated but not experienced in dynamic sense in the Alpha-version
Oc2	Complete implementation and use in the ADR sense, benefits and limitations perceived and continuous use follows	Complete implementation and recognition of the adaptability throughout the system's lifecycle
Oc3	Investigated and formulated, through the Interventions and Mechanisms, resulting with managerial method introduction and inception	Only initially set-up and theoretically elaborated but not experienced in dynamic sense in the Alpha-version
Oc4	Complete implementation and use in the ADR sense, benefits and limitations perceived, contributed to manager's awareness and capabilities	Complete implementation and recognition of adaptability of the system in duration of beginning 3 months.

FIGURE 3.10 OUTCOMES (FROM THE CIMO-LOGIC) THAT HAVE BEEN EVALUATED IN THE BIE STAGE

The adaptability engine(s): SIDA & PDCA Loops

The main focus of our research artifact in terms of its utility for the users is on the adaptability achieved through several specific standpoints and mechanisms. We are observing it in direction of the tactical manager's information system and of the managed business system, all in direction of concluding the adaptability features that are incorporated in the artifact's design, structure and content. To some extent, the traits of adaptability that are incorporated in our artifact's design for IS and business needs are providing for the IS and for the R&A system to be adaptive too. Such is the use of the SIDA and PDCA loop. The first one belonging to the range of generic feedback loops that the sensors are triggering the effectors to sustain adaptive information system (Brun et al. 2009). The generic feedback loop in Figure 3.11 has the comparison Collect (for Sense), Analyze (for Interpret), Decide and Act and incorporates almost exactly the actions a person undertakes to effectuate each of the stages.

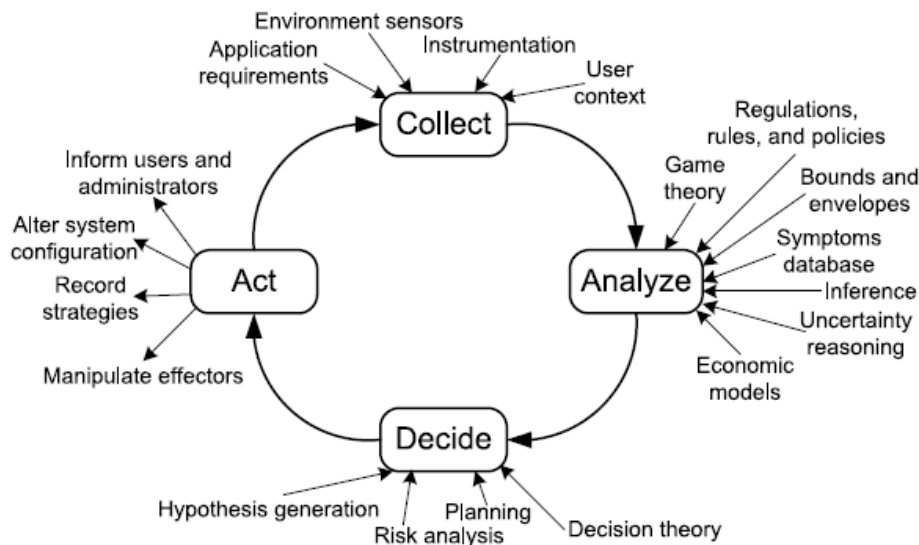


FIGURE 3.11 AUTONOMIC CONTROL LOOP (DOBSON ET AL. 2006)

Examples of the two loops such as SIDA and PDCA functioning towards an adaptive information system and software engineering, incorporating positive and negative feedback too is the architectural blueprint for autonomic computing (IBM 2005) as well as in business terms the works incorporating the single or double-loop learning and feedback (Schneider & Somers 2006; Edson 2010; Dietz et al. 2011).

O1: Assisting the manager with **personalized information system self-design and adaptability** is the background motivation of the research that contributes to the Information Systems understanding of managerial needs and information requirements in static and dynamic terms. This research aims to prove that those needs are changing and should reflect the relevant changes in the environment, for which any addressing with information systems for tactical management needs to support personalized, self-designed, and adaptable information systems. If such exists, it will positively support the adaptability in organizational terms, or as we are referring to – adaptability of the managerial system (which is intended outcome O2). The outcomes of the research are the complex result of the context-interventions-mechanisms and multidirectional interactions of the researchers and practitioners. Through the Interventions and Mechanisms parts of this section we tried to elaborate the most important components with their specifics, while in this part on Outcomes, we will refer to the outcomes as emergent and synergic effect of all interactions and mechanisms previously discussed.

How the personalized IS self-design was supported with the artifact, will be observed and evaluated at this point. Since the Context 2 and Context 4 cases have been fulfilled through Alpha- and Beta-versions of the artifact, and lasted long enough through time to be able to capture the dynamic behavior of the managers using the artifact in practice, we will be following those two intervention contexts for this purpose.

The absolute number of information flows distinguished as Information Sensors, Information Emitters and Risk information that have been set up by the end-user implementing the artifact are presented on Figure 3.12 and Figure 3.13 for Context 2 and Context 4 respectively. It is visible that throughout the five months there have been information flows that have been set up, closed, initiated and re-initiated, in order to adapt to the changing information needs of the manager, and to provide best context-capture. For example, the Information sensors for Context 2 (Figure 3.12) have started as 20, then two months later, due to closing of some and introducing of new ones, there have been 23, and in the fifth month 18. Context 4 recognizes changes in number of information flows too. The total number of information flows generated and maintained by the manager through time in order to adapt to changes and reflect them in the information flows is presented on Figure 3.14 – numbering 58, 63, 45 through the months for Context 2 and 30, 36 for Context 4. In regular circumstances, the tactical manager uses few regular detailed daily reports and monthly and quarterly summarized reports as information flows, while combining flows from various sources, frequencies, information type, ... and structuring them per need. We would like to note that the managers would have to be aware and make the deliberate action of transforming qualitative information flows to quantitative but be continuously scanning for possible change as reversal and so on.

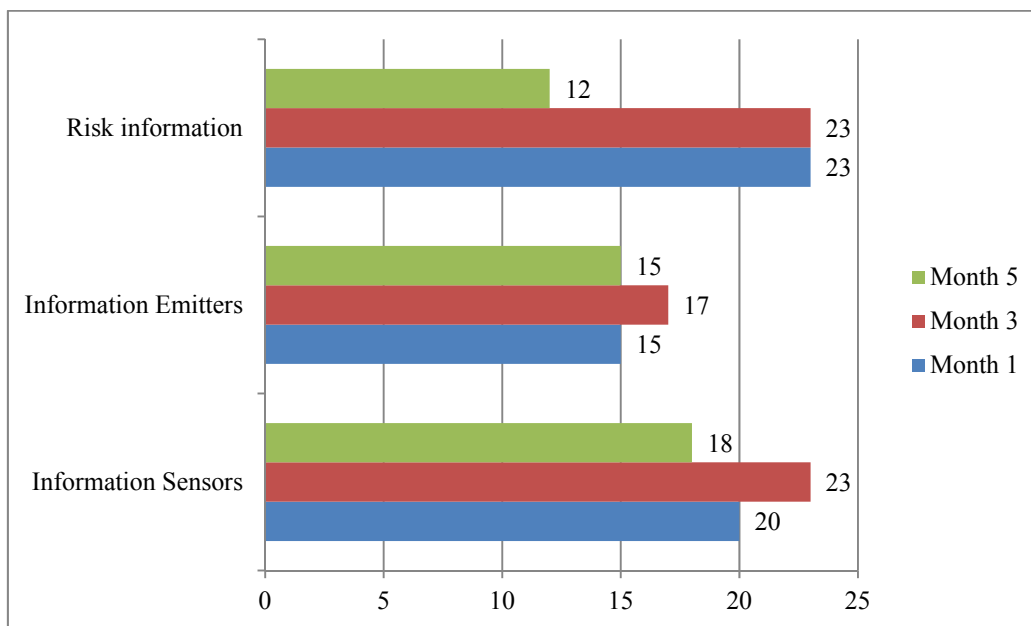


FIGURE 3.12 NUMBER OF INFORMATION SENSORS, INFORMATION EMITTERS AND RISK INFORMATION GENERATED AND MAINTAINED BY THE MANAGER WHEN USING THE ARTIFACT, FOR CONTEXT 2

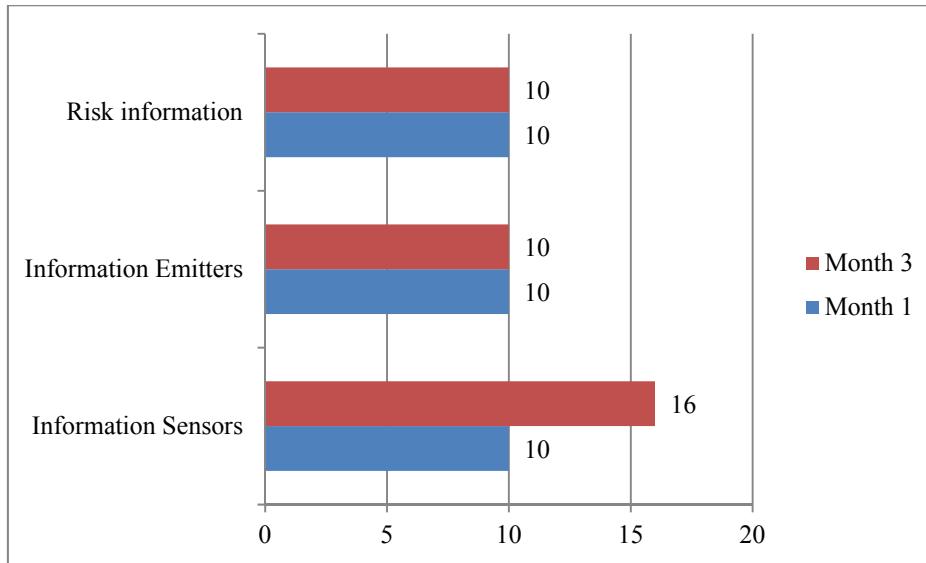


FIGURE 3.13 NUMBER OF INFORMATION SENSORS, INFORMATION EMITTERS AND RISK INFORMATION GENERATED AND MAINTAINED BY THE MANAGER WHEN USING THE ARTIFACT, FOR CONTEXT 4

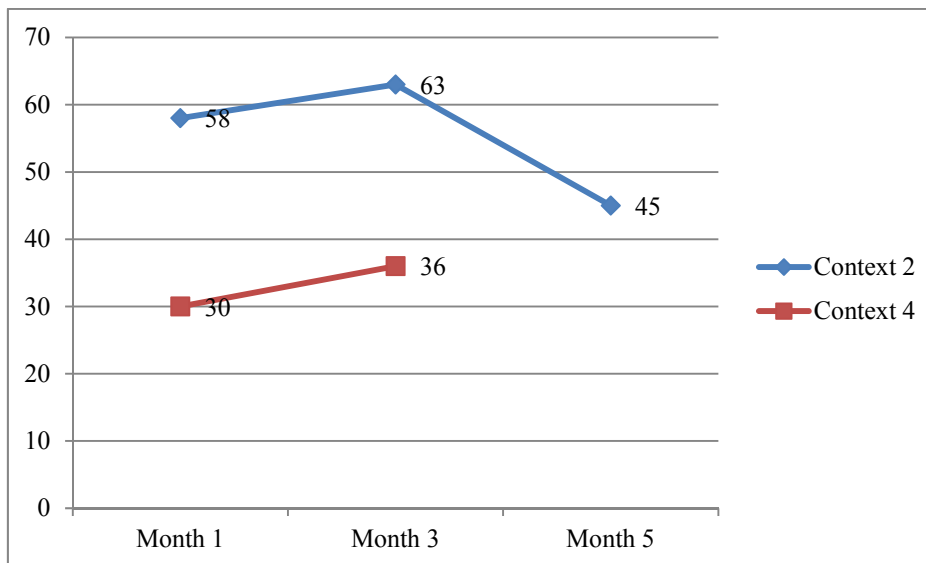


FIGURE 3.14 TOTAL NUMBER OF INFORMATION FLOWS (INFORMATION SENSORS, INFORMATION EMITTERS, RISK INFORMATION) SET UP AND MAINTAINED BY THE MANAGER THROUGH TIME IN ORDER TO ADAPT TO CHANGES AND REFLECT THEM IN THE INFORMATION FLOWS

Another important aspect for the personalized IS self-design is the awareness that the manager needs to set up the informational structure from qualitative and quantitative information, as well as structured and unstructured. For this purpose, we measured the participation of qualitative information in the overall information flows captured with the artifact use (Figure 3.15) which is 93% and 87% for month 1 and month 3 for Context 2, then stabilizing at 51% in month 5. The quantitative content in the information flows was 9%, 19% then 71% respectively. The overlapping percentages over 100% as monthly totals are because of some information flows containing both qualitative and quantitative information, purposefully counted in both categories. Similarly, in the beginning months of the artifact use, Context 4 records 97% and 78% of qualitative information for month 1 and 3 respectively, while designing 13% and 17% of quantitative information. The background reasoning for this intervention to be included in the artifact is

supported by the findings from the exploratory interviews (Chapter 2) that the information for tactical management should be structured from various inflows – that the managers exported data from reports and did their own modifications in own Excels, accompanied by notes, drawings, stickers and other means for combining all necessary info in useful structure before their eyes. Another important finding can be observed from the behavior in Context 2, where in the 5th month the manager has already stabilized the information flows and structures the qualitative and quantitative information and their combination, resulting with information system completely personalized for his/her project or activity with the system of roles and accountabilities he/she is managing towards purpose. But this situation immediately alters when the next SIDA loop detects relevant changes that require information system reflection and if necessary, re-design.

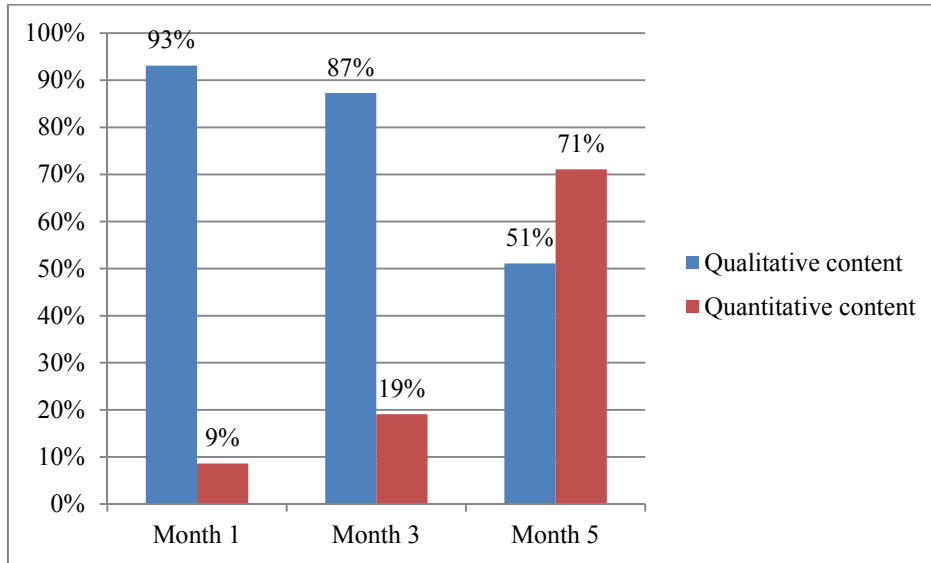


FIGURE 3.15 PARTICIPATION OF QUALITATIVE AND QUANTITATIVE INFORMATION CONTENT FOR CONTEXT 2

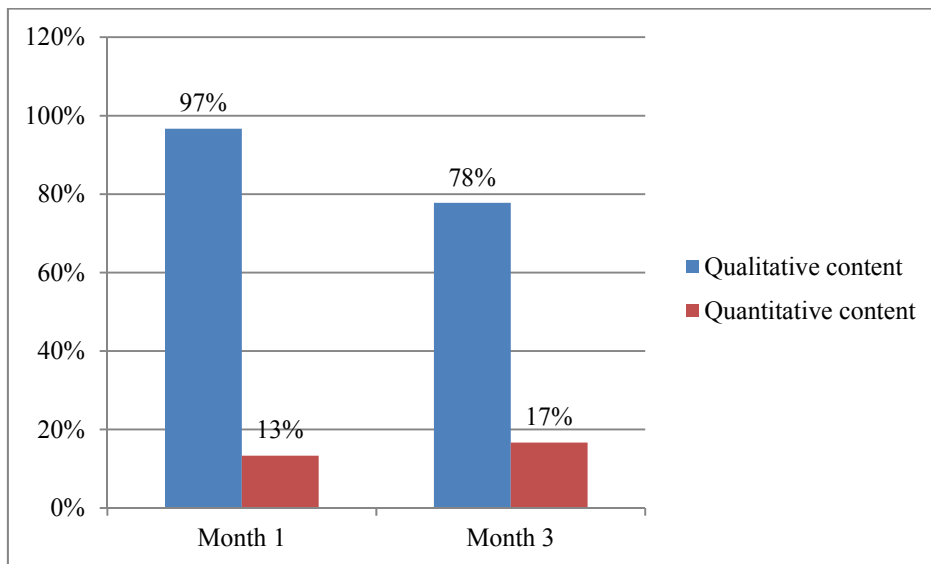


FIGURE 3.16 PARTICIPATION OF QUALITATIVE AND QUANTITATIVE INFORMATION CONTENT FOR CONTEXT 4

Complementary to the qualitative and quantitative information content distinction, is the manner of invoking and obtaining the information – whether ‘on demand’ meaning the manager asks for it, it’s (still) not automatized in some reports or regular flows; and ‘event-driven’ meaning there will be appropriate report for some development

and is prescribed in the existing information flows. This category is very company-specific, and directly relies on the coverage of the software solutions present in the company at manager's disposals, but reflects a situation that informs us about the very little portion of information coverage given to the managers if they rely only on the reports prescribed and relatively affixed in the company, without distinguishing the managerial user profile (for tactical needs, operational needs, strategic needs, ...). The percentages for Context 2 have been 65%, 74%; 78% for on demand information flows (Figure 3.17), while for Context 4 – 50% and 63% (Figure 3.18) respectively over the months. This is significant for our research because it informs us how much an artifact that helps personalized IS self-design is useful for the practitioners to have broad and expanded situational awareness that reflects to increased adaptability. This is interesting because it is not entirely intuitive. It basically means that through prolonged use of the system, managers become aware of more and more information they need and is not readily provided by the system, so the need it 'on-demand'. It is not intuitive because it contradicts a bit the evolution in the proportion qualitative/quantitative. We can expect that after long enough use, the 'on demand' information also becomes event-driven if this type of information (gathering, processing and distribution) is getting automatized, i.e., built into the computer information systems of the company. But, our main standpoint is that this should change with change in circumstances, and we shouldn't conclude it is a static informational structure that needs to be affixed further on in time.

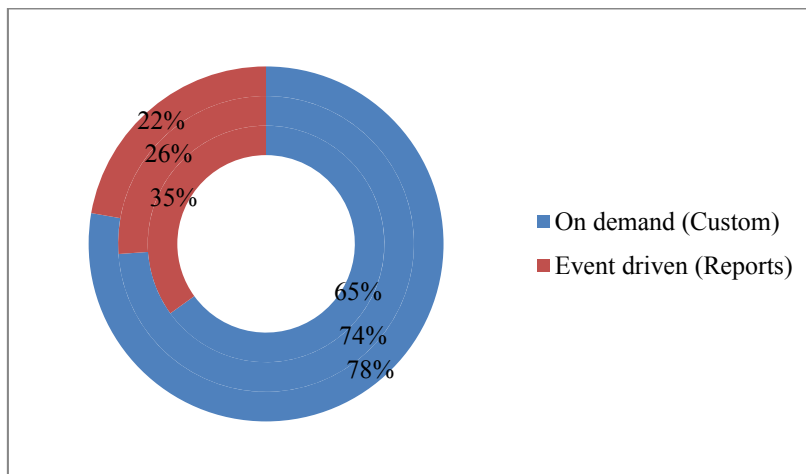


FIGURE 3.17 DIFFERENTIATION OF THE INFORMATION FLOWS AS 'ON DEMAND' AND 'EVENT DRIVEN' FOR CONTEXT 2

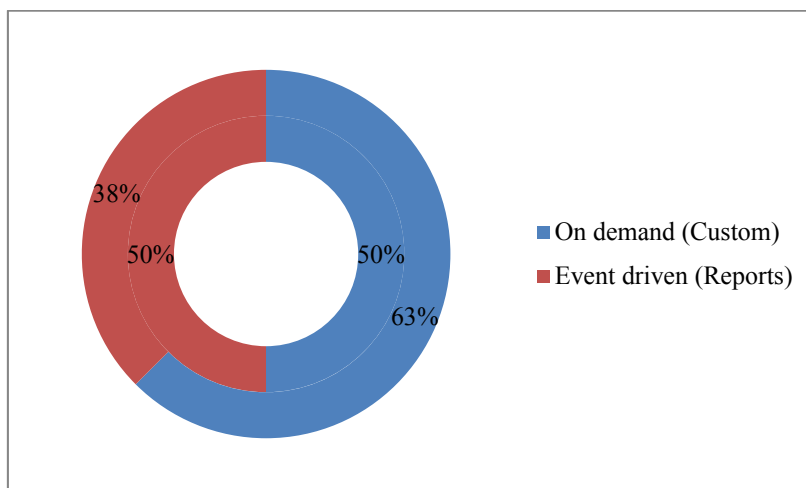


FIGURE 3.18 DIFFERENTIATION OF THE INFORMATION FLOWS AS 'ON DEMAND', 'EVENT DRIVEN' FOR CONTEXT 4

Regarding the frequency of changes in the different attributes of the information flows (type of information to be obtained (Progress feedback, Results, Issues, ...), the manner of obtaining the information (On demand or Event driven), the type of content (Qualitative or Quantitative information), frequency of obtaining the information (Hourly, Daily, Monthly, Quarterly, ...) and others) it was of constitutive importance for the research to measure and prove it. As recordings show, there have been changes in frequency of obtaining information (with variations such as immediate (zero latency), hourly, daily, weekly, bi-weekly, monthly, bi-monthly, quarterly, yearly) in 76% of the information flows in Context 2 and 44% of the information flows in Context 4 (Figure 3.20). Some information flows have increased frequency (26% and 13% for Context 2 and Context 4 respectively) and some have decreased frequency of obtaining (22% and 31% respectively) (Figure 3.19). Regardless the direction of change, it is important to note that in order to support adaptability in dynamic circumstances, the manager's actions need to be in direction of self-positioning and tuning of the information flows according the dynamic changes in the immediate or broader context. Such responsiveness should be expected from the information system support too.

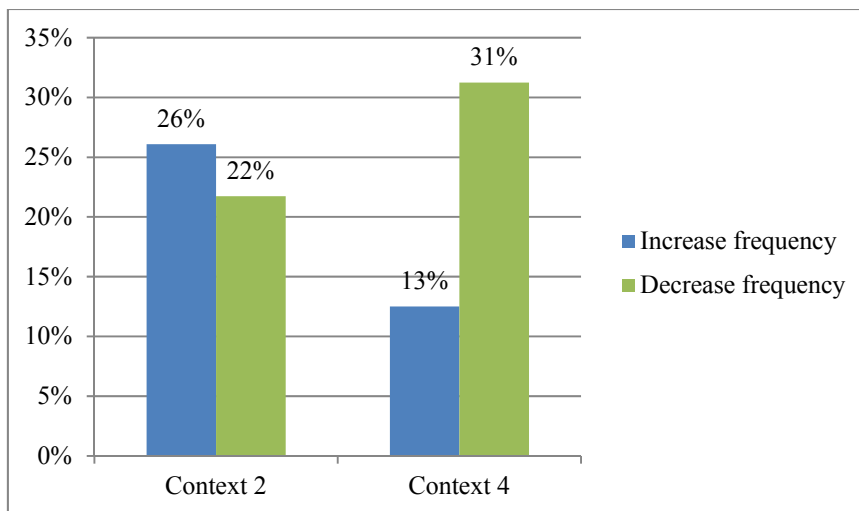


FIGURE 3.19 EVIDENCED CHANGES IN FREQUENCY OF OBTAINING INFORMATION THROUGH TIME FOR CONTEXT 2 AND CONTEXT 4 – INCREASING AND DECREASING FREQUENCY PERCENTAGES

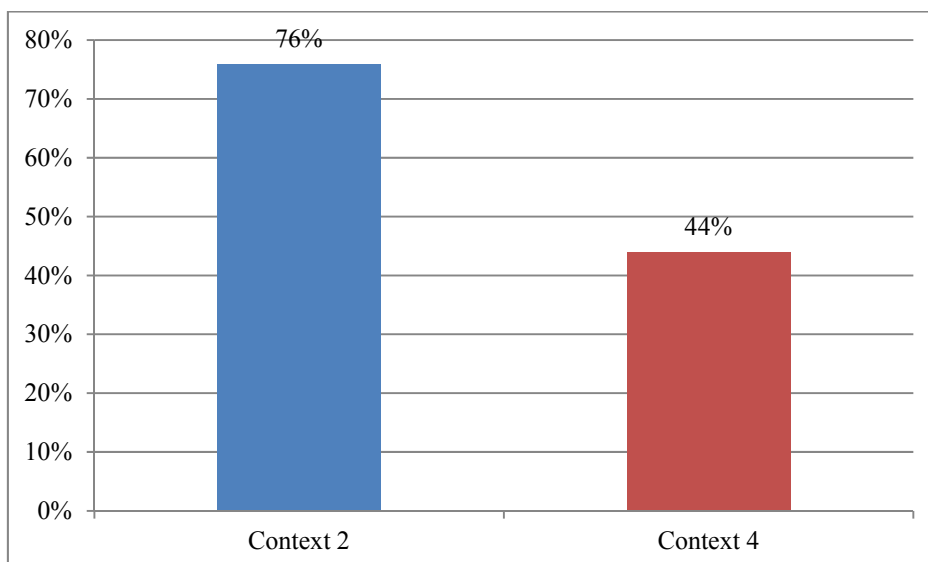


FIGURE 3.20 EVIDENCED CHANGES IN FREQUENCY OF OBTAINING INFORMATION THROUGH TIME FOR CONTEXT 2 AND CONTEXT 4 – PERCENTAGE OF TOTAL INFORMATION FLOWS THAT CHANGED FREQUENCY

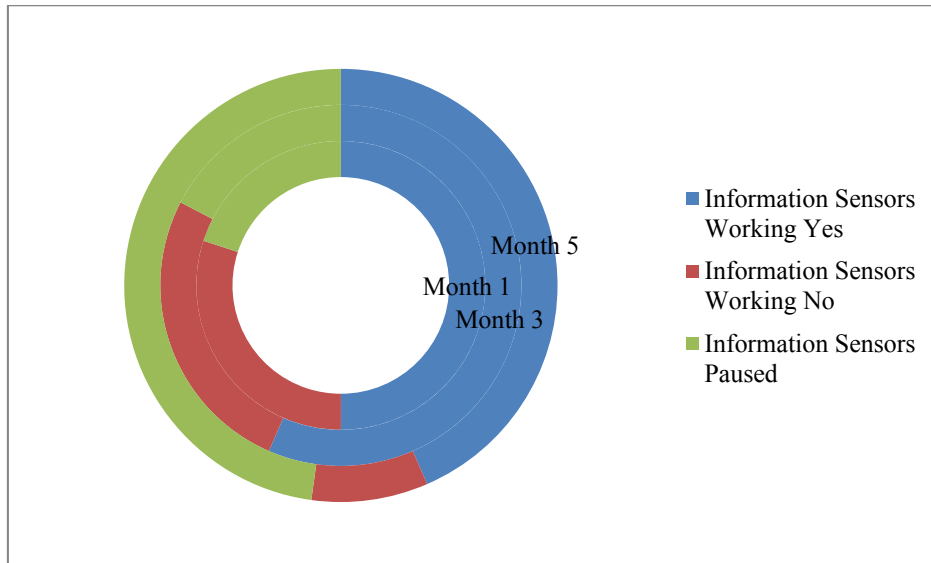


FIGURE 3.21 PREVIEW OF THE INFORMATION SENSORS THAT HAVE BEEN APPOINTED AND HAVE BEEN FUNCTIONAL, NOT FUNCTIONAL OR DELIBERATELY PAUSED FOR CONTEXT 2

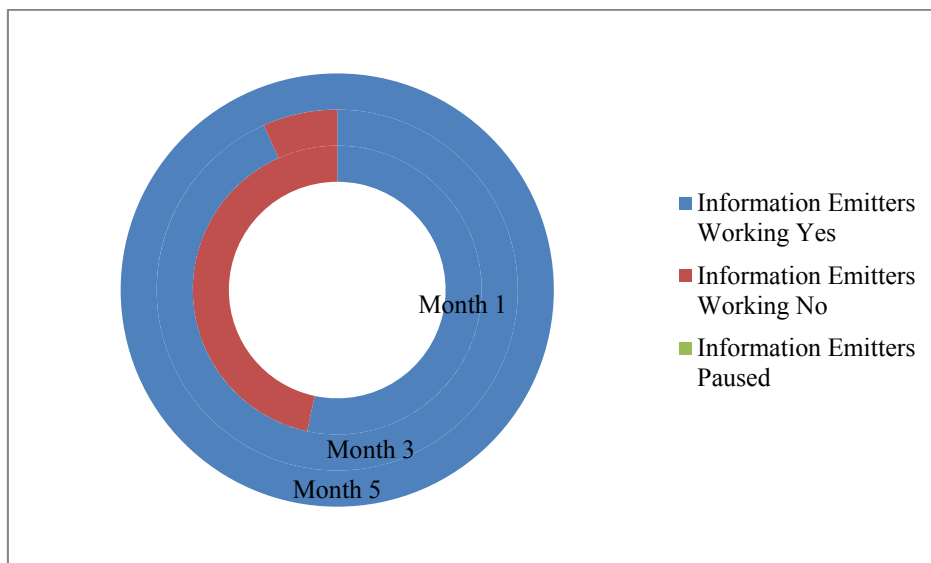


FIGURE 3.22 PREVIEW OF THE INFORMATION EMITTERS THAT HAVE BEEN APPOINTED AND HAVE BEEN FUNCTIONAL, NOT FUNCTIONAL OR DELIBERATELY PAUSED FOR CONTEXT 2

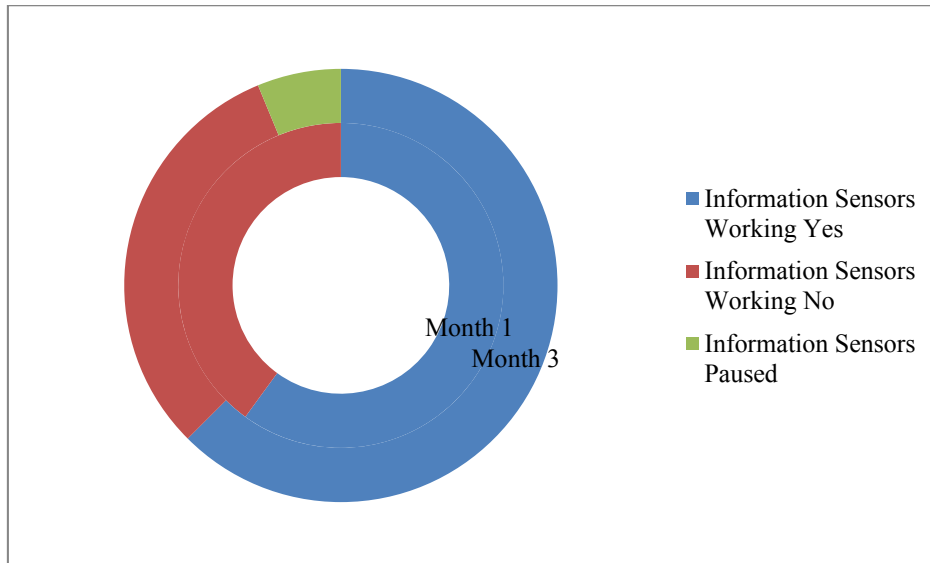


FIGURE 3.23 PREVIEW OF THE INFORMATION SENSORS THAT HAVE BEEN APPOINTED AND HAVE BEEN FUNCTIONAL, NOT FUNCTIONAL OR DELIBERATELY PAUSED FOR CONTEXT4

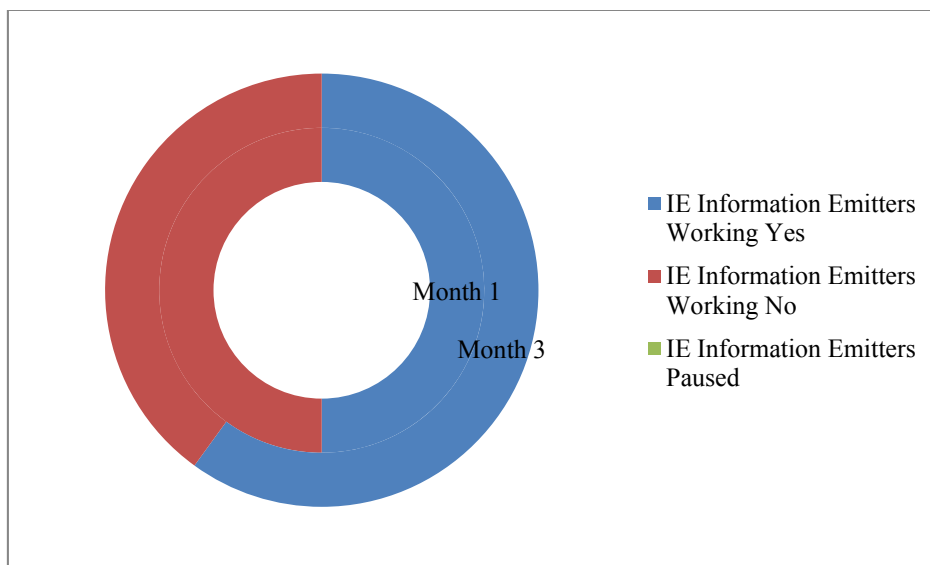


FIGURE 3.24 PREVIEW OF THE INFORMATION EMITTERS THAT HAVE BEEN APPOINTED AND HAVE BEEN FUNCTIONAL, NOT FUNCTIONAL OR DELIBERATELY PAUSED FOR CONTEXT 4

The findings for the positioning, evaluating and maintaining the risk categories in consideration and in the information flows are summarized in Figure 3.25 (in numbers) and Figure 3.26 (in total risk volume). The findings are categorized as: lowered risk chance for occurrence on a scale from 1-lowest through 5-highest (for example from grade 5 to grade 3 on the scale) that occurred in 4% in Context 2 and 40% in Context 4. The lowering of the risk impact to the business on a scale from 1-lowest through 5-highest (for example from grade 5 to grade 4 on the scale) occurred in 22% in Context 2 and 10% in Context 4. Movements in the opposite direction have been recorded too – increase of risk. The SIDA loop scanned and indicated appearance of increase of the chances for some risks to happen in 4% in Context 2 and 20% in Context 4. The lowering of the chances of the risks to occur or their impact on the business are the direct result of the PDCA loop to improve things in the current settings, by the managers. When discussing potential risks in total volume as all risk entities hypothetically receiving grade 5 (highest), we calculated the impact of the risk changes (lowered or increased) to the business ranging from 2%-9% in the different

contexts (Figure 3.26). This again, confirms that there is no static risk management approach that can be prescribed and planned in advance, but needs to be revised, re-evaluated and reflected in the business activities on ongoing basis. Depending on the context the companies are operating in, the dynamics of the environment translated in business opportunities but also risks, as well as the capabilities of the manager and the team, there are discrepancies in the numbers and fluctuations of risk entities. Figure 3.27 presents the total number of risk entities that have registered changes in attributes or in content in Context 2 – 30% and in Context 4 – 70% - confirming the ‘living nature’ and the requirement for continuous scanning and acting upon the information and business flows, and the fine-tuning that is necessary for managerial and system adaptability.

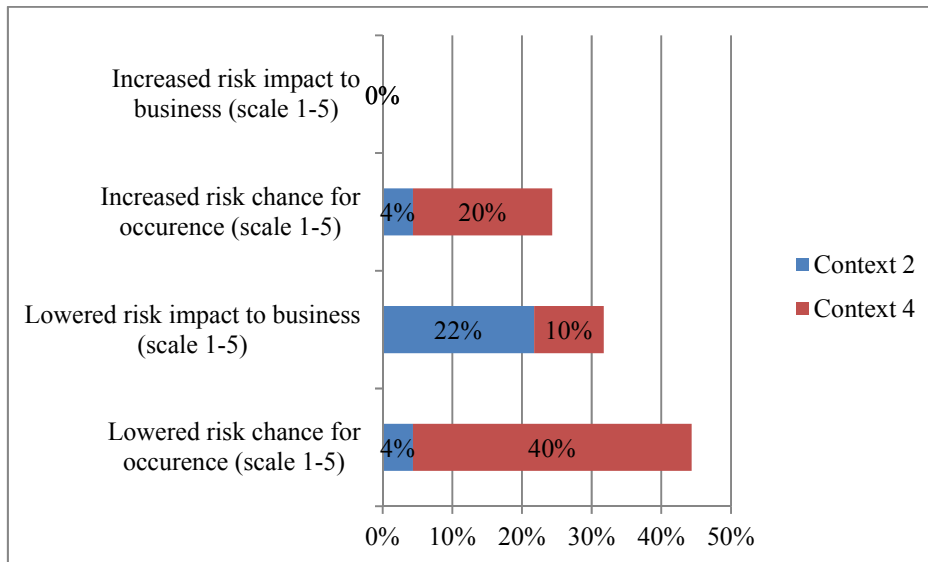


FIGURE 3.25 CHANGES IN DIFFERENT RISK CATEGORIES IN CONTEXT 2 AND CONTEXT 4 IN NUMBER OF RISK CATEGORIES

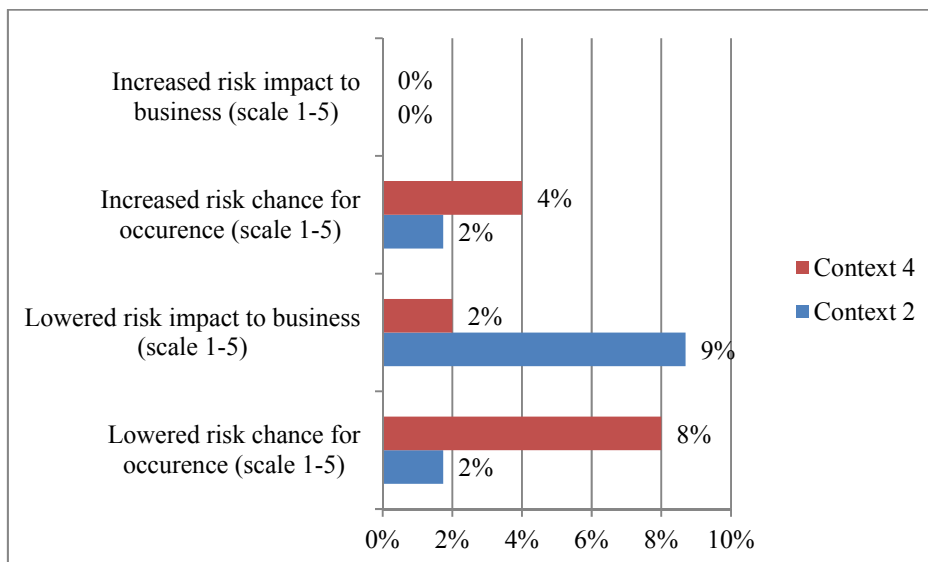


FIGURE 3.26 CHANGES IN DIFFERENT RISK CATEGORIES IN CONTEXT 2 AND CONTEXT 4 IN VOLUME OF RISK (COMPARED TO MAXIMAL RISK VOLUME OF NUMBER OF CATEGORIES MULTIPLIED BY 5)

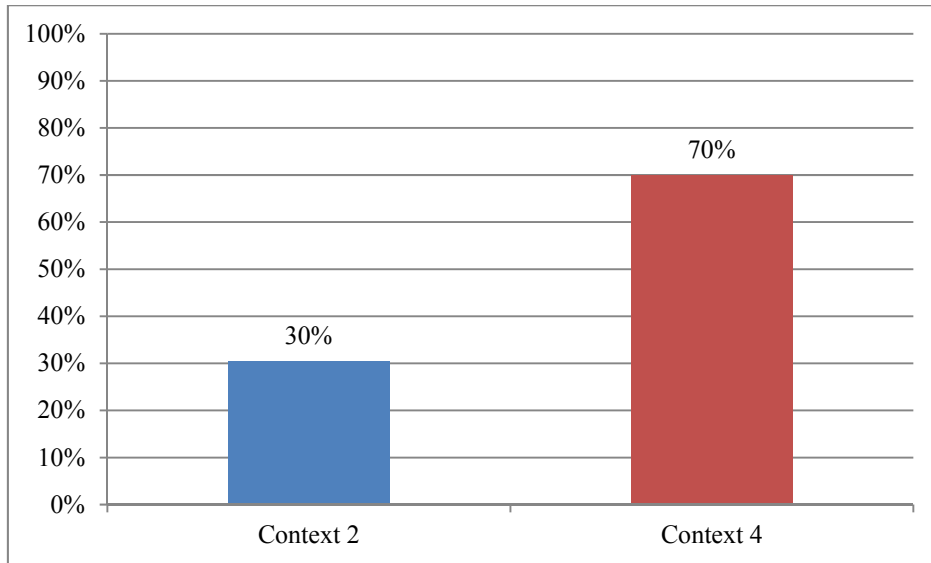


FIGURE 3.27 TOTAL CHANGES IN NUMBERS OF RISK ENTITIES THROUGHOUT THE MONTHS, IN CONTEXT 2 AND CONTEXT 4

O2: In terms of **adaptability of the managed system (through the managerial system)**, we are evaluating the overall experience in Context 2 and Context 4 with the managerial system of roles, accountabilities and entities populating the roles and interacting towards producing an effect. By adaptability, we are referring to the system's ability to change or be changed in order to fit transformed circumstances (Andresen & Gronau 2005). With our artifact, the manager has been given a method that should create adaptable mechanism of roles and accountabilities which is responsive to the manager's intentional actions. That adaptable mechanism is the 'frame' in which the complex adaptive system fits, purposefully acting to fulfill the roles and accountabilities. It is the projection of the manager's idea (what we named as 'managerial system' that is communicated with its population and represents the steering framework. The agents of the CAS have own purposes but are aware of and are interacting to produce the primary purpose around which the adaptable system of Roles and Accountabilities is designed. For this reason, we are observing and evaluating the adaptability of the managerial system of Roles and Accountabilities and all its surrounding (the interrelated artifact components). The collaboration with practitioners in Context 2 has been representative to describe the experience from beginning to end of a system of Roles and Accountabilities. Context 4 will be referred to throughout most of the observations except for a change in the system's primary purpose (which only occurred in Context 2). Since we have separated, for the purpose of proper elaboration, the adaptability of the information needs with the adaptability in business terms, at this point, we will be referring to the adaptability on business level (through the R&A system diagram).

Positioning of the level of 'roles'

The positioning the right level of 'roles' in the system, is an adaptability feature because the manager is not thinking in terms of specific people, employees, names, but on an intermediate level, that of roles. However, it is neither a mechanistic nor straightforward task. In Context 4 the initial Role and Accountability system design proved too generic as early in the first month, and has been changed in order to respond to the manager's perception of the desired system (compare Figure 3.28 to Figure 3.29).

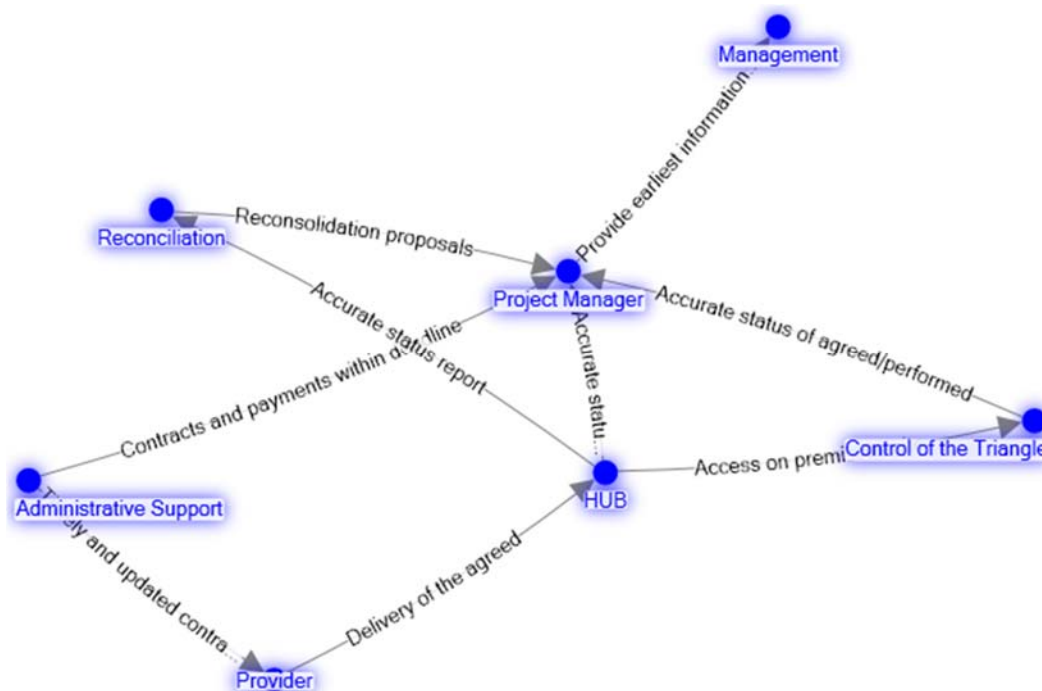


FIGURE 3.28 CONTEXT 4, INITIAL ROLE AND ACCOUNTABILITY DIAGRAM WITH TOO GENERIC LEVEL OF ROLES FOR TACTICAL MANAGEMENT

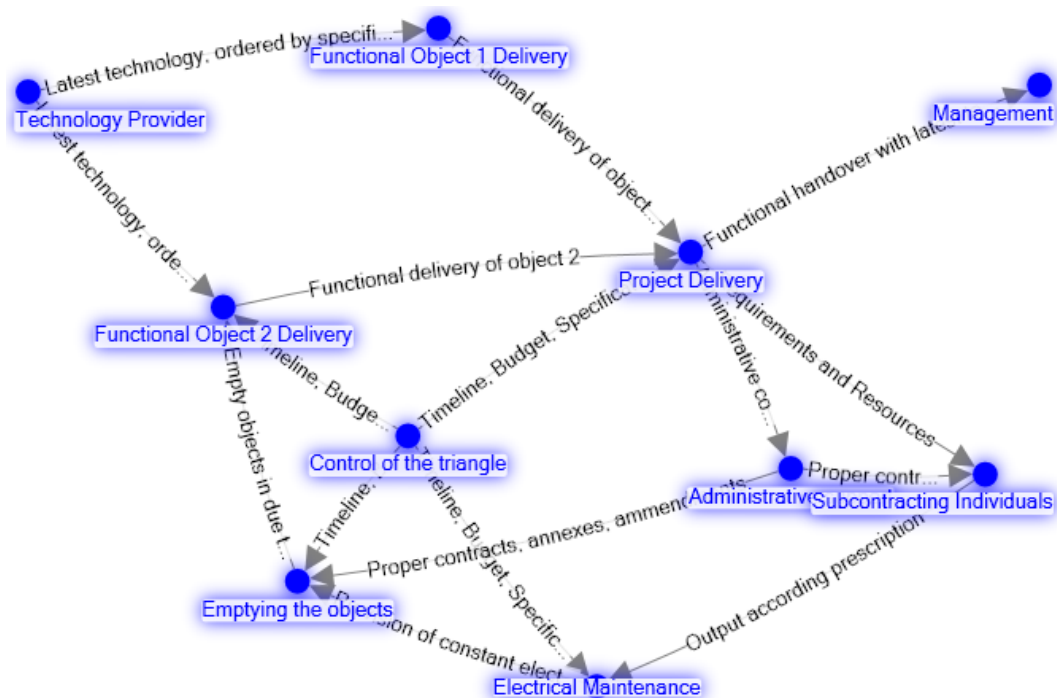


FIGURE 3.29 CONTEXT 4, MODIFIED ROLE AND ACCOUNTABILITY DIAGRAM AFTER 1 MONTH, WITH APPROPRIATE LEVEL OF GENERICITY OF ROLES

Introducing/Removing roles and/or accountabilities

The necessity to introduce new role(s) and/or have new accountabilities as interactions between roles has occurred in both contexts, over time. The manager was able to detect the changes in the environment that triggered the introduction of the new roles through scanning the information flows with the SIDA loop. In Context 2 this need arose after the PDCA loop informed the manager for missing capability that was important for the system, for a certain period of time (Figure 3.30, Figure 3.31).

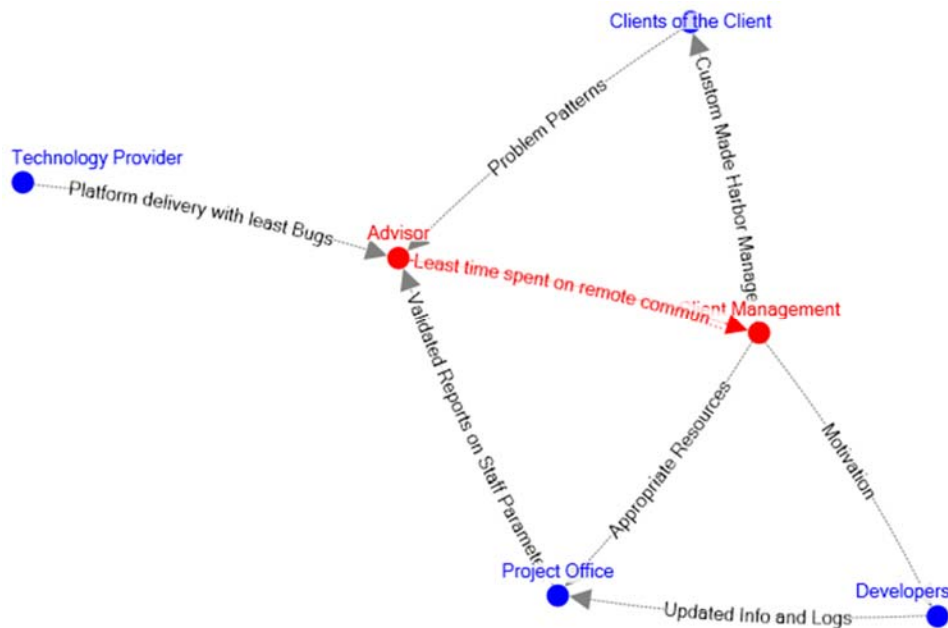


FIGURE 3.30 CONTEXT 2 INITIAL ROLE AND ACCOUNTABILITY SYSTEM DIAGRAM

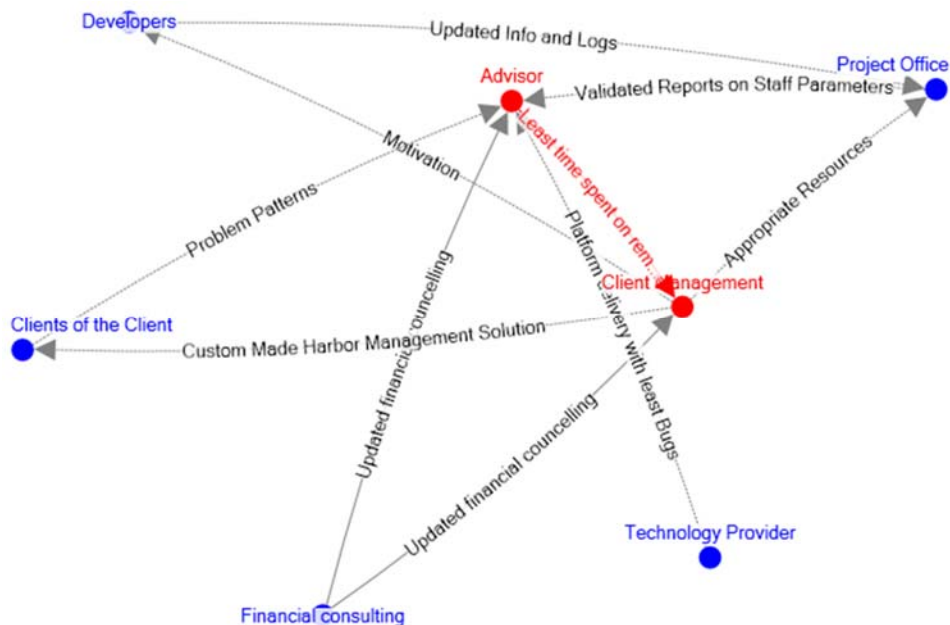


FIGURE 3.31 CONTEXT 2 ROLE AND ACCOUNTABILITY SYSTEM DIAGRAM WITH ADDED ROLE (FINANCIAL CONSULTING) AND ACCOUNTABILITIES

Populating/Re-populating the roles with different employees, departments, sub-systems

Through the research, both in Context 2 and Context 4 have practiced the option to populate and re-populate the roles with different employees, departments, sub-systems which provided flexibility without changing the system design and structure. This was incorporated in the system design as adaptability feature.

The user experience evaluation

Finally, we would summarize the BIE with the qualitative evaluation from the users of the artifact (the managers/end-users 1 and 11 from respectively Context 2 and Context 4) as our primary intended users, citing their subjective experiences, on interviews before, throughout and after the research completion.

1. **Before** the use of the artifact:
 - Management by "gut feeling"
 - Running from incident to incident
 - Unpleasant surprises regarding projects
 - Lot of conversations but not all structured
 - Tough time getting employees to be accountable since they don't exactly know what they are accountable for
 - Never the feeling that I'm "in control"
 - Tough time explaining to higher management the situations they put me in
 - Lot of issues "floating around" so I sometimes drop the ball
 - No overview of all the forces that influence my job, directly or indirectly
2. **After** introducing and experiencing the artifact in their own behavior:
 - Still management by gut feeling but now with insight and facts to support this
 - Being able to predict where the next problem is going to occur
 - Unpleasant surprises regarding projects - Reduced to almost 0
 - Now conversations are structured with an agenda and clear objectives
 - With the help of the drawings and the visualizations it is for the first time easy to explain to somebody what you think they are accountable for, or at least have a fundamental discussion about it
 - By updating and refining the process you get more and more control and understand better why on some points you don't have the control
 - Here is the "poster" that was provided a priceless tool, it indicates exactly the situation you are in and provides insight in the method you will use to improve on the situation
 - The 80/20 rule is a major factor here, when you have 80 percent of the issues more or less under control, you actually have time for the other 20% to either manage them or figure out a way to gain control over them
 - When using the method it is really surprising the amount of insight you gain by making the different drawings and writing down the connections and their meaning.
3. The **Limitations** that the end-users faced during the research are stated as follows:
 - The initial setup (learning the principles and roadmap of S&R and the artifact) is best done with help of a training or consultant
 - Maintaining the method is now time consuming
 - Since (in IT) a lot of the middle management is also doing PM work it would be great to find a way to use the method for that as well
 - If you want to do an integrated view for multilevel it becomes too complex (BU manager; Team Leads and Project leader in 1 view for example)
 - It is not yet capable to advise me in strategic management matters enough
4. The **general conclusion** for the end-users from experiencing the artifact as a managerial method for tactical management, is:
 - End-user 1: "The methodology works! The amount of insight it provides is comprehensive, you can easily translate the method into real life actions, the awareness you can create with the method for higher management is game-changing, the amount of control you gain with the method is unexpectedly

- high, it forces you to think about working in a structured way. It provides you with a method that allows you to see visually what is influencing you. It also gives an insight in not only your own responsibilities but also of the people you are in contact with. The method combines several points of view into a 360° overview of the workspace you are functioning in.”
- End-user 11: “I have experienced great appropriateness of the initially set up system; roles are hard to digest but after a while all I think about is roles, accountabilities, outcomes – instead of fixating on exact people and outputs; visualizations are useful maybe even as benefit number one, especially when printed out on the desk, for quick and easy reference and revision of any change; I was having issues with staff populating roles not being able to follow agreed accountability and is in need of constant re-negotiations for outcomes between roles.”

If we evaluate the outcomes **according the first level solution requirements** as criteria that need to be fulfilled with the research and ultimately, with the artifact, we will conclude the following. The method has been designed and used by the person, the manager, and enabled support for his/her perspective in managing towards accomplishment of goals. The managerial and information system elements provisioned in the artifact are interwoven in mechanisms that support the manager both in his managerial actions and reasoning and informational ones. Regarding simplicity of use we can observe that all managers could use the artifact from initiation on, except for the beginning when they needed to be educated in the S&R framework, introduced to the use of DENICA method, and then coached along the use of the method for some questions and dilemmas. As elaborated in this section, the context was captured in multiple dimensions and not just as a static structure but dynamically through time. This helped the adaptability by giving the right answers why and what kind of adaptation was needed. On the other hand, through the managerial system, the method enabled creating context for reaching goal(s) through the Role-and-Accountability diagram. Being founded on the S&R framework, the method takes systems perspective and provide managed system design around a purpose and at a level of roles, enabling their pursuit and accomplishment, and through the enhancement in DENICA, risks were considered and risk management approach continuously deployed. According the subjective feedback from the end-users – they were successful in establishing, maintaining and managing a system of interrelated entities that accomplished outcomes through time – and their tactical management job had improved adaptability and effectiveness.

3.3. ADR STAGE 3: REFLECTION AND LEARNING

This stage is occurring in parallel with the first two, and contributes in recognition of issues and corrective actions on the side of the researchers along the way. A reader will recognize the activities of reflecting, learning and taking corrective action all throughout the headings of problem formulation and building-intervention-evaluation. In some manner, the reflection and learning provide the adaptability of the ADR towards sustaining the goal of the research and the individual projects that are taking place. The reflection and learning stage “conceptually moves from building a solution for a particular instance to applying that learning to a class of problems. It recognizes that the research process is more than solving a problem. Conscious reflection is critical to identify contributions to knowledge. The research process is adjusted based on early evaluation results to reflect the increasing understanding.” (Westin 2014) Summary of the reflection and learning is presented in Figure 3.33. However, we will be discussing all the tasks in this stage: a) Reflecting on the design and re-design during the project, b) Evaluating adherence to principles c) Analyzing intervention results according to stated goals (Sein, Henfridsson, Rossi, et al. 2011)

In the attempt to assist the manager (the person) with a method for improving tactical management – we approached with broad range of considerations and offered interrelated design of managerial and Information Systems domains. In today’s socio-technical world, any omission to incorporate any of the segments – would have deemed the artifact use as incomplete. A DSR aims to improve the world by prescribing a solution – that works in at least one instance – and can be methodologically sound to generalize to a higher level of concepts.

We have elaborated the stages of the ADR with regards to our actual academy-business collaborations. As ADR assists discovery of field problems as knowledge-creation opportunities and “seeks these opportunities at the

intersection of technological and organizational domains” (Sein, Henfridsson, Rossi, et al. 2011), so have we, when approaching the managers.

The necessity for educating the users that were in the role of designers part of the time, then persuading them and obtaining their and their superiors’ commitment; along with modifying packages to conform to the organizational procedures after learning and reflecting them; and fixing or advising numerous organizational problems before introducing the system, while balancing the benefits and ‘costs of involvement’ for the collaborators (Figure 3.32) (Markus 1983), is an adaptable project for performing the research on its own. However, these activities that have taken place throughout the research, facilitated it in an effective way.

TABLE III. Theories of Resistance: Recommendations for Implementation.

People-Determined	System-Determined	Interaction Theory
Educate users (training)	Educate designers (better technology)	Fix organizational problem before introducing systems
Coerce users (edicts, policies)	Improve human factors	Restructure incentives for users
Persuade users	Modify packages to conform to organizational procedures	Restructure relationships between users and designers
User participation (to obtain commitment)	User participation (to obtain better design)	User participation is not always appropriate

FIGURE 3.32 THEORIES OF RESISTANCE: RECOMMENDATIONS FOR IMPLICATION (MARKUS 1983)

Our **problem-inspired research** activity derived from previous real-life insights (Chapter 2, Interviews) and theoretical research (Chapter 2) – so that when ‘knocking on the doors of companies’, we could communicate scientifically based artifact design (Chapter 2) that will have utility for their organizational context too. These outcomes were of primary importance to (1) promise and (2) deliver, in order to get and secure long-term **commitment** from the practitioners (as individuals and organizations) in the four companies. The **specificity of ADR regarding confidentiality** is the access and continuous use of confidential information from both sides participants (academic, business), regardless whether it is about inside-the-company information that might be ‘precious’ for the competition, or senior and middle management issues that should be properly communicated by the researcher-in-the-middle, where a single wrong or misplaced word may demotivate an entire organization and terminate the research collaboration; or with novel and innovative ideas from the research that are communicated before being published or IP protected. A trustworthy relationship is of utmost importance for the research fulfillment as a project.

The endeavor for **problem formulation** – generic (tactical management issue) and instantiated (the concrete issues elaborated in this chapter) has been demanding and risky. In order to identify and phrase in words and drawings a tangible, understandable problem and get everyone on-board, the researcher had to virtuously communicate, inspire, motivate, project the future success and usefulness to the senior and middle management, and ultimately, the owners of the companies. This required a number of discussions and interviews with practitioners that literally spent their time (their most precious resource) in devoted elaboration of their issues, approaches, needs, ... The researcher did extensive preparations in order to structure the interviews and the group sessions with know-how and tools to share and recommend to the practitioners, that regardless of the outcome of the research would have been immediately useful to them. This was effective for setting the ‘**what’s in it for me**’ understanding on the side of the practitioners. Of course, general manager support played important role in the collaborator dedication to the research needs. Ultimately, at the end of the ADR, some of the managers approached the researcher with interview invite in the opposite direction – for them to interview the researcher with observations, conclusions and recommendations for them as individuals and managers. This was a kind of bi-directional channel of information and knowledge flows that are maintained up-to-date with most of the practitioners participating in the ADR.

Another important issue regarding the reciprocity in the communication and shaping of the artifact, but also influencing the facilitation of the ADR process, is that when designing and implementing Organization-Dominant BIE, the researcher has to put **big effort in familiarizing** with the organization, its context, domain and industry, history and future goals and prospects, its wider business ecosystem – in order to level the communication with the practitioners both in terms of mutually understandable language and concepts when communicating with the practitioners, and in terms of designing the artifact ensemble that provides utility for the users.

With regards to the principle of ‘**guided emergence**’ that denotes seemingly two conflicting perspectives (Sein, Henfridsson, Rossi, et al. 2011) of academia and business successfully collaborating on something beneficiary to the both worlds, we would discuss that our experience has been in directions of every member of the ADR team doing what he/she is most competent in: practitioners – trying to apply the artifact by customizing and modifying some of its features to their context and needs; researchers – trying to provide rigor and scientifically-backed utility. Regardless, we consider the researcher as the ADR process owner and in the value co-creating (Vargo et al. 2008) effort there is still a provider role and customer role. In the case of ADR these two roles are exchangeable – (1) the practitioners are providers of applicability and fine-tuning of the artifact when in use while the researchers are in the customer role for acquiring the instantiated contextual needs and suggestions; and vice-versa – the researchers are providing the design and engineering construction of the artifact and scientific foundations and contributions, while the practitioners are in the customer role of being served an ensemble that needs to be experimented with and shaped for at least one use in at least one context.

It is necessary to a big extent, to get the practitioners’ commitment with sincere motivation of participating in the BIE process. In some instances, we reached the level of **practitioners addressing the artifact as their own** and using it further in practice, for their own career purposes but also for dissemination. Intellectual property rights are one direction, but also in general, the contribution awareness on all sides is another soft issue that may require future clarifications through guidelines, agreements, statements etc.

When reflecting to the experiences in the four companies, we are distinguishing the **Alpha-version** of the artifact investigated in the four companies (Company A, B, C, D) and with all end-users (1 – 11). It denoted building, implementation and evaluation of the artifact for identified tactical management issue and identifying features and components of the artifact that would be good to be incorporated in a complete solution in order to achieve the ADR goal. We consider the second part of the artifact formulation, implementation and evaluation in Company B, End-user 1 and Company D, End-user 11 as **Beta-version**, where several refinements have been done and utmost utility for the users have been achieved, while continuously capturing the contributions for the research too (Figure 1.2).

With regards to the **research collaboration with practitioners in Belgium and Macedonia**, there have been (1) open doors from business collaborators to researchers, high professionalism and responsiveness – in Belgium and (2) pushing and pulling type of communication – in Macedonia. The communication channels varied from e-Mail, telephone, DMS platform, Skype, and of course, in person. The practitioners showed (1) appropriate dedication to filling the evidence, recording changes and commented on ease-of-use of the supporting Workbook as a tool (that necessitated little effort) to keep the implementation ‘alive’ – in Belgium and (2) big reluctance to get deeper involved into expected recording and observation activities – in Macedonia.

The Action Design Research maybe most of all kinds of research that prescribe solutions, has **specific** communication and collaboration line with practitioners and high value outcome from the research project completion. First, the researcher has to find the right channels to be heard, almost always by a top manager with decisive power to invite a researcher in the company. Then to persuade that the time spent will be fruitful for the company, as well as for the research. Afterwards, the organizational context needs to be understood, and the actual end-users need to be interviewed and attracted on-board of the project – not just as observers or interviewees but as proposers and co-designers, to some extent. There are few business entities that will allow dedication of time and resources if they find no utility for themselves, especially in duration of months and years – be it for competences growth of the people involved or for actual organizational solutions. As one senior manager pointed to the researcher – at least for his managers to listen to educated out-of-the-box thinking, get questioned by someone who is not their superior, and address issues individually and together. Ultimately, the references of successful utilization of the artifact in one, two or more settings are precious for the technology-transfer and in general, with ADR technological artifact reaching technology readiness level (TRL) of at least 6 and 7 (European Commission 2015).

The researcher needs to make **great efforts** for no-nonsense expenditure of time and attention of the practitioners, optimized communication and process flows, well thought of guidelines and tools to be used – and last but not least – be constantly alert to practitioner’s reactions and read between the lines in order to keep the involvement and satisfaction level high by **continuously adapting** to the organizational context. Visualizations are of great importance for the communication. The researcher used numerous visualizations – some for introduction to the idea of the research, some for the research artifact. Chapter 3 elaborates on the benefits of visualizations, but when working with practitioners, it is even more important – their time and attention is short and scattered with own problems – and visualizations make a lasting impact. The feedback to the researcher regarding visualizations has

been excellent. Hence, throughout the ADR the researcher's quest for most appropriate artifact visualization is visible (using SNA tools such as Gephi, NodeXL, LikurioUs, CorelDraw, Paint, Word/Excel/PowerPoint, nVivo, ...) – to communicate but also to ease the use of the artifact from designated end-users. Also, visualizations have been used throughout the individual and group discussions, training and follow-up sessions.

When reflecting to the implementation principles used throughout the ADR, we will elaborate the most important ones, as summarized in Figure 3.33.

Design principle reflection and learning	Alpha Version - S&R framework adapted for Tactical management issue	Beta Version - Tactical management adaptability and information systems method dynamic implementation
Introduction to the S&R framework	Complete, Lengthy	Summarized, Shortened
Communication channels	Meetings at premises	Multiple open communication channels (eMail, meetings in person or virtual, collaboration platform Moodle, ...)
Allowing inconsistencies with the S&R framework - because the utility for the users for tactical issues was to be detected and followed. Allowing S&R components to be differently emphasized and incorporated compared to the original roadmap - Governing principles varieties	In Company A the Governing principles and Mission were hard to state (separated top and middle management), while in Company C they were implicitly in the head of the owner/manager and changeable through time	In Company B the owner/manager had some clear Governing principles and tried to consult the clients with them, while in Company D there was surprisingly good knowledge and adherence to the Governing principles even though the top and middle management were separated persons.
Allowing imperfect Role and Accountability diagram names for the Roles and Accountabilities	The content of the R&A system is company and problem-specific, so the naming of the roles and accountabilities sometimes was just fixtious and understandable for the immediate participants only	The content of the R&A system is company and problem-specific, so the naming of the roles and accountabilities sometimes was just fixtious and understandable for the immediate participants only
Making the follow-ups more efficient (as a process flow, but also as needed materials). Next steps agreement at the same occasion too.	The follow-up of the learned and implemented method by the researcher with the managers has been structured with announcement e-mails, deadlines, homeworks for inserting in the Excel workbooks, meeting negotiations and re-scheduling, follow-up. This proved not very efficient with the already busy schedules of the managers.	The follow-up of the learned and implemented method by the researcher with the managers has been announced in the same occasion when scheduling a meeting, they didn't have to type in electronic form anything, just bring the scrapbooks and notes and together the researcher and end-user contemplated the electronic version, finished and exchanged by the next day. Next steps agreed at the same occasion too.
Introduction to the radical changes in the mindset of the managers, owners and employees; and clients and collaborators with the following categories: Adaptive vs. Matrix organizational structure; Outcome vs. Output; System design before Process design; Roles vs. Job descriptions; Accountabilities and Customer-back vs. Firm-forward system design	Long, elaborate group sessions, invoked feedback for understanding the differences, and ultimately, practicing through the artifact implementation. In the Alpha-version only inception was done.	The practitioners involved in the Beta-version needed to comprehend fully these changes in order to apply them in the system-design and follow-up. The researcher provided the end-users a ready, but also alternative solutions for visualizations design, so the quest was mutual for best and most practical visualization solution.
Visualizations experimentation	The researcher presents the end-users a ready solution, because of time limitation and effort needed.	Necessary to visualize the changes over time in the system of Roles and Accountabilities, in the Information Sensors, Emitters and Risks.
Dynamic graph data visualization application support	Not needed in the alpha-version	

FIGURE 3.33 REFLECTION AND LEARNING THROUGH THE BIE CYCLES (SUMMARIZED AFTER ALPHA- AND BETA-VERSIONS OF THE ARTIFACT)

Regarding the design and re-design during the project, we are reflecting on the Alpha-, Beta-version experience, communication channels, challenges with existing mindset and behavior, design-related principles.

Our **Alpha-version** of the artifact has been to design an artifact that baselines on the Sense-and-Respond framework for strategic adaptability and attempts to solve a tactical management issue. It has been undertaken in two existing organizations, with experienced managers and employees (Context 1 and Context 3) and it has taken substantial amount of time to introduce the Sense-and-Respond framework as a whole to the end-users, in order to make sure they know how to implement it on their specific problem.

However, for the **Beta-version** of the artifact, aiming to complete the tactical management managerial support for adaptability and information systems, this purposefully didn't happen. The introductory part for the Sense-and-Respond framework for the (Context 2 and Context 4) wasn't as long as for the Alpha-version because the researcher has identified the necessary minimum of guidelines and instructions for 'teaching' Sense-and-Respond to managers-practitioners and leaving the referencing materials, further instructions and consultation at hand through open channels (eMail, meetings in person or virtual, collaboration platform Moodle, ...).

The **communication channels** were subject of changes too, from meetings at business premises that was effective but not efficient with manager's busy schedules and geographically scattered locations. After discussions with the end-users the researcher established multiple open communication channels (eMail, meetings in person or virtual, collaboration platform Moodle, Skype, instant messaging, ...) that proved sufficient for any practitioner to use the

channel he/she deemed mostly appropriate, especially since the managers in the early stages still hadn't experienced any benefits from the collaboration, just invested their time and effort.

Another **deliberate design principle** has been – allowing inconsistencies with the S&R framework - because the utility for the users for tactical issues was to be detected and followed, and S&R is primarily strategic framework. This meant allowing S&R components to be differently emphasized and incorporated compared to the original roadmap. One substantial example were the governing principles varieties: In Context 1 the governing principles and mission were very hard to state (because of the separated top and middle management), while in Context 3 they were implicitly in the head of the owner/manager and changeable through time. In Context 2 the owner/manager had some clear governing principles and tried to consult the clients with them, while in Context 4 there was surprisingly good knowledge and adherence to the governing principles even though the top and middle management were separated persons. Regardless of the four very different occurrences of the governing principles, they were not emphasized and insisted on for tactical management use as have been for strategic. Ultimately, when discussing with top managers or owners, the governing principles came to realization.

Allowing imperfect Role and Accountability diagram names for the Roles-and-Accountabilities enabled freedom in the already complicated task of learning and implementing the Sense-and-Respond framework and its derivation for tactical management. The content of the R&A system is company and problem-specific, so the naming of the roles and accountabilities sometimes was just fictive and understandable for the immediate participants only.

Another **important principle** while conducting the collaboration with practitioners has been – making the follow-ups more efficient (as a process flow, but also as needed materials). Next steps agreement happened at the same occasion too. At first, the follow-up of the learned and implemented method by the researcher with the managers has been structured with announcement e-mails, deadlines, homework for inserting in the Excel workbooks, meeting negotiations and re-scheduling, follow-up. This proved not very efficient with the already busy schedules of the managers. After the alpha-version the follow-up of the learned and implemented method by the researcher with the managers has been announced in the same occasion when scheduling a meeting, they didn't have to type in electronic form anything if they didn't have time, they just had to bring the scrapbooks and notes and together they contemplated the electronic version, finished and exchanged by the next day. Next steps have been agreed at the same occasion too. This optimization of the follow-up flow could have been possible after the researcher had gained proper understanding of the business context and the end-users had understanding of the framework, vocabulary, expectations etc. so the following communication was leveled and with less need of elaborate discussions as in the beginning.

It is important to reflect to **one of the biggest challenges** in the implementation of the research and artifact: the introduction to the radical changes in the mindset of the managers, owners and employees; and clients and collaborators with the following categories: Adaptive vs. Matrix organizational structure; Outcome vs. Output; System design before Process design; Roles vs. Job descriptions; Accountabilities and Customer-back vs. Firm-forward system design. Namely, it is one thing to theorize and define concepts and their relations, and completely different when one needs to fulfill them in real-life setting with radically different mindset and approach to the business. The categories that we needed to enforce, in the Alpha-version collaborators have been discussed through long, elaborate group sessions, invoked feedback for understanding the differences, and ultimately, practicing through the artifact implementation. For these end-users we can say that only inception was done. It continued further on, but it needs a lot more interventions to be 'living' across the entire business ecosystem. The practitioners involved in the Beta-version needed to comprehend fully these changes in order to apply them in the system-design and follow-up.

The **visualizations experimentation** is visible throughout the entire timeline of the research – with practitioners and solely, by the researcher. Namely, the graphs should be easy to draw and use. At the beginning the researcher started using Gephi (Gephi Society 2016; Levallois 2014; Cherven 2013) which was broad platform that required special training to be used, and would have been a burden to train the managers, install it locally etc. because the primary goal weren't the graph metrics and calculations, but just the visualizations. The Social Network Analysis as a complete analysis package, offers numerous metrics on individual entity or complete system level. Through our research we have observed the values of several metrics such as betweenness centrality of nodes, graph diameter, and others, and reached some preliminary conclusions. However, we don't feel strong enough validated with data to argue recommendations on these metrics for optimal solution. Also, the platform is in Beta-version so a lot of effort to maintain and keep it functional was needed. The visualizations could have been exported as images, but then they

needed positioning corrections. Along with its good features for working with graphs, for our purpose to design and visualize the system of Roles and Accountabilities, it was extensive cost of time and effort, compared to the benefits. Other applications that have been used are: Linkurious (Linkurious 2016) that was also extensive platform in beta-version, in the cloud, but not easily transferable as guidelines to the managers; nVivo (QSR International 2016) – a qualitative data analysis software that has a rich suite offer. However, the actual network visualizations that were needed by the research and practitioners have been offered only in a nVivo Plus option, which was few steps further than the nVivo Starter and nVivo Pro we had available; Paint – a simple drawing application where one can draw nodes (oval shapes) and edges (arrow lines); Microsoft Word – shapes tool – again, with the same easy drawing of nodes and edges to visualize a system of R&A; CorelDRAW Graphics Suite (Corel 2016) has been used frequently by the researcher, enabling most user-friendly visualizations without the metrics.. Eventually, the researcher experimented with the use of NodeXL (The social media research foundation and contributors 2016; Aldhous 2012), which was an Microsoft Excel plug-in that had some issues but the basic goal to easily visualize a graph with nodes and directed edges could be achieved in a straightforward manner with already present office application such as Excel. Having this tool at hand, the managers could do own maneuvers with the graphs (their systems) which helped them get in-depth understanding of the artifact ideas and scientific foundations as well as propose further improvements, drawbacks and ideas.

Related to the previous reflection, the dynamic data application support for graph visualizations was one of the **challenges still not overcome**. Namely, in order to visualize the changes over time in the system of Roles and Accountabilities, in the Information Sensors, Emitters and Risks, there is a need for dynamic graph visualization, or, a timeline of graph snapshots. This was necessary to the practitioners, to be able to clearly follow their actions and changes and communicate them with management, for example; but even more to the researcher, to visualize the adaptability of the business and information system when the manager used the artifact as managerial method. However, the biggest potential candidates for the dynamic graph feature – Gephi and Linkurious, as both in Beta-versions, have provided complicated support to the dynamic graph (Gephi) or early stage development (Linkurious).

3.4. ADR STAGE 4: FORMALIZATION OF LEARNING

The final stage of the ADR is the formalization of learning – which implies necessary wrap-up and aftermath of the undertaken actions in conveying the six ADR principles (Practice-inspired research, Theory-ingrained artifact, Reciprocal shaping, Mutually influential roles, Authentic and concurrent evaluation, Guided emergence and Generalized outcomes) (Sein, Henfridsson, Rossi, et al. 2011). It is also referred to as abstraction (Pries-Heje & Baskerville 2008) The Context-Intervention-Mechanism-Outcome (CIMO) logic (Denyer et al. 2008; Van Aken & Romme 2012; Van Aken 2007) and realist evaluation (Pawson & Tilley 1997) fully support the ADR's situated learning where the researchers need to 'outline the accomplishments realized in the IT artifact and describe the organizational outcomes to formalize the learning. These outcomes can be characterized as design principles and with further reflection, as refinements to theories that contributed to the initial design' (Sein, Henfridsson, Rossi, et al. 2011). In order for our 'ensemble' artifact to be a true 'bundle of properties in different domains' (Sein, Henfridsson, Rossi, et al. 2011), we will articulate the generalization threefold, as prescribed for ADR research (Figure 3.34):

- Generalization of the problem instance (Level 1)
- Generalization of the solution instance (Level 2)
- Derive the design principles from the design research outcomes (Level 3)

in order to achieve contributory feedback to the design theory (Level 4).

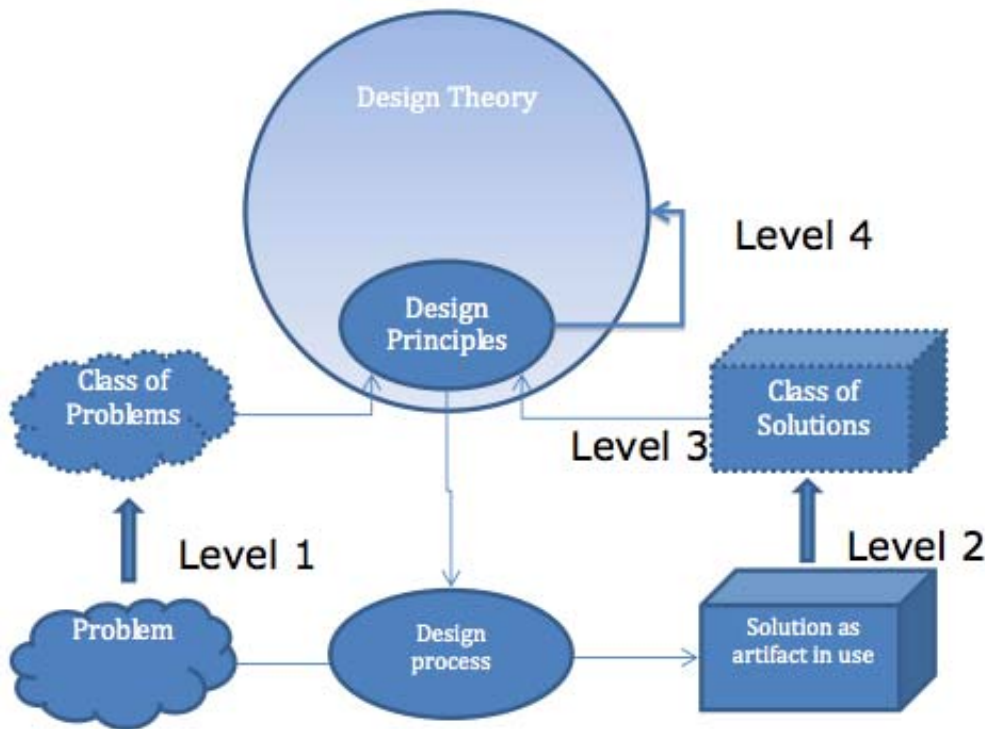


FIGURE 3.34 LEVELS OF GENERALIZATION FROM DESIGN RESEARCH (ROSSI & PURAO 2012)

3.4.1. GENERALIZING FROM PROBLEM INSTANCES TO CLASS OF PROBLEMS

The problem instances in the four contexts where the research has been performed need to be situated with regards to several parameters.

With regards to *problem type*, there have been interventions in ‘Existing situation improvement for existing organization’ (in Context 1 and 4), ‘New project support for new organization’ (Context 2) and ‘New project support for existing organization’ (Context 3). The parameter *size of the company* notes the Contexts 1 and 4 are big companies with international markets, while 2 and 3 are small ones. The *industry domains* of the collaborators are software and management consultancies (Context 1 and 2), Geodesic and engineering bureau (Context 3) and Food production (Context 4). The *organizational structure* varied too – from Matrix (Context 1 and 4), Project structure (Context 2) and Functional (Context 3). Each of these parameters defined the organizational and environmental context in which the collaborators have been operating (elaborated in detail in all the previous ADR stages). These observations (Figure 2.1) help us deduce a conclusion that the problem contexts we investigated and addressed are diverse and general and not domain-specific.

However, in order to narrow the problem instances that the research focused on, we would point out the collaborator’s *specific managerial and organizational problems*:

1. Optimizing staff utilization across projects
2. Enable customer’s management to spend least time possible on remote communication with geographically scattered staff members
3. Shifting the Customer Perception for the Company (from only geodesic services to engineering, geodesic and consultancy services)

4. Provide earliest information for status and discrepancies to management in a new factory construction and equipment alignment project

When we combine these problems with the *organizational and hierarchical level of the human actors* we collaborated and supported in Context 1 through 4, listed below:

1. Project Managers/Team Leads (9 middle level managers (lower and upper level))
2. Owner of the company (1 top level manager)
3. Owner of the company (1 top level manager)
4. Project Manager/Team Lead (1 middle level manager)

we can recognize issues that concern managerial and organizational activities that pursue given goals of mid-level range (not generic strategic goals of existential and competitive nature, nor operational with high hands-on technical and domain knowledge). According our definition for the managerial function of tactical management as ‘How to achieve what is expected by utilizing what is given and following certain governing principles in the current context of the organization and environment’ (Petrevska Nechkoska et al. 2016), we can generalize that the managers in the four contexts handled ‘what was expected’ from them, their teams and projects; they had to ‘utilize’ what was given and ‘follow certain governing principles’ varying from the fact whether the manager being owner of the company was defining the governing principles or the lower level project manager should follow them with little intention of altering them; and the most important aspect of managerial behavior, especially for tactical management, orienting and addressing the ‘current organizational and environmental context’ which was captured and addressed continuously. *With this argumentation, we can generalize that the **class of problems** being focus of this research are the **tactical management issues (how to dynamically (re)structure yourself and others to accomplish given outcome(s) with given resources in context in time) from the point of view of the person, the manager.***

What has been our focus and the main part of the definition that differentiates tactical management was the ‘HOW to achieve’ that? This leads us to the second generalization – of the solution instances into a class of solutions.

3.4.2. GENERALIZING FROM SOLUTION INSTANCES TO CLASS OF SOLUTIONS

In this part we are referring to the artifact, its main constructs and components, its implementation pathway and the mechanisms behind it. Regarding the interventions that the DENICA method for tactical management is doing in the as-is situation in order to achieve a to-be state of personalized and adaptable managerial and information system, we can discuss each one of them separately per each of the four contexts (Figure 3.3) (Figure 3.7).

Namely, the *tactical authority level* has been monitored and so called ‘helicopter altitude or view’ should have been achieved. In the 1st and 4th Context that meant a level below the ‘strategic altitude’, while in Contexts 3 and 4 it was the actual strategic level that coincided with the tactical level because the manager was at the same time the owner of the company – setting and changing the priorities and governing principles. Most of the companies have been giving the assignments but not the authority to the tactical managers – and that resulted with conflicting situations and status quo on the improvement efforts. However, when the top manager has become aware of the certain ‘free hands’ that needed to be given to the tactical manager in order to do his/her job properly, things changed in positive direction. The *big picture overview (business ecology) and scope* have been estimated to be of primary importance, according to the feedback of the managers. It has been what differentiated greatly from what was being considered up to the moment of our intervention, denoting a limited and introvert view of things. The *system design of roles and accountabilities* has resulted with overall initial hardship to design a (managerial, hypothetic, intangible and invisible) system and think in terms of roles, not job descriptions or positions nor people. However, this feature proved to be of utmost importance for the adaptability of the system during continuous changes, so it was the first requirement to be adhered to by the managers. Achieving *clarity of purpose and governing principles* has helped remove ambiguity and achieve clarity and proper communication within the company, which was not at all case before the intervention. All companies had stated or non-stated purpose, mission, vision, governing principles which the managers and even less employees could enforce and follow, and to some extent, even put in statement. We

noted ambiguity, overlaps, complicatedness, big numbers of things to follow – which certainly made the work harder and less purposive. But in order to enable tactical managers have the appropriate authority, the top management needs to be sure they will transcend the governance and stay on the right track exactly through the clarity of purpose and principles. The *guidelines to the manager on reasoning and acting for informing and translating decisions on business and information level* are the actual essence of the method. The managers needed to take time to get used to it, then convince others, and then accelerate. However, it was welcome for orienting the actions of the manager and getting all on-board; for clarifying things to employees and position, their role in the system, and what they are accountable for; and for helping the personal moves and what to do next. The importance of the *Sense-Interpret-Decide-Act Loop for adaptability* couldn't be more emphasized. This kind of instruction that is always kept in mind and enforced intentionally - on individual level is the perpetual engine of adaptability. In all the contexts, the managers have been buried in 'extinguishing burning fires', alternating obligations on various levels of detail, facing large amounts of data and little informational structure and content. The SIDA loop helped scan the horizon according own reasoning, clear importance of the events/actions and act accordingly. What has been surprising but very relevant has been the incorporation of the *Plan-Do-Check-Act Loop for improvements*. If we ask ourselves, where is the planning as a function – we can now answer that it lays in the Denica method twofold: once, when the initial role and accountability system design is being done, and all clarifications around it; and again, when on small iterations, small improvements for each of the components are being done. In a way, we can generalize that our artifact enforces the double loop organizational learning by alternating: Plan-Do-Check-Act Loop and Sense-Interpret-Decide-Act Loop continuously. Another distinguishing intervention of this artifact is the *incorporation of risk in parallel with outcomes* which is making sure that the accountabilities are either fulfilled or adapted – an essential step that is ensuring the effects accomplished and is keeping the system from disintegrating. Last, but not least, with regards to the interventions, is the aspect of *visualization* used in the method. The managers are obliged to visualize their system with a graph where intuitively a primary purpose and roles and accountabilities can be seen. The visualization feature complies with the complex adaptive system needs to offer simple and clear rules on how to detect information and act in response. The visualizations have been drawn by hand, by the managers, and have been communicated with all stakeholders on all levels up and below the tactical level, and could have been maintained by the manager with no trouble. Any drawing component of any office or graphic software application served the purpose too.

The mechanisms that are triggered and in force when using the artifact as a solution (Figure 3.7) should also be generalized, since they have been observed in all four contexts and their influence has been visible. The *personalized IS self-design* is enabling the manager to consider the horizon of important-not urgent issues and have proper focus on the primary things. We have come to the realization that when looking for dynamic Information System response and dynamic business response are totally different things; but also the organization wide and the individual information systems are two very distinct categories and can't be assumed the same. We can generalize that the managers needed educated support for positioning own IS requirements and be aware that their information needs differ in time, content, scope, frequency, manner of obtaining etc. related to their own context, the current situation that results with handling own information needs on different ways. In terms of *simplicity of the artifact use* there have been limitations. On one hand, we would like to offer a simple and straightforward artifact for setting up and maintaining an effective managerial system in time. However, when put in practice, this feature seemed complicated to achieve when things got more complex in reality; and sometimes, incompleteness in a sense resulted with big effort from the side of the researcher in order to push through the inception so that the manager can simply take over and use the method in a straightforward manner. However, the managers encouraged complete use of the Denica method for managerial and communication needs, being of primary importance for use in a reluctant busy manager's schedule. The *multifaceted context-capture* is one of the biggest downsides of the 'planned' and more rigid information systems. We tried to solve that issue through the intervention that broadens the scope of entities, takes a big picture view, but still imposes its own information structure relevant to the manager. *Maintaining the system till purpose is reached* is a kind of a technical recommendation that finds very appropriate use in this non-tangible managerial system, its components and purpose. This mechanism enables clarification and pursuit of a common goal, synergy and emergent effect. The mechanism of *double loop organizational learning* has numerous potentials when in place. For this reason, even though the Sense-and-Respond framework incorporates planning in the initial design, and then maintains it through the SIDA loop; we encountered with the first user an occurrence of performing the PDCA loop very important for small scale improvements and subsequent achievement of higher efficiency in parallel to the primary goal of effectiveness. The mechanism of *effective communication* is relevant even nowadays when we are overwhelmed with communication means, tools and channels. The artifact enables its achievement and maintenance through the visualization, clarification of goals and principles, roles and

accountabilities, risks, information flows and all of their dynamics. The idea of *empowerment of the entities in roles* should be commented with regards to the manager's authority but also to the each employee/department/collaborator populating any role. Because of the use of the artifact prescriptions, the manager designs the roles and accountabilities and specifies what any one populating them needs – which means utilization of resources, acquiring new ones, asking for changes, ... anything that (usually) transcends the established matrix-organizational structure job positions. Finally, by achieving *situation awareness*, from recognizing anything in the environment (inner and outer) that is relevant for our purpose, in our reasoning; through comprehending the situation and integrating efforts; all the way to reasoning on the future projections of our system dynamics, the feedback to the entire system becomes complete and sustainable.

A. ARTIFACT COMPONENTS AND IMPLEMENTATION ROADMAP

The generic implementation roadmap for the DENICA managerial method for tactical management, based on the Sense-and-Respond framework (Haeckel 2016) that can be extracted from all the investigated four contexts and has been practiced by all involved managers is:

- A. Identification of the Primary constituents
- B. Clarification of the Reason for Being and levels of desired effects
- C. Framing of the Governing Principles
- D. Designing the Role-and-Accountability system diagram around the primary purpose
- E. Setting up the initial Conditions of Satisfaction
- F. Addressing the information needs through the Heads up-displays and the Commitment protocol
- G. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and effectuating adaptability to changes through the R&A diagram

Each of these components on the roadmap have been adjusted, modified and enhanced for tactical management use – which can be expressed as A', B', ..., G' of the S&R roadmap.

- A'. Identification of the Primary constituents (on strategic and tactical level – given)
- B'. Clarification of the Reason for Being and levels of desired effects (on tactical level – purposiveness)
- C'. Framing of the Governing Principles (on strategic and tactical level – given)
- D'. Designing the Role-and-Accountability system diagram around the primary purpose (that communicates between strategy-tactics-operations and is purposive on tactical level)
- E. Setting up the initial Conditions of Satisfaction and re-negotiating them continuously
- X. Introducing Risks and Risk management both in the managerial components and in the information system
- F'. Addressing the information needs through the Heads up-displays and the Commitment protocol (Generating complete Information System mapping of structure, relations that dynamically captures context in structured person-specific manner)
- G'. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and effectuating adaptability to changes through the R&A diagram (and adding Plan-Do-Check-Act (PDCA) Loop for improvements)

Organized for managerial use the components of the Denica method are visualized on Figure 3.35 and described as follows:

1. **A System of Roles and Accountabilities**, designed according to the Sense-and-Respond Framework principles (Appendix B, Figure B.6)
 - a. Having in mind the Purpose, the End, the Reason for Being
 - b. Visualizing the Role and Accountability Diagram
 - c. Specifying Conditions of Satisfaction for every negotiated outcome accountable for (Appendix B, Figure B.7)
2. **Information Sensors** – what the tactical manager would need to have as information (regardless of the current supply with reports) in order to have overview of his system (Appendix B, Figure B.8)
 - a. Visualizing the Information Sensors per Role and Accountability, around the role of the System Designer – the Tactical Manager (Appendix B, Figure B.9)
 - b. Stating the necessary attributes of the Information Sensors
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. the Entity where the tactical manager is placing the Information Sensor,
 - iii. the Type of information to be obtained (Progress feedback, Results, Issues, ...)
 - iv. the Way of obtaining the information (On demand or Event driven)
 - v. Type of content (Qualitative or Quantitative information)
 - vi. Frequency of obtaining the information (Hourly, Daily, Monthly, Quarterly, ...)
3. **Information Emitters** – what the tactical manager would like to have been told by the other roles in order to be aware on time for possible issues disturbing the agreed outcomes (Appendix B, Figure B.10)
 - a. Visualizing the Information Emitters per Role, around the role of the System Designer – the Tactical Manager (Appendix B, Figure B.11)
 - b. Stating the necessary attributes of the Information Emitters
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Emitter (the Role that should emit the specific information)
 - iii. Type of Information (Expectations, Personal issues, Not recording logs, ...)
4. **Risk Management** (along with Risk positioning and Information flows) (Appendix B, Figure B.12)
 - a. Visualizing the Risks per role, around the role of the System Designer but to some extent also around all other Roles too (Appendix B, Figure B.13)
 - b. Stating the necessary attributes for Risk Management
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Sensor, the actual Role or Entity or Business Process or general place where the tactical manager needs to point the 'radar' to in order to receive that signal
 - iii. Risk type (Experience of Management, Lack of knowledge for cross-checking, ...)
 - iv. Probability to happen (1 (low) – 5 (high))
 - v. Impact on the business (1 (low) – 5 (high))
 - vi. Risk Management approach (accept, avoid, transfer, mitigate, contingency plans)
5. Continuous performance of the **Sense-Interpret-Decide-Act (SIDA) Loop** and effectuating adaptability to changes through the R&A diagram and **Plan-Do-Check-Act (PDCA) Loop** for improvements

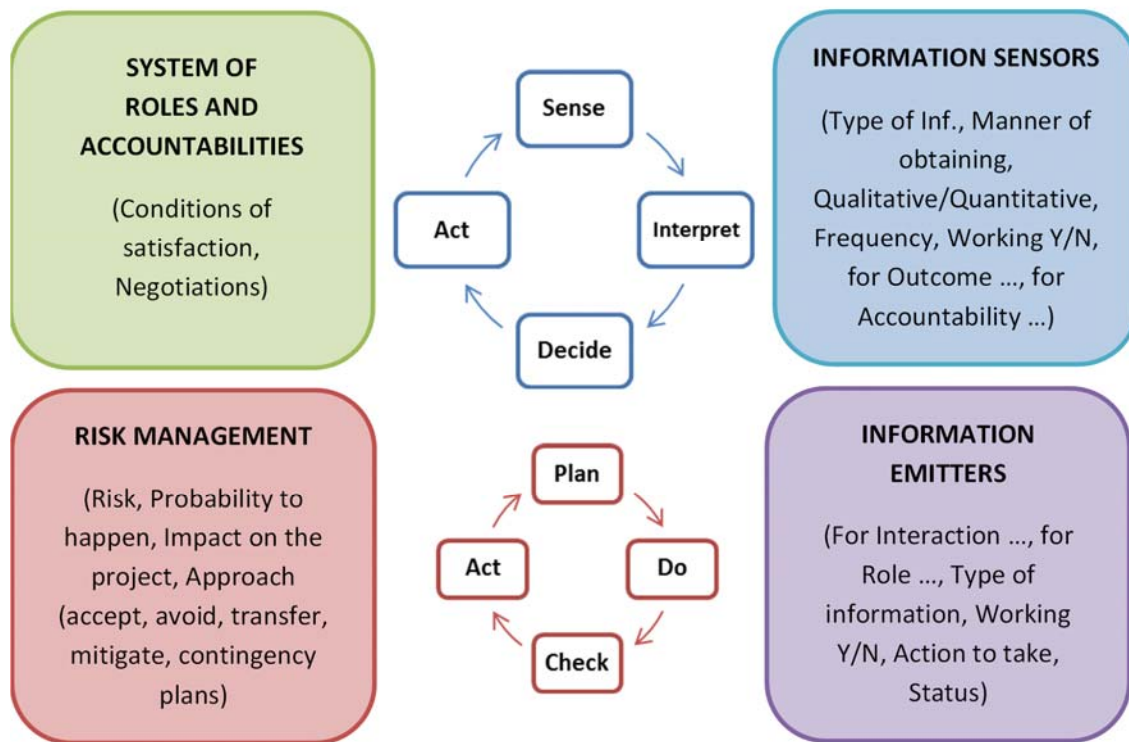


FIGURE 3.35 COMPONENTS OF DENICA – THE MANAGERIAL METHOD FOR TACTICAL MANAGEMENT

The overall generalization of the Denica managerial method as class of solutions can be wrapped up in socio-technical perspective through the achieved outcomes (Figure 3.10). From these, the *tactical management adaptability* can be perceived and accomplished through two dimensions, as:

- a) *Purposive adaptability of the manager and the managerial system*
- b) *Adaptability of the Information System and personalized self-design*

These generic characteristics are important input for the tactical managerial function alone, and as activity that is embodied in big section of the strategic management – performed by top managers, owners, shareholders; project management in general; to some extent operational management. In fact, in any situation when there are numerous ‘givens’, dynamic changes, goals, unpredictability and support is needed in ‘how’ to steer successfully.

3.4.3. GENERALIZING FROM THE DESIGN PROCESS INTO DESIGN PRINCIPLES

The design process, components and principles this research went through are comprehensively captured and presented through four main methodological pillars:

- the DSR framework (Hevner et al. 2004)(Gregor & Hevner 2013),
- the ADR method (Sein, Henfridsson, Rossi, et al. 2011),
- the Nested problem solving (Wieringa 2009) and
- the CIMO logic (Denyer et al. 2008).

The research could have been relevantly presented through various other approaches to design theory research processes, such as: in the nominal flow of (Peffer et al. 2007), through the design theory for systems that support

emergent knowledge processes (Markus et al. 2002), or as instantiation of the organizational change nexus (Pries-Heje & Baskerville 2008). The choice of this methodological composition has been deliberate and dictated by the needs of the specific point in the research process and the compatibility of the existing methods and tools with the researcher's mindset and approach. One important aspect is that the design process has been steered in order to enforce and perpetuate the three DSR cycles: the relevance cycle, the rigor cycle and the design cycle (Hevner 2007)(Hevner et al. 2004; A. R. Hevner & Chatterjee 2010). To some extent, each next step came almost intuitively, which only confirmed the applicability of DSR framework and guidelines. The research process, but also the need for performing the relevance and design cycle when contextualizing the actual real-life problems and questions raised the need for a more specific guidance of what should be done and how to preserve the rigor while still working with practitioners (and/or end-users in companies). This was the moment when from performing relevance activities and positioning of the problem with behavioral methods (such as individual and group semi-structured and unstructured interviews), we switched to ADR which guided almost all other stages of the research that comply with DSR principles. The instantiation of problems with all its challenges (contextual analysis, PEST, SWOT, ..., ensuring communication flows and business liaison collaboration, dedication and motivation, and sustainability of the ADR, as well as management cooperation and support) necessitated for clear distinction of practical problems and knowledge questions, because of the inevitable predominance of pragmatic and utility aspects of the project when business collaborators are on board. The rigor cycle invoked the researcher to seek for scientific aid to evaluate and generalize the experiences – which came especially necessary in the stage of communication of the research.

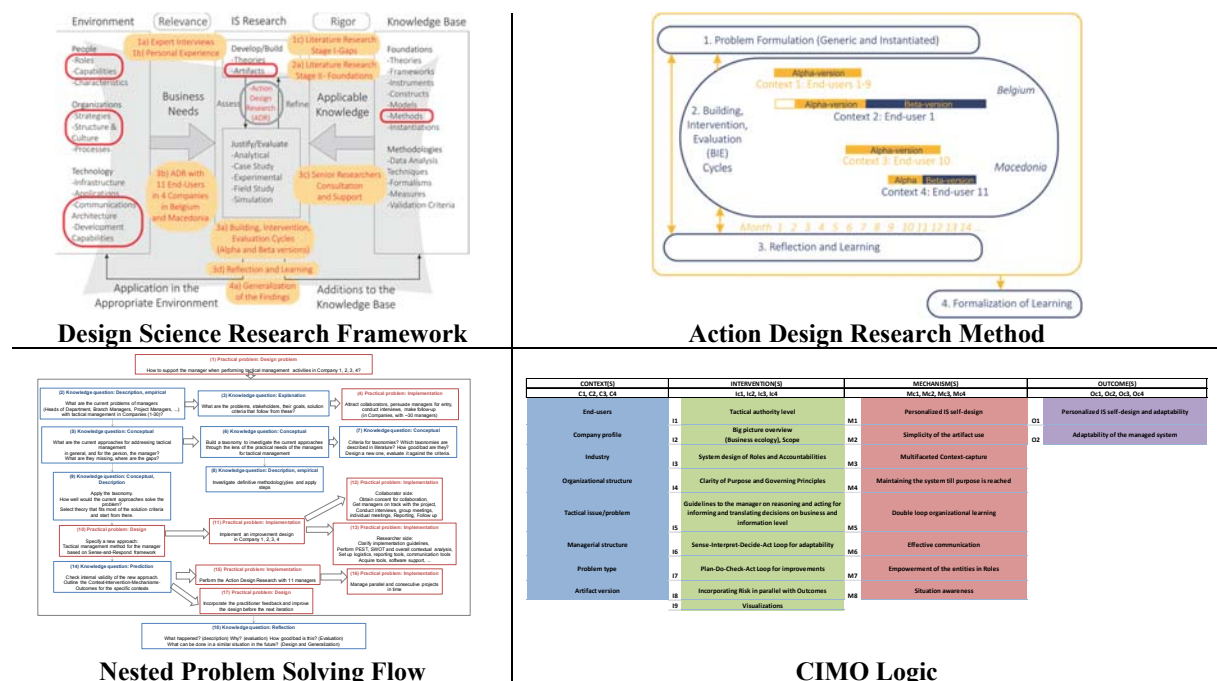
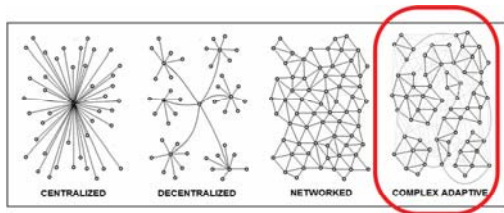


FIGURE 3.36 RESEARCH AND DESIGN KALEIDOSCOPE REPRESENTING THE METHODOLOGICAL FRAMEWORK OF THE RESEARCH

The research and the design principles effectuated in this research can be described as kaleidoscope of (at least) four methodological pillars, with different level of genericity and focus (as presented on Figure 3.36). The Design Science Research (Hevner et al. 2004)(Gregor & Hevner 2013) provided the generic foundation of the main pillars that need to be incorporated and affected, and the perpetual cycles of the research, along with general principles on the process how to achieve the artifact design. This socio-technical quest for truth and utility was effectuated with the more specific methodological formation of Action Design Research (Sein, Henfridsson, Rossi, et al. 2011) that informed the contextual touch-down of the research process. The problem formulation already initiated with DSR

has been instantiated for the specific collaborations in the ADR. Through the Building-Intervention-Evaluation cycles, ADR informed for the necessary actions of all participants, while the Reflection and Learning stages enabled the researcher to continuously trigger the three DSR cycles (Hevner 2007) in order to produce a viable artifact. It is through these ADR stages that we realized the need for a research logic that finally structures into a feasible construction the context on one side, and the theory on the other, through the Context-Intervention-Mechanism-Outcome logic (Denyer et al. 2008). The CIMO-logic also guided the construction of the wiring matrix that enabled a wrap-up of the Evaluation stage of the ADR enabling one-of-a-kind formative and summative evaluation. In this sense, the CIMO-logic perceived from instantiations to generalizations provided the intuition for concluding the formalization of learning (Rossi & Purao 2012). The nested problem solving (Wieringa 2009) process flow captured all these activities and components in a rather clear way prescribing choices and reasoning upon the practical and knowledge questions.

In order to generalize the domain(s)-specific aspects of the research: management and information systems, we would shed light on the following aspects that need to be considered when performing a DSR that should result with an artifact that addresses a socio-technical system and supports the manager. Namely, the researchers should consider with no neglect WHAT IS BEING MANAGED? In our case this resulted with the answer – a Complex Adaptive System. Its specificities guide towards a very different direction compared to not considering this aspect. The next question that needs to be asked is IN WHICH CONTEXT? Is it a planned and simple real-life environment, complicated, complex or chaotic? The managerial approaches to any of these, and also the IS needs and solutions to these are significantly different among each other. An addition to this would be even geographically – in a developed, underdeveloped or developing country. Because the change management differs depending on many contextual characteristics of the economy, politics, individual factors, collaborator dedication and limitations. We need to consider stand-alone product that needs to provide benefits and utility for all involved stakeholders in the research and design process, not just research added value. Another generalization to make is to USE EXISTING FRAMEWORKS that fit best with the research goals and move up from there. Creating environment for criticism and honest feedback and if possible, to quickly act on its response to encourage another is of primary importance both in behavioral and in design sciences. Getting firsthand advice is always recommended, along with exposure to educated opinions both in real world and in the academe, preferably multidisciplinary. And last, but certainly not least recommendation is the rigorous but creative implementation of methodology. Figure 3.37 illustrates the main considerations when performing DSR for managerial and IS artifacts.



What is being managed?
A Complex Adaptive System

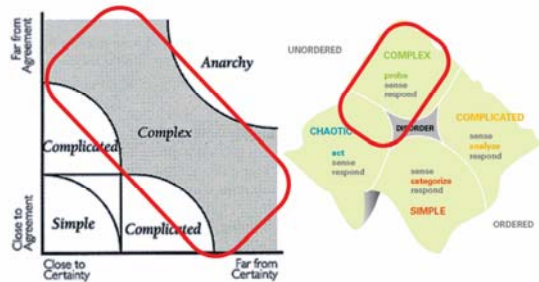


Which managerial function is in focus?
Tactical Management



DENICA
A Method for the Manager

What is the context, the external environment?
Unpredictable, Uncertain - Complex



Artifact Components and Features

Role-and-Accountability System Design across the Business Ecology
 Helicopter view Based on the Sense-and-Respond Framework Risk Management
 Purposive Adaptability Information System Dynamic Requirements
 Information System Self-Design Context Capture and Situation Awareness
 Visualizations and Metrics - Social Network Analysis Dynamic Networks
 Sense-Interpret-Decide-Act Loop & Plan-Do-Check-Act Loop

FIGURE 3.37 RESEARCH CONSIDERATIONS WHEN ADDRESSING MANAGEMENT AND INFORMATION SYSTEM DOMAINS WITH ARTIFACTS

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CHAPTER V

CONCLUSIONS

CONCLUSIONS

A researcher attracted by Design Science Research usually has an idea in the head – that orients the efforts, the beginning and the flow of the activities. If done properly, at the very start there is a demand to clarify practical relevance, theoretical domains, research gaps and challenges and scientific contributions. Fortunately, the DSR methodology guides the exchange between the practical and academic worlds rather intuitively and with clear prescriptions. It is somewhere around the middle stages when the researcher driven to provide a solution starts to uncover and answer bit by bit, not only practical but also knowledge questions. The motivation boosts come more frequently from the practical collaborators – because of the pragmatism, fast reflection in action and no nonsense approach. It is rather frequent that the scientific world discussions lag behind the anxiety to make a difference and see the change one wishes to produce – because of the rigor but also because of the specificity of the multidisciplinary research where disconnecting is more present than wished for, among disciplines. The real world is very multidisciplinary and needs such support from science. And the socio-technical sciences are to be addressing a living matter, very context- and time-dependent issues that flow away till science recognizes and wraps up a methodologically sound contribution.

The challenge for offering a solution to the insufficiently addressed problem of managerial and information system support for tactical management and its needs for adaptability has been addressed with an assortment of efforts – researcher's personal experience, mentors' guidance, various practitioners' experience, scientists' standpoints and discussions, managerial efforts and thoughts, all with fruitful influx of multidisciplinary scientific standpoints. Fortunately, today's technology provides multiverse of information – that feeds the hungry creative researcher with an abundance of threads that are attempted to be mentioned and incorporated in this dissertation.

This final chapter is designed for the reader to be able to orient the summary of contributions from the research and have referrals to the parts where each of them is elaborated in detail.

- The novelty and originality of the 5 groups of contributions of this research are discussed in Section 1
- The implications for research are discussed in Section 2
- The implications for practice are discussed in Section 3
- The limitations and future prospects whose seeds are planted with this research are discussed in Section 4

1. RESEARCH CONTRIBUTIONS

This research has aimed to contribute as a type V – Theory for design and action (Gregor 2006). It provides analysis, descriptions, explanations and is being motivated by a prescription in the form of a method for a manager. At this point, we will summarize the original aspects and the novelty of this research, both towards theoretical contributions (thus completing the ‘rigor’ cycle) and practical implications (thus completing the ‘relevance’ cycle) (Hevner 2007; Hevner et al. 2004) all in relation to the goal of the research and problem we are solving, as well as the outlined solution requirements (Chapters 1 and 2).

With regards to the research questions (as stated in Chapter 1, Heading 1.1), extended from the investigation on **how should the tactical manager think, reason and act, in order to facilitate toward accomplishment of purpose** we can conclude that the research resulted with an artifact as a method for the person in the shoes of a tactical manager that embodies principles, guidelines and prescriptions on how to achieve adaptability for the tactical management function and proper information system self-design. This artefact resulting from our Design Science research is the DENICA method. The research question **(1) what are the Tactical Management adaptability needs** has been answered in two directions: managerial adaptability and informational adaptability. Both should be interconnected and should mutually communicate and reflect each other’s content and structure. The tactical manager should be provided with a managerial roadmap that enables him/her to set up a managerial system designed around a purpose, communicate it, facilitate it while continuously sensing the context and reflecting its dynamics back to the managerial system. This behavior should mirror in content in the management information system. And vice versa – the changes sensed through the information flows should be reflected to the managerial system and actions, and communicated with the managed system; And last, but not least, tactical management adaptability requires mid-level genericity of system components – as suggested here ‘roles’, helicopter view and appropriate authority level to be able to dynamically reconfigure the system components in time. The enabler of tactical management adaptability (to changes initiated by the environment and towards the environment) is the combination of SIDA & PDCA loop. The research question **(2) which are the Tactical Management Information Systems requirements** is addressed through the structure of the information flows that correspond with the managerial system and its dynamics – represented with information sensors, emitters and risks. The management information system for tactical management should offer the opportunity for the person to be able to self-design the information flows and reconfigure them upon personal assessment of how the changes in the managerial system influence the information flows and vice versa. The information content for tactical management is qualitative as much as quantitative, dynamic, with broad scope of the entire business environment, varying frequency and manner of obtaining. The third research question **(3) how to design a method for a person in the role of tactical manager that addresses those needs** has been addressed with the introduction of the DENICA method for tactical management adaptability. Its design and evaluation pathway incorporates reasoning on: what is being managed (a Complex Adaptive System), in which environment (unpredictable and dynamic) and which managerial function – tactical management situated in the management control domain. Furthermore, the design of a method for a person required an Action Design Research with direct collaboration with the profiles of managers and their input.

1.1. CONTRIBUTION 1 – THE ARTIFACT DENICA

Designing an artifact in the form of a method – the DENICA managerial method, that addresses the tactical management personal managerial and informational needs, providing purposive adaptability. The research results with an artifact implementation roadmap and components, for future implementations and replications. The method based on the S&R framework for strategic management is incorporating risks in the managerial and informational perspective, as well as combining the SIDA loop with the PDCA loop – which, when combined, contribute towards effectiveness but also to efficiency. The method supports self-design both the managerial and information system perspective. It shifts the business-IT alignment point of view from the organizational to the personal level. The artifact incorporates ease-of-use, addresses CAS specificities and complex dynamic environment, visualizations, simple tool assistance for the manager and instructions for implementation.

The generic **implementation roadmap** for the DENICA managerial method for tactical management, based on the Sense-and-Respond framework (Haeckel 2016b) that can be extracted from all the investigated four contexts and has been practiced by all involved managers is:

- A. Identification of the Primary constituents
- B. Clarification of the Reason for Being and levels of desired effects
- C. Framing of the Governing Principles
- D. Designing the Role-and-Accountability system diagram around the primary purpose
- E. Setting up the initial Conditions of Satisfaction
- F. Addressing the information needs through the Heads up-displays and the Commitment protocol
- G. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and effectuating adaptability to changes through the R&A diagram

While the **components** of the DENICA method are visualized on Figure 1.1 and described as follows:

1. **A System of Roles and Accountabilities**, designed according to the Sense-and-Respond Framework principles
 - a. Having in mind the Purpose, the End, the Reason for Being
 - b. Visualizing the Role and Accountability Diagram
 - c. Specifying Conditions of Satisfaction for every negotiated outcome accountable for
2. **Information Sensors** – what the tactical manager would need to have as information (regardless of the current supply with reports) in order to have overview of his system
 - a. Visualizing the Information Sensors per Role and Accountability, around the role of the System Designer – the Tactical Manager
 - b. Stating the necessary attributes of the Information Sensors
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. the Entity where the tactical manager is placing the Information Sensor,
 - iii. the Type of information to be obtained (Progress feedback, Results, Issues, ...)
 - iv. the Way of obtaining the information (On demand or Event driven)
 - v. Type of content (Qualitative or Quantitative information)
 - vi. Frequency of obtaining the information (Hourly, Daily, Monthly, Quarterly, ...)
3. **Information Emitters** – what the tactical manager would like to have been told by the other roles in order to be aware on time for possible issues disturbing the agreed outcomes
 - a. Visualizing the Information Emitters per Role, around the role of the System Designer – the Tactical Manager
 - b. Stating the necessary attributes of the Information Emitters
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Emitter (the Role that should emit the specific information)
 - iii. Type of Information (Expectations, Personal issues, Not recording logs, ...)
4. **Risk Management** (along with Risk positioning and Information flows)

- a. Visualizing the Risks per role, around the role of the System Designer but to some extent also around all other Roles too
- b. Stating the necessary attributes for Risk Management
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Sensor, the actual Role or Entity or Business Process or general place where the tactical manager needs to point the 'radar' to in order to receive that signal
 - iii. Risk type (Experience of Management, Lack of knowledge for cross-checking, ...)
 - iv. Probability to happen (1 (low) – 5 (high))
 - v. Impact on the business (1 (low) – 5 (high))
 - vi. Risk Management approach (accept, avoid, transfer, mitigate, contingency plans)
5. Continuous performance of the **Sense-Interpret-Decide-Act (SIDA) Loop** and effectuating adaptability to changes through the R&A diagram and **Plan-Do-Check-Act (PDCA) Loop** for improvements

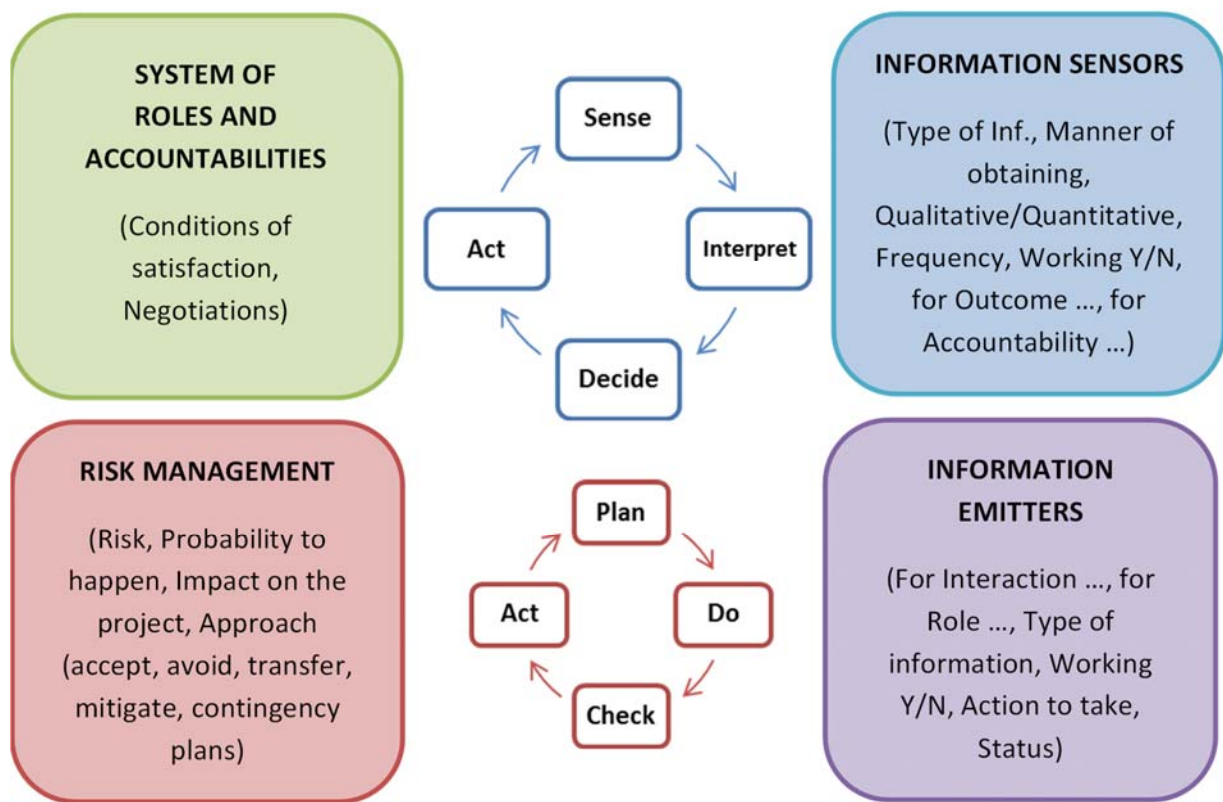


FIGURE 1.1 COMPONENTS OF DENICA – THE MANAGERIAL METHOD FOR TACTICAL MANAGEMENT

The overall generalization of the DENICA managerial method as class of solutions can be wrapped up in a socio-technical perspective through the achieved outcomes. From these, the *tactical management adaptability* can be perceived and accomplished through two dimensions, as:

- a) *Purposive adaptability of the manager (through the managerial system) and of the managed system*
- b) *Adaptability of the Information System and personalized self-design*

These generic characteristics are important input for the tactical managerial function alone, and as activity that is embodied in all other managerial functions. In fact, in any situation when there are numerous 'givens', dynamic changes, goals, unpredictability and support is needed in 'how' to initiate and enforce change towards improvement in order to steer successfully.

The distinctive categories of managerial and managed system are introduced with the artifact, offering clear division of the projected system a manager communicates with the broad ecosystem interrelated parties, and the managed system – which are those exact parties populating the roles and being accountable in the managerial system represented as Role-and-Accountability diagram.

Another distinction that is very important to make is towards differentiation of the managerial aspect of the Denica artifact, on one side and of the management information system aspect, on the other – for tactical management. Namely, we have attempted to continuously align the business and the informational aspects for the manager. Thus, the managerial aspect is present in the Role-and-Accountability system diagram (which represents the managerial system and is populated by the managed system). In this sense, all the elements that lead to composition and adaptable maintenance of the R&A diagram towards a purpose (Reason for Being, Primary constituents, Conditions of Satisfaction, Negotiations, Governing Principles, ...) belong to the managerial aspect for tactical management. Also, the Risk management component of the Denica method is profoundly situated in the managerial domain. On the other side, the mirror of the R&A diagram in the Information Sensors, Information Emitters and Risk Management represents the informational structure for the management information system for tactical management. The SIDA and the PDCA loops provide the continuous and dynamic adaptability both of the managerial and of the management information system with the broad context, but also between each other. This means that whatever is assessed as important by the manager of managerial nature will immediately find its reflection in the informational structure and vice versa – whatever new insight the informational changes result with, they can be effectuated in managerial terms (and imply changes in the R&A system, CoS, ...). Even though ultimately, everything is informational representation of managerial aspect and of management information system aspect and the underline is that we are all working with information, it is important to make this distinction to support the claim that we are addressing both managerial and management information system adaptability for tactical management and their mutual dynamic alignment.

In order to address the tactical management adaptability support in its full meaning (initial and static setup of mechanisms and components and dynamic support through time) – we contemplated a solution that provides dynamic adaptability support, which was one of the main goals and solution requirements (defined in Chapter 2, evaluated in Chapter 4). DENICA method's dynamic support serves the manager for his/her tactical management adaptability through time, facing changes and unpredictability, while steering a system towards purpose. Its behavior and robustness are presented on Figure 1.2.

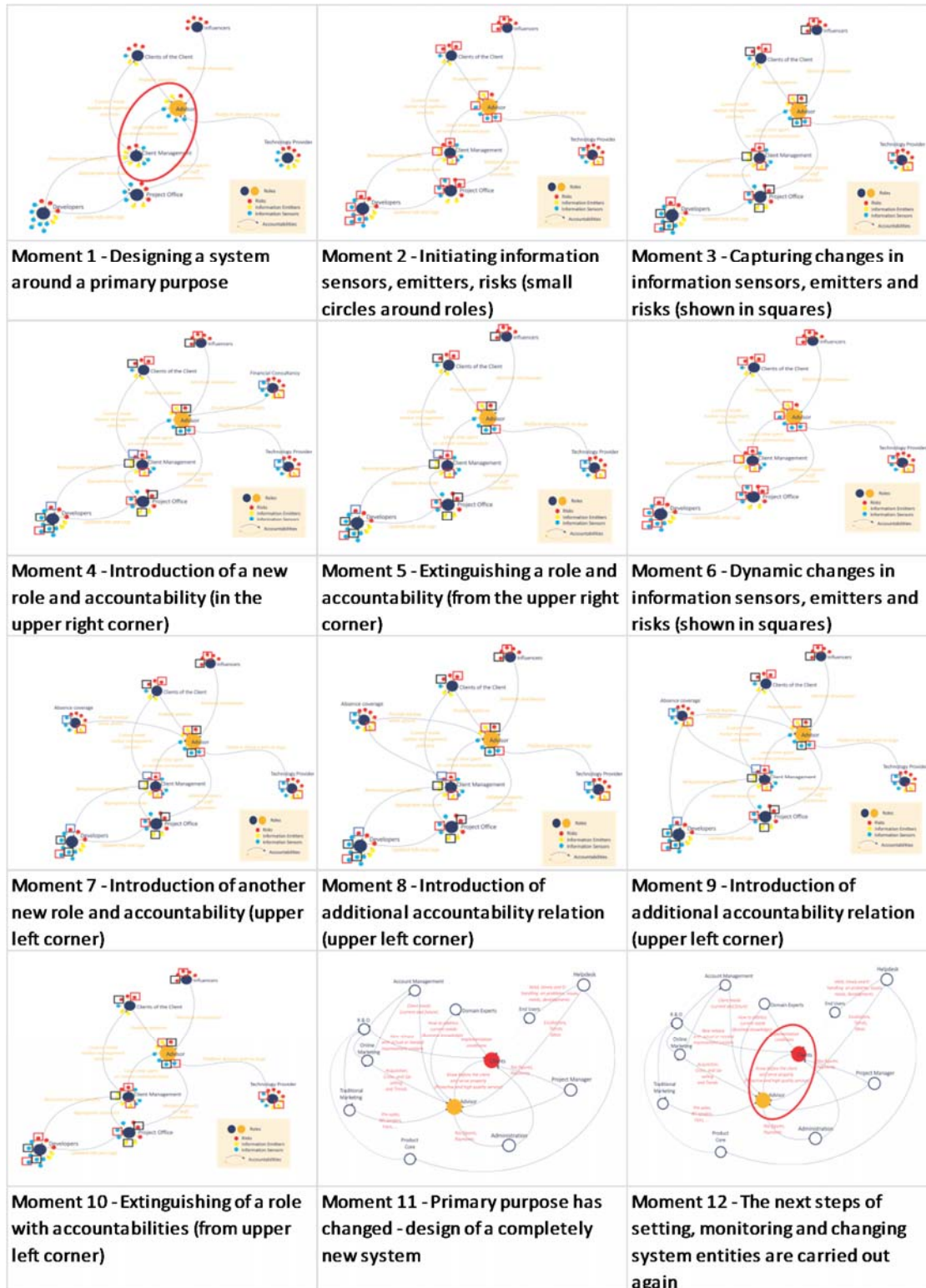


FIGURE 1.2 PRESENTATION OF THE DYNAMIC ADAPTABILITY SUPPORT OF THE DENICA METHOD

1.2. CONTRIBUTION 2 – THE METHODOLOGICAL KALEIDOSCOPE

Design Science Research Framework

The framework is a cyclical process involving the interaction between the Environment, Business Needs, Knowledge Base, and Applicable Knowledge. It includes steps like Expert Interviews, Literature Research, Design Research, and Evaluation.

Action Design Research Method

The method is a cyclical process involving Contexts, Intervention, Mechanisms, and Outcomes. It includes steps like Problem Formulation, Building Intervention, Evaluation, Reflection and Learning, and Formalization of Learning.

This approach exhibits also a novel use of the: CIMO logic for the ADR stages of evaluation, according the nested problem solving process flow. Namely, in order to properly perform formative and summative evaluation, our approach in a solution- and impact-driven investigation (Wieringa 2009) was to use the realist evaluation. The “argument precisely in the structure of realist (non-positivist) evaluation, in which outcomes are identified and attributed to the interaction between solution and problem domain, and then evaluated against stakeholder goals (Pawson & Tilley 1997) (Pawson 2004) has been used in the sense of ‘What works for whom in what circumstances and in what respects, and how?’ Answers for the six questions – What? Why? When? How? Where? Who? (Kipling 1902) (Mackrell & McDonald 2014) have been searched through the Context-Intervention-Mechanism-Outcome logic (CIMO logic) (Van Aken & Romme 2012; Denyer et al. 2008), in our case transcending over four real-life contexts: Context(s)-Intervention(s)-Mechanism(s)-Outcome(s).

CONTEXT(S) C1, C2, C3, C4	INTERVENTION(S) Ic1, Ic2, Ic3, Ic4	MECHANISM(S) Mc1, Mc2, Mc3, Mc4	OUTCOME(S) Oc1, Oc2, Oc3, Oc4
End-users	Tactical authority level	Personalized IS self-design	Personalized IS self-design and adaptability
Company profile	Big picture overview (Business ecology), Scope	Simplicity of the artifact use	Adaptability of the managed system
Industry	System design of Roles and Accountabilities	Multifaceted Context-capture	
Organizational structure	Clarity of Purpose and Governing Principles	Maintaining the system till purpose is reached	
Tactical issue/problem	Guidelines to the manager on reasoning and acting for informing and translating decisions on business and information level	Double loop organizational learning	
Managerial structure	Sense-Interpret-Decide-Act Loop for adaptability	Effective communication	
Problem type	Plan-Do-Check-Act Loop for improvements	Empowerment of the entities in Roles	
Artifact version	Incorporating Risk in parallel with Outcomes	Situation awareness	
	Visualizations		

In our tactical management information systems and adaptability research, there have been ongoing ‘sensors’ and corrective actions with regards to the most important interventions (I1 through I9) for the different contexts (Ic1, Ic2, Ic3, Ic4), that were expected to be functional, effective, and in some cases efficient – providing proper reflection in action. The interventions coupled with mechanisms (M1 through M8) that are triggered by them in the specific contexts have been subject to formative evaluation. The production of the desired outcomes (O1 and O2) for the four contexts have served for our summative evaluation. This methodological wiring has served in the reflection and generalization stages too – only in the opposite direction – to synthesize from the contexts and the respective context-specific interventions, mechanisms and outcomes towards a class of problems, a class of solutions and design principles.

1.3. CONTRIBUTION 3 – ENHANCING THE SENSE AND RESPOND FRAMEWORK FOR TACTICAL MANAGEMENT

Investigating the Sense-and-Respond Framework (Haeckel 1999; Haeckel 2016a; Haeckel 2016b) potentials for tactical management use and constructing a tactical management framework for the manager, that addresses the overall socio-technical aspects and needs (Chapter 3) has been another one of the major contributions of this research. With the DENICA method we have extended the S&R framework for tactical management, enriched and completed all its components and extended and completed the workflow for implementation as well as maintenance of the method.

The areas where the Sense-and-Respond framework has been influenced, altered, made tactics-applicable and enhanced have been expressed as A’, B’, ..., G’ of the S&R roadmap as follows:

- A’. Identification of the Primary constituents (on strategic and tactical level – given)
- B’. Clarification of the Reason for Being and levels of desired effects (on tactical level – purposiveness)

- C'. Framing of the Governing Principles (on strategic and tactical level – given)
- D'. Designing the Role-and-Accountability system diagram around the primary purpose (that communicates between strategy-tactics-operations and is purposive on tactical level)
- E. Setting up the initial Conditions of Satisfaction and re-negotiating them continuously
- X. Introducing Risks and Risk management both in the managerial components and in the information system
- F'. Addressing the information needs through the Heads up-displays and the Commitment protocol (Generating complete Information System mapping of structure, relations that dynamically captures context in structured person-specific manner)
- G'. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and effectuating adaptability to changes through the R&A diagram (and adding Plan-Do-Check-Act (PDCA) Loop for improvements)

We have also identified and categorized the adaptability components and mechanisms in the Sense-and-Respond framework:

- Adaptability component 1 - The Re-negotiations for outcomes, every role can perform through conditions of satisfaction, in order to adapt to changes.
- Adaptability component 2 – Introducing and terminating roles and accountabilities.
- Adaptability component 3 – Populating roles according human resources/systems.

We consider the Sense-Interpret-Decide-Act (SIDA) loop as perpetual engine to adaptability, which enables the system designer (manager) to continuously scan the organizational and environmental context for changes, and receive early warning signals, on the entities previously incorporated in the widest system of Roles and Accountabilities. This opens the radars (Information Sensors, Emitters and Risks) and initiates information flows with variable content, frequency, type, manner of obtaining etc. The SIDA loop helps the managers reduce unexpected events and self-design the information system needs, on an ongoing basis, and identify whether some activity or information flow needed to be more efficient or automatized (Chapter 4).

Through the interrelatedness of the SIDA and the PDCA loop we have completed the mechanism for double loop organizational learning and offered the DENICA method that can serve as standalone fully functional method for the manager.

1.4. CONTRIBUTION 4 – TACTICAL MANAGEMENT 2.0

1.4.1. DEFINITION

Providing a contemporary definition of tactical management (TM 2.0) (Chapter 2) that incorporates the connecting tissues of tactical management, operations, strategy and context capture, while clarifying that we actually need to answer to the 'how' question.

Our working definition of tactical management as a managerial function is: **How** to achieve what is **expected** by **utilizing** what is **given** and following certain **governing principles** in the **current context** of the **organization and environment**.

At this occasion we would elaborate on the most important fragments of this definition, and their relation with the strategy and operations:

- **How to achieve** (tactics)
- **what is expected** (strategy)
- **by utilizing what is given** (operations)
- **and following certain governing principles** (strategic guidelines)
- **in the current context of the organization and environment** (adaptability)

1.4.2. DELINEATION

Delineating TM characteristics and needs (Chapter 2), by situating TM properly among operational, strategic and project management, by providing a new categorization for how to make the distinctions and recognize similarities

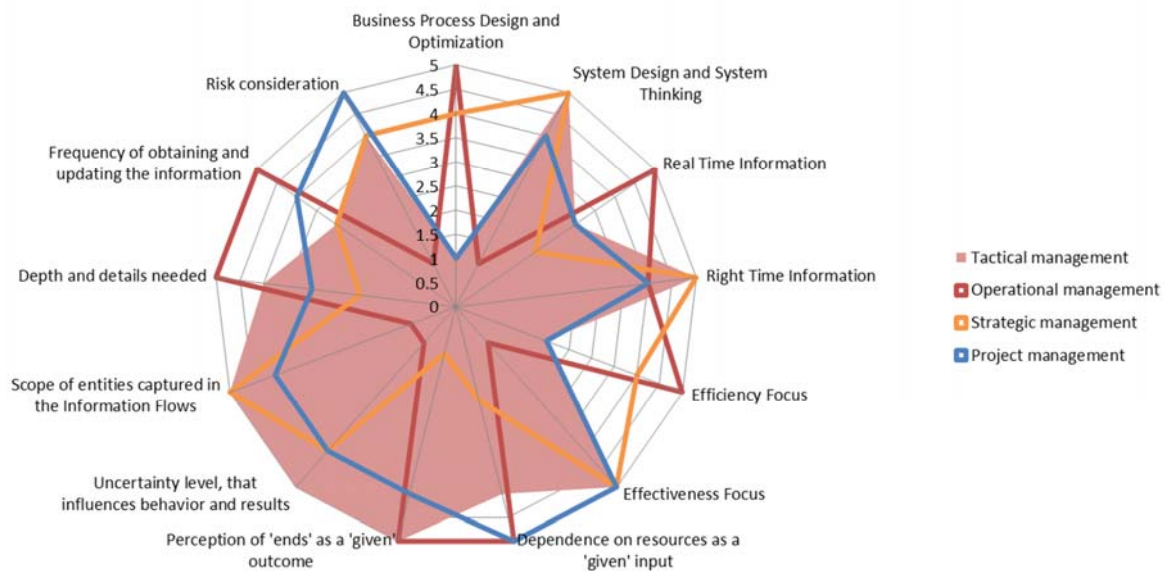


FIGURE 1.4 RADAR CHART VISUALIZATION OF THE SIMILARITIES/DIFFERENCES OF THE TACTICAL/OPERATIONAL/STRATEGIC/PROJECT MANAGEMENT WITH DELINEATION OF TACTICAL MANAGEMENT

1.4.3. MANAGERIAL AND INFORMATION SYSTEM REQUIREMENTS

Shedding light on the specifics of tactical management information system requirements – that differ from other managerial functions – in terms of scope of information entities (broad and through the entire business ecosystem), in terms of type of information entities (roles, people, systems-of-systems, ...), manner of obtaining (on request, reports, structured, unstructured, ...), frequency of obtaining (changeable), type of information (qualitative prevails over quantitative), incorporation of risks, information entries from information emitters (things not said that the manager needs to know) – all with the conclusion of person- and context- sensitive structure, dynamics and continuous renewal. The idea of personalized information system self-design is rather radical for today's automatizations in the IS domain, but the 'elbow' in the managerial sense will be present only in such an adaptable way (Chapter 2, 3, 4).

We combined the tactical management's trait for 'purposive adaptability' (Chapter 3), that goes in line with the tactical management's nature for being adaptable while dealing with various 'givens', and supporting initiated change. A categorization of the tactical management postulates for purposive adaptability (Chapter 3) is:

- System design and system thinking (in managerial and information terms)
 - Business ecology scoping the system boundaries
 - Level of ‘roles’ and interactions
- Context capture (in managerial and information terms)
 - Dynamic structure and content
- Effective communication and visualization (for managerial and information purposes)

The recommendation for positioning the level of ‘roles’ and their ‘interactions’ for tactical management system design is novel and significant for proper addressing of tactical management. Also, discovering the appropriate authority level for tactical management – on ‘helicopter altitude’ is transcending many current practices in companies towards overcoming an important managerial problem.

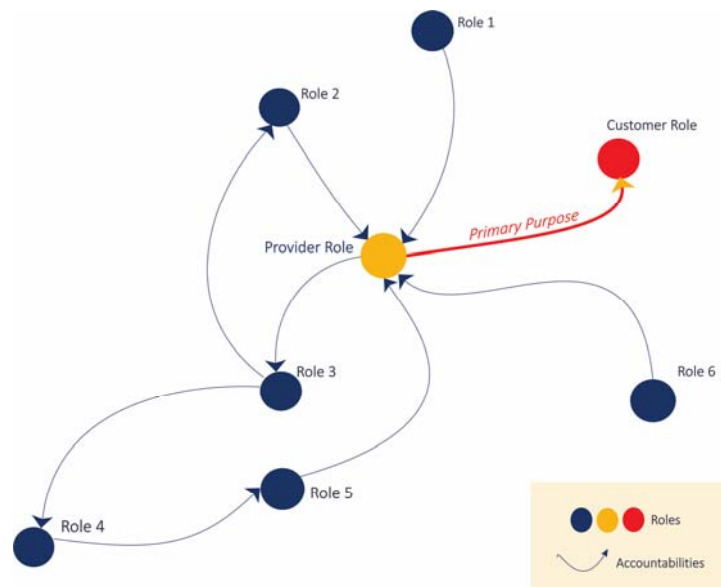


FIGURE 1.5 GENERIC TACTICAL MANAGEMENT SYSTEM OF ROLES AND THEIR INTERACTIONS IN TERMS OF ACCOUNTABILITIES DESIGNED AROUND A PURPOSE

Applying the concepts of situation awareness to structure and enforce the contextual awareness of the manager (Chapter 3). Situation Awareness as the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in near future, is present in complex systems (aircraft industry, air traffic control, medicine, large systems operation, tactical and strategic systems, transportation, law enforcement, emergency management, healthcare, space, education, mining, oil and gas operations and other disparate domains) (Endsley 1995; Endsley 2015). However, its use where the operator is the (tactical) manager is under-used.

We approached the effective communication solution requirement through verifying the benefit of use of visualizations for improved effective communication in teams and with all stakeholders, but visualizations that adhere to the CAS principles of simple rules; moderately dense connections and human rules on: how to detect information, how to interpret information and how to act in response. The uncovering of directed graphs to properly serve these principles resulted with selection of Social Network Analysis for the research artifact visualization. The selected visualizations fit yet another requirement – the ability to capture, reflect and present changes in the managerial system, environment, context, ... through the Dynamic Network Analysis (Chapter 3).

Mapping the business ecology that scopes the system boundaries for tactical management – and enables appropriate context capture, effective communication and purpose accomplishment (Chapter 3) is a standalone contribution that differentiates from any other, to the best of our knowledge.

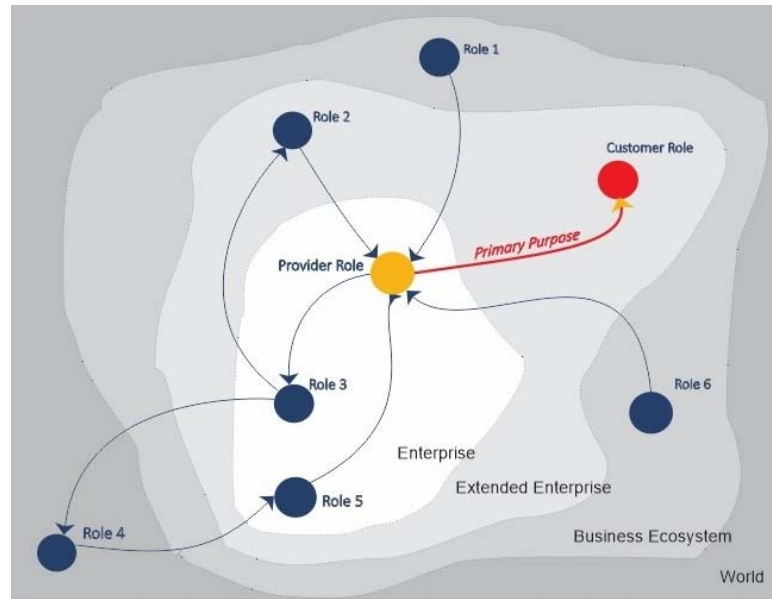


FIGURE 1.6 GENERIC TACTICAL MANAGEMENT SYSTEM OF ROLES AND THEIR INTERACTIONS IN TERMS OF ACCOUNTABILITIES DESIGNED AROUND A PURPOSE SPREAD ACROSS THE WIDEST BUSINESS ECOSYSTEM

Mapping of the compatibility among Complex Adaptive Systems, Sense-and-Respond Framework and Social Network Analysis (Chapter 3) in order to prove why tactical management can be supported with graphs both to project the managerial system of roles and accountabilities around a purpose and to visualize the environment to which the complex adaptive system adapts to. The more fundamental use of this mapping is that CAS can be managed towards a purpose with the S&R and DENICA method for tactical management with the assistance of social network analysis and dynamic network analysis.

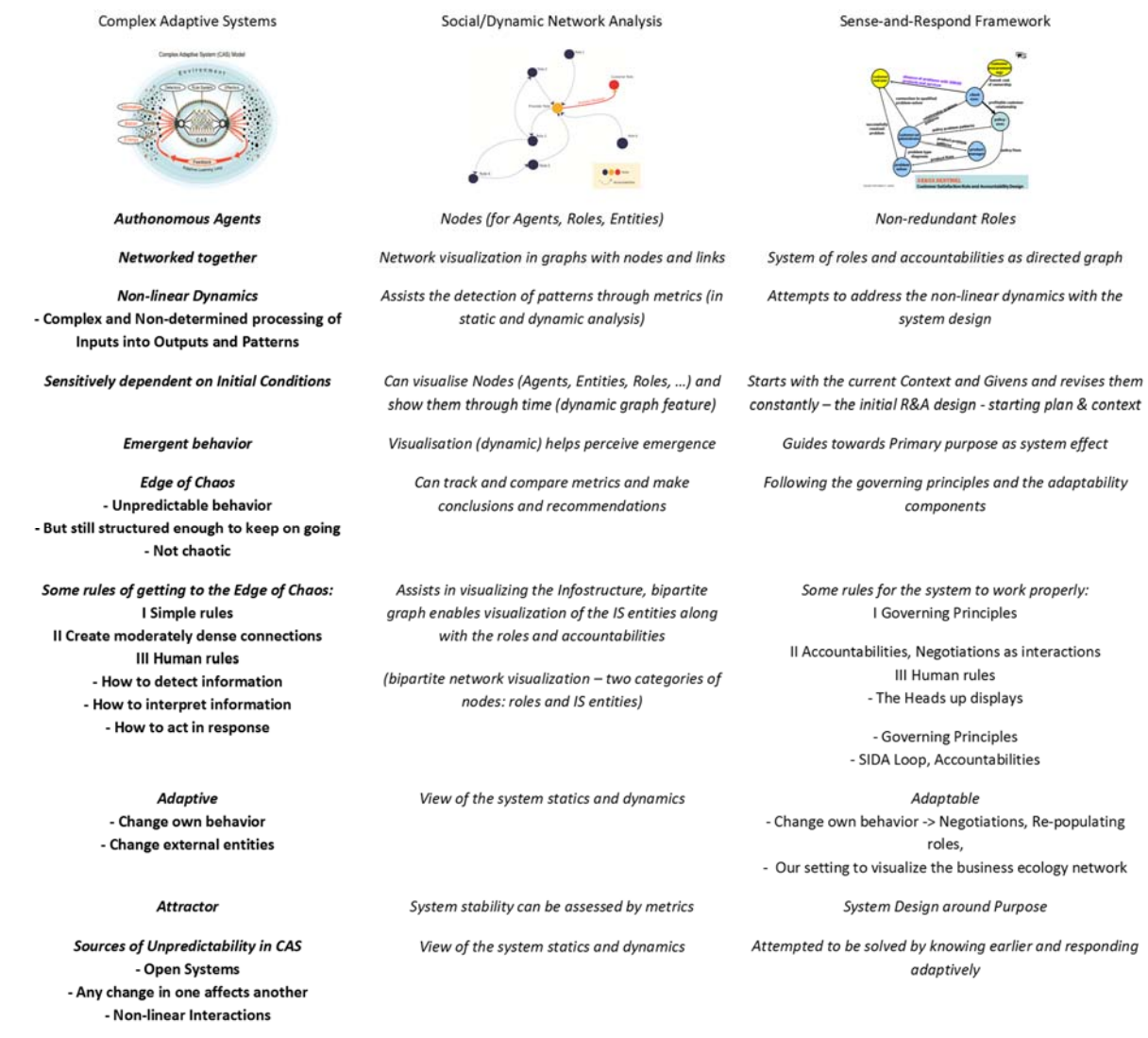


FIGURE 1.7 MAPPING THE COMPATIBILITY AMONG CAS, S&R AND SNA/DNA FOR PROPER MANAGERIAL APPROACH FOR TACTICAL MANAGEMENT ADAPTABILITY

1.5. CONTRIBUTION 5 – INTERRELATING COMPLEX ADAPTIVE SYSTEMS, UNCERTAINTY AND TACTICAL MANAGEMENT

Incorporating complexity theory notions of Complex Adaptive Systems (CAS) to describe WHAT the manager is managing and complexity to describe IN WHICH CONTEXT the work is being done – as important components that complement, clarify and properly design the HOW to manage. In this direction, the specificities of the CAS require: (1) Simple rules; (2) Moderately dense connections; (3) Human rules on: how to detect information, how to interpret information and how to act in response. The real-world environment that represents the external context is complex, unpredictable, uncertain. The current scientific and practical managerial methods do start to address the complexity of the context, while the specificities of the CAS are rarely considered (Chapter 3). The DENICA method considers these specificities in its design, and addresses them appropriately, being designed to support managing a socio-technical Complex Adaptive System in uncertainty.

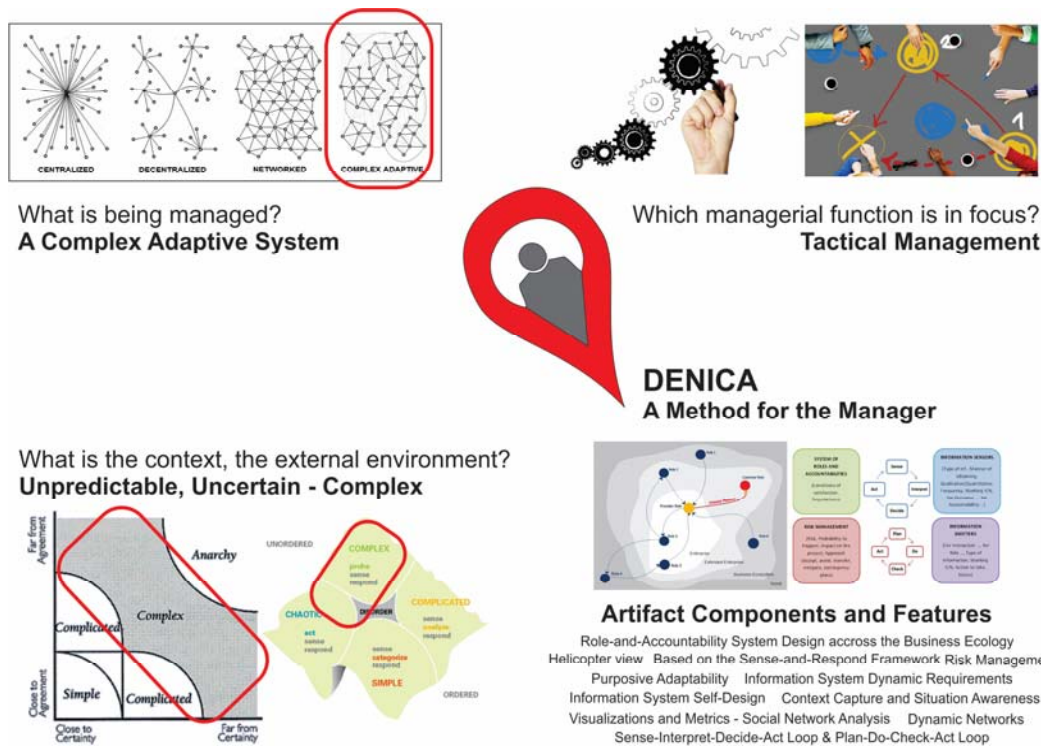


FIGURE 1.8 RESEARCH CONSIDERATIONS WHEN ADDRESSING MANAGEMENT AND INFORMATION SYSTEM DOMAINS WITH ARTIFACTS (WHAT IS BEING MANAGED AND IN WHICH ENVIRONMENT)

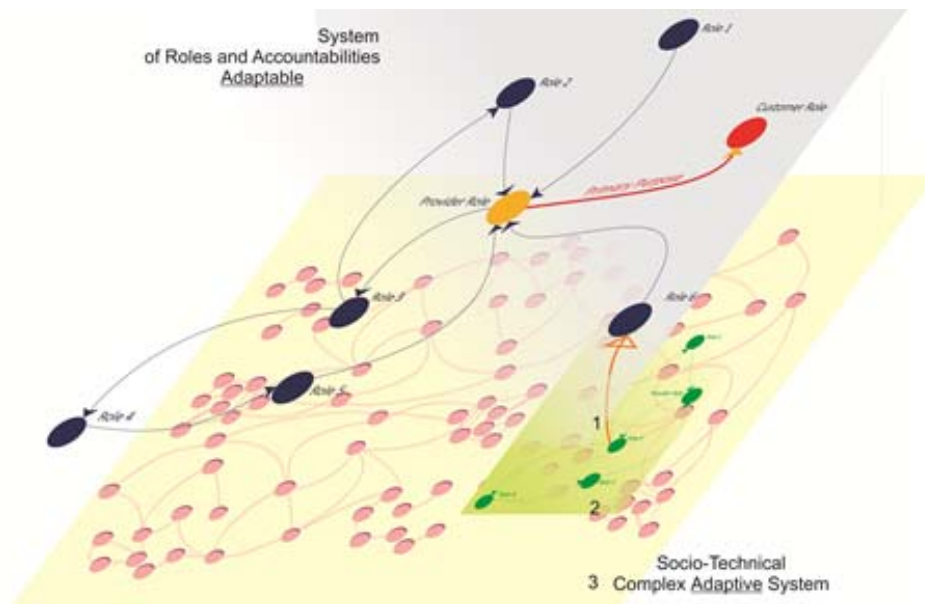


FIGURE 1.9 COMPLEX ADAPTIVE SYSTEM POPULATING ROLES AND ACCOUNTABILITIES OF TACTICAL MANAGEMENT ADAPTABLE MANAGERIAL SYSTEM

Clarifying the distinction and use of the concepts: ‘adaptable’ and ‘adaptive’ in terms of systems in general, in terms of socio-technical systems, and finally, in terms of managerial system and managed system (Chapter 2). This distinction is essential, because it represents a crossroad for appropriate managerial methods.

Last but not least, is the visualization of the adaptable managerial system of roles and accountabilities for tactical management in a plane separate from the socio-technical complex adaptive system sub-systems and entities it is being populated with (that we referred to as the ‘managed system’) (Chapter 3). The managerial system is a sort of projection of the system the ones who populate should follow. It needs to be communicated and visualized, and also responsive to manager’s actions, because it serves as orientation of the complex adaptive system for the collective purpose to be achieved.

2. IMPLICATIONS FOR RESEARCH

The rigor in Design Science Research needs to be continuously provided, at each stage of the research. It is a way to ensure proper scientific contributions that can be identified from the early steps, through the artifact design all the way to formalization and generalization of the research. The rigor cycle prevents re-discovering what exists and pushes towards upgrading on existing already proven and functional scientific foundations, while enabling creativity and novelty to find their way. In our research we have performed the rigor cycle several times, as described in the DSR figure at the beginning of each chapter, and through the flow of knowledge questions in the nested problem solving figures.

Call for Tactical Management focused research: From the initial literature review we pointed out several points that can be improved, regarding tactical management – lack of methods, approaches and solutions that address it; tendency to omit tactical management or treat it the same as strategic or operational, just with mid-term maturity; rigid information system support and lack of adaptability incorporated in the theoretical or practical solutions. These findings, combined with the interview insights on dilemmas what tactical management is, how it should be addressed with managerial and information system solutions, resulted with our efforts to (i) define, (ii) delineate tactical management, and point out its (iii) managerial and information system requirements and specificities. *The ultimate wish to imply for researchers, is to pay distinctive attention to tactical management as the ‘elbow’ of an arm (discussed in Chapter 1) and tailor appropriate solutions considering the traits of adaptability, purposiveness, managerial-informational alignment and person-specific nature.*

Set of questions to be asked when addressing management and management information systems: Another significant implication we would like to point out is the set of questions that needs to be considered when designing a method for management (strategic, operational, tactical, project):

- ‘What is being managed?’ – to which the answer is – complex adaptive system
- ‘In which environment?’ – where the answer is – complex, dynamic and unpredictable
- ‘Which managerial function?’ – in our case tactical management

And start from these pillars when thinking of the scope of the system being managed, level of roles, dimensions, people, ..., proper visualization of CAS such as graphs, simple rules to address CAS, specificities of the environment that suggest specific managerial probing, sensing, adapting, acting, etc.

Distinction adaptable/adaptive: The distinction of adaptable and adaptive is necessary but also neglected. If we know that adaptable is something that we can manipulate, while the adaptive chooses to follow or not, then we would re-shape many theoretical and practical managerial, organizational and procedural expectations to be followed by people, groups and systems.

Methodological kaleidoscope: The methodological kaleidoscope has multifold implications for research. One is the iteration of tactical management (managerial and information systems) research in a Design Science Research methodology. The same goes for Action Design Research, Nested-problem solving and CIMO-logic. When guidance was needed for in-depth business-academia collaboration when designing the artifact, DSR lacked detailed

guidance that ADR could provide. For evaluation, both ADR and DSR give instructions and principles, but the realist evaluation and CIMO-logic give the prescription how to perform it and maintain validity. The novelty of referring to the Interventions and Mechanisms in the specific Contexts for formative evaluation and the observed and desired Outcomes as summative evaluation may be useful for many researchers. Finally, while the DSR, ADR and CIMO-logic gave the components of the methodological framework, the Nested-problem solving gave the roadmap, the pathway of how to think and act while performing the research.

Tactics revisited with Denica: The artifact DENICA's theoretical implications come from: its need being identified in practice, it is built on various theories, developed with and evaluated in practice through strong methodological framework. It will hopefully start a trend in research by revisiting tactics, its importance and distinctiveness, in combining multiple theories to provide a solution, in bridging business and academia to facilitate a design and evaluation, in observing and addressing a phenomenon from all sides and in-depth.

Multidisciplinarity in socio-technical research should correspond and relate to the complex multi/inter/transdisciplinary real world: To end with what is maybe most important implication that this research wanted to be example for. Social and technical sciences are identifying and addressing real problems of socio-technical nature that exist in certain context and timeframe or future problems that may result from investigations of past and present events, mechanisms and circumstances. For these sciences to be effective in addressing and solving those problems in those contexts we need to, rather quickly, make research efforts that resemble the reality – which is never pure disciplined, static, in one domain, from one viewpoint, and from one community in research and/or practice. We are hoping to strengthen the multidisciplinarity and applied socio-technical sciences through our attempt to perform multidisciplinary research and offer functional, tailored but also socio-technically interweaved solution that touches ground and lives to see making a positive difference.

3. IMPLICATIONS FOR PRACTICE

Having in mind the specific user of the artifact: When summarizing the relevance of the research, the anxiety is great. Design Science Research is inspired to result with an artifact whose designers are eager to see implemented, improved, fruitful when assisting the intended users and more ... making a positive difference. The idea to have a method that supports the manager in tactical management that can be learned and implemented by the manager him/herself is to some extent has been well-off.

Offer for ready-to-use artifacts: The DENICA artifact is a complete functional method. Of course, it has issues that can be worked on, to make things easier and simpler to use, but in this shape it is generic enough but also practical enough to be taken 'off the shelf', introduced with user-specific content and put to practice. Its intended users: people that need to steer others (or themselves) in accomplishing outcomes, in professional or private life. Tactics is needed everywhere when strategic goals are being set, guidelines for governance are drafted and resources need to be utilized. Tactics effectuates strategy and DENICA method, based on the Sense-and-Respond framework, helps structure oneself to accomplish the strategy in dynamic environment. It is not a one-time endeavor (even though it could be). It is continuous adaptation to changing circumstances, while still steering towards the 'northern star'. And last, but not least – DENICA helps initiate changes for improvement and translates the managerial actions in order to effectuate change. Its domains of application: diverse, for tactical management – in this research investigated in business: ICT solutions implementation projects and staff optimization across projects, construction and equipment project, marketing. From realization of policies of heads of states; successful achievement of Sustainable Development Goals where the stakeholders are global, behavior is diverse, and still, goals need to be achieved and effects produced; through accomplishing paradigms of sustainable economic growth, co-evolution, value co-creation, ... that can be perceived as purposes and tactics as a manner how to achieve them; all the way to business strategies achievement, personal life purposes pursuit and much more. We are deliberately pointing out the high-level achievement of outcomes and tactical management of global systems because we believe that it is in these challenges DENICA will realize its full potential – being grounded in complex adaptive systems, complex and unpredictable environment, business-ecology-wide scope of roles and accountabilities, individual and shared situation awareness and personalized information flows – for offering adaptable support on managing systems that

(need to) produce desired effects. The DENICA method's use in various levels, size and scope of business or non-business undertakings is possible – with each of them exhibiting own specificities that may result in method instantiations and improvement in future. To conclude with the person using DENICA – to you DENICA should provide support in achieving goals, by providing guidance on how to act, what to think and how to carry out your managerial intentions through time, how to achieve what is expected with what is given, how have the captain or pilot awareness, how to set and get your information, how to perceive and align risks and how to get everyone on board.

Changing the paradigm(s): The thorough analysis and understanding of the Sense-and-Respond framework (coached and supported directly by Mr. Haeckel), helped researchers deconstruct and adapt its mechanisms but also the paradigms in its foundation and provide practical usefulness of the framework for tactical management, touching upon strategic and project management. But these efforts also reflected back to S&R knowledge on how the framework can be improved in some components (visualization with graphs, SNA, DNA; complete information system self-design; adaptability components), mechanisms (the SIDA loop combined with PDCA loop), and applicability (tactical management; purposive management), when used in SMEs or big companies; when attempted to implement in existing traditional matrix or functional hierarchies; in developed or developing countries; with new or existing users.

Generic and/vs Instantiated solution and knowledge: The set of novelties under the contribution name 'Tactical Management 2.0' has practical as well as implications for research. When discussing the practical implications, the definition as well as the delineation of tactical management is a direct answer to the first question from almost all interviewed practitioner, communicated researcher and discussions in general. The usual tendency was to put tactics as mid-term planning and as a job description of middle managers, while the information system needs to be automatized from operations, interpolated and projected into strategic goals. The generic solutions didn't pay much attention to the context, even though context is what makes tactical management so specific and in need for adaptability. We helped clarify that tactics is very much about 'now' as it is about the future, it is about the 'how' to achieve what is expected. We elaborated why and how it is different from strategic, operational and project management as well as similar and in which points. We hope that such distinctiveness can influence the practitioners to pay proper attention to the unrevealed competitive advantage that lays in tactical management.

Software solutions flexibility: Implication for the application and software producers is to address tactical management information flows with a sense of flexibility, to provide practitioners (managers) the possibility to map their own information requirements and to change them frequently, while building responsive mechanisms for those changing information requirements for tactical management to be served. The top managers can use our finding that for the tactical manager to do his 'role' properly he/she needs 'helicopter view' on his/her big picture as well as appropriate authority to be able to set roles and accountabilities, populate and re-populate them with people and sub-systems, negotiate for conditions of each accountability and acquire information.

CAS's specifics need special emphasis: Hopefully, the recommendations on how to manage complex adaptive systems – by giving simple rules, maintaining moderately dense connections and providing guidelines on how to detect information and how to act in response will resonate with the managers on all levels not to further complicate or try to prescribe and automatize everything. Instead, they should focus on establishing, providing, visualizing, communicating and adapting a system, purpose(s), several governing principles and empower entities in roles to interact within the system ... to facilitate and witness emergent effects from complex adaptive systems pursuing their own and collective purposes.

4. LIMITATIONS AND FUTURE PROSPECTS

Generic and on-the-ground at the same time: This research is positioned at a rather generic level for theory creation and very practical implementation level that provides testable functionality. It is also very broad while attempting to formulate a complete outcome. There might have been made statements that contain dangers of being too generic, or residing too much in practice, having a too broad range of raised questions to which all answers can't

be given. However, proper project management of the research has been undertaken to ensure results as well as relevance and rigor to the design.

Holograms needed: In the imagination of the researcher, the role-and-accountability diagrams should have been represented as holograms – so that the big picture of many individual managerial systems is able to be perceived – along with all the dependencies, subsystems, systems-of-systems, information requirements and mapping, roles that are populated and changed, as well as outcomes that add upon each other. What would we be able to see on such a hologram? A 3D image of the organism of managerial systems, how they behave and live, and how they accomplish purpose(s). Being aware that there is a complex adaptive system populating those systems, we would be ultimately able to see the synergetic effect of the mutual efforts, and the mechanisms that work towards it. It can be achieved we only need to set our minds to it.

Software tool: Another practical limitation of the research, is that because of the motivation to offer simple and straightforward tool support that can produce easy drawings of the diagrams, and easy maintenance of the information sensors, emitters and risks – in dynamic sense, we offered the practitioners an Excel Workbook with four worksheets for each category. However, the visualization of the graphs was done by hand from the practitioner side and in beta-versions of different software packages that deal with social network analysis. This has proven to work but it hits a limit when more projects need to be involved, when things need to be shared with employees and/or collaborators, etc. In brief, there is a need for a tool that provides graph visualization for the dynamically changing role-and-accountability diagram and information sensors, emitters and risks recording and update. This easy to use tool is in the process of development, from the side of the researcher and the practitioners that implemented and continue to benefit from the use of the method in real business environment.

Competitive advantage in tactics: Since the limitations present future prospects, as two sides of one coin, we will continue with another one that fits this reasoning. Namely, a significant aim of the research is to shed light on the competitive advantage that exists in tactical management and is rarely used – because of lack of realization for this issue, and little specific support. The tactical management information systems need to provide diverse input options, possibility for changes and maneuvers, plug-ins to different information sources and flexible reporting options according the needs of the manager and contextual changes. We aim to reduce rigidity and automatization of reports – by showing that most of the information is qualitative and unstructured; and all of it is dynamic, not static and fitting in one report scheme. The flexible managerial profile of tactical management requires flexible information systems – simple for use, robust but also very comprehensive and overarching. At this point, we can't prescribe specific components tactical management information system should have – but we can emphasize what characteristics it ought to bear: adaptability, accessibility, immediate person-directed changes, information requirements self-design. This challenge is greatest for software development companies, that try to incorporate the organization-IT alignment into the software solutions, but with the old paradigm of plan and act, with solution requirements and design in static mode and predominantly IT profile of software design. It can be such, but with proper and continuous input from the users, and before all, with great sense of dynamics – knowing that the software solution is already outdated from the current context, even on its first day of use, especially for tactics.

The Denica method: Regarding managerial potentials, tactical managers have been using adapted methods that were originally designed for strategic or operational management. This results in hardship to establish autonomous position among the managerial functions and behave in its real essence – as the 'elbow' of the arm. In such setup, tactical management will result with radiant improvements on small scale, but also with feedback to strategy and operations, because it is the one that most accurately needs and captures context and knows earliest whether the captured signals will influence the business or not. The DENICA method gives the managers at hand a functional prototype of how to behave and what to think and do to successfully accomplish the purpose(s).

Service Science and value co-creation: The Sense-and-Respond framework, does provide the scientific foundation both for strategic management, and through the DENICA method for tactical management. If it is used organization-wide, it will be a completely different paradigm than what is currently practiced in most of the real domain. Furthermore, the DENICA method show the borderless enterprise, which portrays the big picture and the real value co-creation, something Service Science (Maglio et al. 2010; Poels et al. 2013; Spohrer & Maglio 2008) is discussing about, among entities interrelated towards a purpose. Such a view posts future challenges for thinking outwards instead of just inwards. Mostly because of, as has been proven in this research, the changes and influences to the ultimate result derive from the big picture, and we should (as managers) at least be aware of that, if not even taking actions to steer the entire imaginary system towards the goals.

Capabilities: The specific research on business capabilities (Bērziša et al. 2015; Zdravkovic et al. 2013) is an approach where overlaps with this research are visible. From the runtime adjustments to capture the contextual changes and update the organization-wide information flows, through the sole understanding of capability as capacity and ability, for which tactical management can be perceived as one. The dynamic capability concept (Danesh et al. 2015; Teece et al. 1997; Lichtenstein et al. 2006) is a step further from a slightly different starting point, but still very much in line to the dynamic adaptability that this research has attempted to offer for tactical management.

Empowerment and change management: The empowered manager and its off-stage behavior as facilitator that utilizes these resources is our continuous challenge. With our research, we have attempted to shift from hierarchical, matrix or any kind of job-position organized company to role-populating adaptable one. There are many challenges in sub-optimization, in lower efficiency, authority conflicts, ... that needs to be improved for the Sense-and-Respond organizations, but they are significant part of the future, as should be at present. Regardless of the educational domain and experience, tactical managers should be able to grasp their role, position themselves and manage changes with awareness, structured information flows and responsive information and communication channels.

Country-specific research: By capturing the current tactical management state, and the business and managerial adaptability in a developed country (Belgium) and developing country (Macedonia) and instantiating Action Design Research in various contexts we witnessed numerous differences which could be pointed out in the future. Verifying the DENICA method applicability in various domains, different economies and managerial profiles are a future prospect too – especially towards clarification how and to which extent strategic, operational and project managers practice tactical management.

“Renata Petrevska Nechkoska has a prodigious talent for finding, assimilating, and building on knowledge from an almost alarmingly broad spectrum of disciplines and sources. She consistently and successfully integrates her learnings from these into original and important contributions to managerial theory and practice.”

Stephan H. Haeckel, Sense-and-Respond framework, Adaptive Business Design, USA

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APPENDIX

A. DESCRIPTION OF THE PROBLEM FORMULATION (PROBLEM TYPES, CONTEXTUAL FACTORS AND RISKS) FOR THE FOUR CONTEXTS

A.1. EXISTING SITUATION IMPROVEMENT FOR EXISTING ORGANIZATION – CONTEXT 1

In Company A, first the senior manager in charge of Human Resources was interviewed to get insight into the general directions or categories of issues the company needed to resolve and on first-hand pointers on the governing principles and expectations from management (semi-structured, 2 hour interview). The company was willing to train its middle managers and to find a new modus of organizing the projects because the current setting had conflicting points of matrix organizational structure and project lifecycle on one hand and project assigned human resources with department-specialized staff on the other.

Afterwards, the researcher interviewed individually (in semi-structured, 2 hour interviews), each project manager/team lead, discussing on their specific issues and approaches regarding tactical management, the tools and approaches for their information flows, problems, issues and challenges. This insight served for assessment of the personalized approach towards the tactical management issues of interest in the research – managerial adaptability, information system design and tools. Also the researcher explained the distinctive approach that was going to be practiced and investigated during the collaboration with the company.

The following phase was more desk research, when the researcher gathered documentation, explored the company web-content, various information sources and discussions notes from the individual interviews in order to prepare for the next phase of group sessions. The researcher had gained understanding and an impression of the organizational context and of the individual issues and challenges. In communication with the senior and some of the appointed middle managers, the researcher defined the boundaries of an instantiated tactical management challenge: Optimizing staff utilization across projects (Microsoft Dynamic implementations and consultancy).

Next, in the group sessions, the researcher positioned the aspects of the research that are relevant to the business participants such as the (1) generic problem of tactical management that necessitates adaptability, and the (2) instantiated problem in their specific projects/company. We situated the collaboration with the practitioners by clarifying the Organization-Dominant BIE (Building-Intervention-Evaluation) cycle (Chapter 3) (Sein et al. 2011) and pointed out the risk categories for the risk management in the project (Figure A.1) (Baskerville et al. 2008). The actual risks, the risk assessment (0-highly unlikely through 5-highly likely) and the risk treatments (avoidance, controlling, self-insurance, transfer) have served a purpose to announce to the practitioners possible communication lines with the researcher in the following months, and to get them accustomed to the risk component in the managerial thinking and acting that was constituent component in the research artifact being proposed to them. We elaborated on the CIMO (Context-Intervention-Mechanism-Outcome) research logic (Denyer et al. 2008) (Van Aken & Romme 2012) for their own context. Also, we tried to summarize and get the overall consent on the problem analysis (of the research and in their context), conceptual framework for the research (information latencies, handling mismatch of information, right-time information, context-capture, continuous scanning of the information flows, risk management), and the goal and the motivation of the research.

Risk Categories

A. Business Needs (Problem Analysis and Choice)

- A-2 Difficulty getting information about the problem
- A-3 Different and even conflicting stakeholder interests
- A-5 Solving the wrong problem
- A-7 Inappropriate choice or definition of a problem according to a solution at hand
- A-8 Inappropriate formulation of the problem

B. Applicable Knowledge (Retrieved from the Body of Recorded Human Knowledge)

C. Develop/Build (Develop Theory/Knowledge and Build an Instantiation)

- C-1 Development of a conjectural (uninstantiated) solution which cannot be instantiated (built or made real)
- C-2 Development of a hypothetical (untried) solution which is ineffective/inefficient in solving the problem

D. Justify/Evaluate (Justify Theory/Knowledge and Evaluate an Instantiation)

E. Applications (of Knowledge to Business and Organisational Problem Situations)

- E-1 Implementation in practice of a solution does not work effectively, efficiently, and/or efficaciously

F. Additions (to the Knowledge Base of Recorded Human Knowledge)

- F-2 Publication of low significance research
- F-3 Publication of incorrect research

FIGURE A.1 RISK CATEGORIES IN THE ACTION DESIGN RESEARCH IN COMPANY A (BASED ON (BASKERVILLE ET AL. 2008))

Next, the context analysis of the company was performed and presented in another group session. The following contextual factors were discussed: Internal and External Organizational Context, Organizational Structure, Target client profiles, Target client domains, Client portfolio, Geographical network of business and clients, Products, Competences, Services, Competitors, Technology, Economy, Regulations, Collaborators. Also, a SWOT analysis for the company was performed and discussed, getting surprising consensus on each item. The company mission, vision, targets, expectations and measuring results were separately discussed, since they are the goals and expectations for the managers to fulfill. With regards to this issue, the company had several widely elaborated mission and vision statements. This presented a problem because everybody started hesitating – what is the actual mission of the company. Substantial amount of time was spent on introducing and translating the Sense-and-Respond framework to the managers, and what it would mean in their work and approach. In these few occasions, the business participants in the research were expected to ingest, comprehend and try to apply the Sense-and-Respond principles adapted from our side for their specific tactical management use and our guidelines, and try them in their context, within the next months. We provided implementation steps and guidelines, and placed the content and the research progress on an e-learning platform to serve as communication and update portal between the researchers and the practitioners as end-users.

A.2. NEW PROJECT SUPPORT FOR NEW ORGANIZATION – CONTEXT 2

Regarding Company B, the founder of the company is the main carrier of the business – being an experienced consultant and project manager (in our case end-user 1). Once again, it is important to note that end-user 1 has been previously employed in Company A (Context 1), and then started own business (our Context 2). This is the only user that has been our collaborator in two contexts, and has been involved in two alpha and extensive beta-version of the artifact (for details refer to Chapter 4). The experience with the researchers since the beginning of the ADR and in two different contexts has been of benefit for faster integration with the S&R framework, the artifact's clarification and use, so the end-user 1 had transcended much easier and faster towards the alpha and beta-versions and contributed the most to the formation of the artifact during the ADR. Another important note is that this manager is still using the artifact in 3 more real contexts with great success and benefits for tactical management issues.

Usually, the strategy/tactics/operations/project management, at least in the beginning years of such companies are conducted by one person – the owner. This, along with his background and knowledge, made the problem identification phases easier, for this organizational context. The researcher interviewed the practitioner in three 2-

hour individual semi-structured interviews in order to clarify and gain mutual understanding and eventually agreement on the tactical management issue, purpose, approach to be used and actions to be followed. There was no need for senior management interviews for governance and strategy and middle management interviews for tactical issues – the practitioner had the proper authority level and decisive power for pointing out a tactical management issue and work on designing appropriate solution to it. The identified issue was: Least time spent on remote communication for our practitioner’s client management. The practitioner was consulting his client management in overseeing their project – software development and implementation for Antwerp’s harbors, while outsourcing work to software developers in several European countries. The identified risks in this occasion have been as in Figure A.2.

Risk Categories

A. Business Needs (Problem Analysis and Choice)

- A-2 Difficulty getting information about the problem
- A-3 Different and even conflicting stakeholder interests
- A-6 Solving a problem partially, that doesn’t satisfy the practitioner needs
- A-8 Inappropriate formulation of the problem

B. Applicable Knowledge (Retrieved from the Body of Recorded Human Knowledge)

- B-1 Necessity for the researcher to quickly introduce another scientific artifact because the practitioners are used to something else

C. Develop/Build (Develop Theory/Knowledge and Build an Instantiation)

- C-1 Development of a conjectural (uninstantiated) solution which cannot be instantiated (built or made real)
- C-2 Development of a hypothetical (untried) solution which is ineffective/inefficient in solving the problem

D. Justify/Evaluate (Justify Theory/Knowledge and Evaluate an Instantiation)

- D-1 Receiving preferential evaluation due to courtesy of the practitioners

E. Applications (of Knowledge to Business and Organisational Problem Situations)

- E-1 Implementation in practice of a solution does not work effectively, efficiently, and/or efficaciously

F. Additions (to the Knowledge Base of Recorded Human Knowledge)

- F-3 Publication of incorrect research

FIGURE A.2 RISK CATEGORIES IN THE ACTION DESIGN RESEARCH IN COMPANY B (ACCORDING TO (BASKERVILLE ET AL. 2008))

A.3. NEW PROJECT SUPPORT FOR EXISTING ORGANIZATION – CONTEXT 3

The situation in Company C is similar as in Company B. It’s a small company, where the management is in the hands of the owner (in our case end-user 10). The development of the company to the current extent and future prospects has been done by the owner, with his experience, expertise and managerial capabilities. The researcher conducted three 2-hour semi-structured interviews in order to identify the problem, get the practitioner acquainted with the research, the artifact, and the things-to-do when collaborating with the researcher. The situation in the company was such that it was known in the country as private geodesic cadaster. The ambition of the owner, as well as current practice, included a range of seven other domains in which the company offered and performed services – such as engineering, architectural solutions, rental services, intermediary services for clients living abroad etc. In order to provide a structure, a setup that will enable the company to change its clients’ perception from being only a geodesic cadaster to being a full ‘Engineering and Geodesic services bureau’, the identified tactical management issue was: Achieve client recognition of the company as full ‘Engineering and Geodesic services bureau’. From a strategic point of view, the mission of the company is to be the town’s neighborhood one stop shop for engineering and geodesic services. The question – how to achieve this primary purpose as strategic goal – is answered by structuring the company’s system on tactical level with our artifact. To paraphrase: tactics provides the answer how to structure yourself to achieve the strategy – through the roadmap of the artifact, and by introducing, maintaining and adapting the system that produces the desired effect (until the strategic goal is changed). If we consider tactical management as the ‘how’ to achieve ‘what’ is expected, considering given resources and circumstances and

changing environment, then this would be a proper example of tactical management issue in managerial and information system adaptability and effectiveness.

The risk assessment for this specific collaboration is as in Figure A.3.

Risk Categories

A. Business Needs (Problem Analysis and Choice)

- A-2 Difficulty getting information about the problem
- A-6 Solving a problem partially, that doesn't satisfy the practitioner needs
- A-8 Inappropriate formulation of the problem

B. Applicable Knowledge (Retrieved from the Body of Recorded Human Knowledge)

- B-1 Necessity for the researcher to quickly introduce another scientific artifact because the practitioners are used to something else

C. Develop/Build (Develop Theory/Knowledge and Build an Instantiation)

- C-1 Development of a conjectural (uninstantiated) solution which cannot be instantiated (built or made real)
- C-2 Development of a hypothetical (untried) solution which is ineffective/inefficient in solving the problem

D. Justify/Evaluate (Justify Theory/Knowledge and Evaluate an Instantiation)

- D-1 Receiving preferential evaluation due to courtesy of the practitioners

E. Applications (of Knowledge to Business and Organisational Problem Situations)

- E-1 Implementation in practice of a solution does not work effectively, efficiently, and/or efficaciously

F. Additions (to the Knowledge Base of Recorded Human Knowledge)

- F-3 Too low level of details or context-specific project to generalize

FIGURE A.3 RISK CATEGORIES IN THE ACTION DESIGN RESEARCH IN COMPANY C (ACCORDING TO (BASKERVILLE ET AL. 2008))

A.4. EXISTING PROJECT SUPPORT FOR EXISTING ORGANIZATION – CONTEXT 4

Company D is a big production company managed by a CEO and Management Board. Most of the decisions are streamlined from the top management to a couple of middle managers and on execution operational levels. A manager who is heading the development department and overseeing projects is our end-user 11.

After the initial discussion with the top manager of the company, there has been pretty straightforward idea what the research can be focused on – and the person appointed for collaboration – the end-user 11.

The next meetings have been with this middle manager – three semi-structured interviews of each 2 hours and ongoing remote communication. In these occasions the researcher and end-user 11 have discussed the company's and manager's specific issues and approaches regarding tactical management, the tools and approaches for the information flows, problems, issues and challenges. This insight served for assessment of the personalized approach towards the tactical management issues of interest in the research – managerial adaptability, information design and tools. Also the researcher explained the distinctive approach that was going to be practiced and investigated during the collaboration with the company.

The next phase was establishment of initial tactical management issue that will be addressed with the implementation of the artifact, and kick-off for the next months. The factory was going through a process of acquiring new production line equipment (an investment of 1 mil Euros). This wasn't the sole project, even though on its own it has been pretty extensive. Namely, the overall project has been that one existing factory hall with part of existing equipment should be joined with a new building where the new production equipment would be installed;

and the two components (existing and new one) should be fully functional as one, with no interruption of the production process when the time comes. This meant that all the design, engineering, construction, customization and synchronization activities should be successfully implemented before switching to the new (integrated) line. The identified issue was: Provide the earliest possible information for status and discrepancies to management in a new factory construction and equipment alignment project.

The risk categories for this occasion have been mostly concentrated on the establishment and the maintenance of the business-research continuous relation through the timeline of the project, on one side due to unavailability of the manager and on the other, due to reluctance to bother with research needs when having more important everyday issues. The end-user in this occasion, was involved to a great extent in micro-management of routine daily operations, controls and follow up of activities in order to make sure things are getting solved; as well as all the other project management and department heading issues.

Risk Categories

A. Business Needs (Problem Analysis and Choice)

- A-1 Difficulty contacting (or finding) the manager (obligations, travel, ...)
- A-2 Providing solution that will be override by the top management

B. Applicable Knowledge (Retrieved from the Body of Recorded Human Knowledge)

- B-1 Company insists on practices that don't incorporate the artifact guidelines

C. Develop/Build (Develop Theory/Knowledge and Build an Instantiation)

- C-1 Development of a hypothetical (untried) solution which is ineffective/inefficient in solving the problem

D. Justify/Evaluate (Justify Theory/Knowledge and Evaluate an Instantiation)

E. Applications (of Knowledge to Business and Organisational Problem Situations)

- E-1 Implementation in practice of a solution does not work effectively, efficiently, and/or efficaciously

F. Additions (to the Knowledge Base of Recorded Human Knowledge)

FIGURE A.4 RISK CATEGORIES IN THE ACTION DESIGN RESEARCH IN COMPANY D (ACCORDING TO (BASKERVILLE ET AL. 2008))

The context analysis of the company was performed by the researcher and discussed with the practitioner and focused on the following factors: Internal and External Organizational Context, Organizational Structure, Target client profiles, Collaborator international network, Client portfolio, Geographical network of business and clients, Products, Competences, Services, Competitors, Technology, Economy, Regulations. Also, as in the other contexts, a SWOT analysis for the company was performed and discussed, to get mutual understanding of the points of improvement and how they should be tackled. The company mission, vision, targets, expectations and measuring results were pretty clear in the head of the middle manager, which was surprising but can be explained by the daily direct communication line of the middle with the top managers, and with the flat hierarchical structure. A substantial amount of time on the meetings was spent on introducing and translating the Sense-and-Respond framework to the manager, and what it meant in his work and approach. In these occasions, the practitioner was expected to ingest, comprehend and try to apply the Sense-and-Respond principles adapted from our side for his specific tactical management use and our guidelines, and try them in his context, within the next months. We provided implementation steps and guidelines, and established consultation and communication channels. However, the developments haven't been very self-perpetuating as in Context 1 and 2.

B. THE BUILDING-INTERVENTION-EVALUATION STAGE ELABORATED FOR EACH OF THE FOUR CONTEXTS

B.1. CONTEXT 1

Sense-and-Respond Framework foundation for tactical management: The first organizational tactical management problem for which we implemented the initial version of our artifact, founded on the managerial framework Sense-and-Respond, has been: Optimizing workforce utilization throughout the projects. The background idea of the senior management was to clarify the role of the team leads and to minimize planning disturbances in order to provide management with feasible monthly projections of billable hours. This was our chance to practically prove the applicability of the S&R framework in an existing company that has a matrix organizational structure and existing business processes. As the S&R provides the theoretical basis for the solution, the solution itself required adaptation to the (generic and instantiated) problems of information systems support for tactical management and its need for adaptability – but the S&R core distinction of outcome vs. output, roles vs. job posts; accountability vs. responsibility, ... have been substantial to make. Shifting the mindset towards S&R within an existing organization that works traditionally was almost ‘mission impossible’, since the current situation didn’t allow for much out-of-the-box thinking. First, together with the managers (reciprocal shaping, (Sein et al. 2011)), we identified problems and possible existing disturbances that disrupt the planning process – whether it’s the communication flow, the late or regular requests, the tools used, the communication channels, the frequency of changes, the profiles of the people involved, the client special requests, the mixed responsibility for influencing and measuring outcomes, the risk management attitude and tools, the recruitment process, the training process, ... We identified 27 issues that influence the system we were trying to redesign (Figure B.1) We ranked those issues by priority (from 1-urgent to 3-takes time). The researcher provided the senior management with the list of potential challenges (Figure B.1) and issues that were identified and possible ideas on how to address them, which was of utmost importance for the practitioners and an important bridge in the researcher-client agreement (Davison et al. 2004).

No.	DISTURBANCE, ISSUE	PRIORITY 1-urgent 2-asap 3-takes time	OUTCOME	IDEA or PROPOSAL for SOLUTION
1	No system or flow for handling Late Requests	1	Now the communication is going PM to TL taking some other's PM member, individual communication, involvement of higher level managers - waste of time and efforts, when someone else may also be convenient for the job	Annex 1
2	Role for streamlining staff changes throughout portfolio of profiles, with proper tools and procedure	1	The TL can optimize only his current staff and send them to most profitable projects (?) but optimization happens from higher level view, at least one level above TL, with perception on all projects as portfolio of projects	Annex 1
3	Demotivating Late requests that could have been prevented, with penalty, possibility to stay unanswered or not as wished for, ...	1	Maybe 50% of the late requests are due to turbulence, unexpected (that could be predicted) changes, issues ... and could have been prevented. They should be aware that sometimes a possible answer will be No	Annex 1
4	Authority level for optimizing staff utilization (helicopter view of portfolios and resource usage)	1	Necessary for looking at staff 'pockets' throughout the projects, not only in 2 projects	Annex 1
5	Mixed responsibilities for influencing and measuring the outcomes	1	TL needs to optimize and has no influence on the budget. TL should take care of the HR issues for the staff, the PM should take care of usage of capabilities, and Planning Role and Authority should provide staff utilization and its optimization	Annex 1
6	Risk Management Attitude and Tools - Anything that Can go wrong Will go wrong	1	Mitigating risks, Contingency Planning, Less stress over "how did this happen ... again"	Annex 3
7	Labor profiling database - per person but also per Capabilities	1	Tool that can be searched for most appropriate people at any stage of the project lifecycle	Annex 1
8	Signaling recruitment/training needs as early as possible.	1	Appointing feedback lines from PMs and TLs for recognizing staff needs so that recruitment/trainings can have time to find/do. Also from their side, having some pool of applicants, interested part time availabilities, traineeships etc as Plan B or sometimes Plan A for staffing and Cross-training.	Annex 1
9	Rules for communication, requests, consequences, alternatives of the responses, communication parties	1	Several communication rules prescription to all staff, especially management levels ... idea that I should elaborate in person	Annex 1, Annex 2
10	Less of the unstreamlined One-on-One Up-and-Down communication	1	Not every PM should go 'retail shopping' but 'warehouse ordering'	Annex 1, Annex 2
11	Enterprise wide Project Portfolio Management - Ad Ultima has grown enough to have this role	1	Deploying limited resources Tracking relationships among projects Tasks that add value across projects	Annex 1
12	Clarification of roles in the basic systems - for example of TL, PM, HR...	1	In some cases even formal up-to date brief documents	Annex 1
13	Sales Department Differences in Understanding	2	To make confident and realistic promises, Touch-and-Feel Demos, ... that disturb either planing or the client's perception	Annex 2
14	Making estimates only having parameters, and many unknown variables	2	The first estimate on the budgets and planning are on parameters and with almost none of the variables (client and Ad Ultima side). There should be at least 2 more re-estimates that re-negotiate the triangle Time, Budget, Scope and lead to more successful project and planning	Annex 1, Annex 2, Annex 3
15	Software Architect estimates not adjusted when specific resources are scheduled	2	Accountability on this stage or smaller accent on this document for planning purposes	Annex 1, Annex 2, Annex 3
16	Use of some recognized techniques for estimating - Work Breakdown Structure, Resource Leveling, Floats for free resources, Phased estimating, Apportioning, Parametric estimates, Bottom-up estimates, CPM, PERT, ...	2	Very few, maybe none of these techniques are used on group level - it is up to the individual knowledge - possible Trainings and insisting of at least basic PM and Risk Management aspects in everyday work	Annex 4
17	Handover protocols for quick staff change within projects, and for knowledge formalization	2	Transferability - To ease up taking over from another person on the previously done job	Annex 4
18	Alternative recruitment - freelancers, part time, ...	2	Food for thought for recruitment	Food for thought
19	Signaling FLOATS of staff 'on the bench' - by having ongoing internal projects, projects on hold or waiting	2	Every PM and TL should be recognizing and signaling 'floats', at least in duration of days - to redirect such employee to some internal project with less strict deadline, or to assist someone else that is behind deadline	Annex 4
20	Involving staff in estimates - to get them striving to the deadline with the same engagement as the higher levels	2	This idea means to consult the appointed persons for their estimate on any module - how much they think it would take them. It could turn the wheel with their engagement since they are the ones who made the estimate - Food for thought	Food for thought
21	Different PM/TL educational backgrounds - need of streamlined training, to make the best of their intuition and potential	3	Unified Ad Ultima Specific trainings for Project Management, Risk Management and some HR issues	Food for thought
22	Internal Manuals for core business processes - concise, summarized, updated	3	It takes time, but eventually the core-business processes and the main business focus - customer intimacy, should be prescribed	Food for thought
23	Employee traveling time reduction - is every presence of developer with a client necessary?	3	I believe that this should happen only if some client insists, otherwise not. Gradually in time, this should be in minimum. Nowadays technology offers many options for remote yet successful work.	Food for thought
24	Proper positioning of some incentives - maybe awarding successful project bonuses, as motivation and recognition ...	3	For some profiles of people some incentives may propel the motivation and energy - taking care of the project and then getting some reward from a successful one, ...	Food for thought
25	System of Ad Ultima is still not designed for Customer Intimacy	3	The current system still doesn't have all the radars to proactively sense the client's needs even before the client himself. Long term partnership in this sense means - flawless taking care of what exists, and proactive care for what may come. Customer intimacy is achieved depending on the PM and some do it really good, but it is not a collective consciousness, nor with the prescribed systems	Food for thought with Proposal how to solve
26	Different approach for Small/Corporate clients and for Standardized/Customized solution	3	Small clients and Corporate clients need different Ad Ultima approach. Standardized solutions are one and Customized solutions need also very different approach. The selling, cross-selling and up-selling efforts are also to be adapted to at least these four modalities	Food for thought with Proposal how to solve
27	Motivation of employees - preferences, skill and career development, proper incentives	3	Staff as resource's difference from objects is that its utilization is best if it's Willingly, and coming from a motivated person. The people themselves will tell what makes them fully activated and the company should put sensors and answers to that too, it is a process and awareness.	Food for thought with Proposal how to solve

FIGURE B.1 IDENTIFICATION OF ACTUAL CHALLENGES, ISSUES AND DISTURBANCES IN THE COMPANY AND RESEARCHER'S PROPOSAL TO THE COMPANY ON POSSIBLE SOLUTIONS

A. Primary constituents: We followed the guiding principles of Sense-and-Respond framework implementation (Haeckel 1999) and attempted to modify them to be applicable for tactical management, since the framework has been primarily designed for strategic adaptability. Firstly, we framed in words an outcome of the current setting with a proposal or idea how to address this outcome in solving the problem. The outcome was formulated as ‘Delivering the client a solution he asked for in the specification and contract’. With these issues to be solved in mind, we needed to clarify what was the design point of the new system, namely, the ‘end’, the ‘purpose’. After relatively brief discussion, the working group concluded that it was to ‘Accomplish a no error solution to the client’ (as the primary purpose, outcome, end). It is measurable (the client should experience no or minimum errors when using the solution in practice; and indirectly, it should provide business, internal communication, etc. improvement in the client’s business). This was the first shift necessary for getting on the right tactical management track – thinking in terms of ‘outcomes’ not in terms of ‘outputs’. The two goals are different in superficial but also in substantial way. The proposed new one is motivated by the company’s refined purpose of achieving ‘customer intimacy’ as a business model; while the existing one was guided by the premise to make profit for the company. The former goal can be considered as ‘output’ – provide what was asked for in the contract; while the second one can be considered as ‘outcome’ – make sure there are no errors in the solution for the client, which considers many other aspects to make sure the client is satisfied with the collaboration – even many things not included in the contract or maybe even wrongfully stated by the client. The second level purpose that the managers wanted to achieve was ‘To solve possible upcoming issues and problems even before the client is aware they exist’. Upon mutual decision, this was incorporated in the solution design – because ‘knowing earlier’ is one of the vital features of the S&R framework and its tactical management derivative. The most important problem that urged overcoming was the utilization of staff. Optimizing staff utilization has been the third level purpose the solution was to incorporate.

B. Reason for Being: The reasoning of the Sense-and-Respond Framework is to have the customer role (the client’s management in this case) be the ultimate evaluator whether the goal has been achieved (and actually experience a no-error solution). This is the ‘customer-back’ system design (Crim 2014). In the existing situation, the company is aiming towards delivering what was asked for, and acts with a ‘firm-forward’ logic. But in most of the cases, the communication should be broader than a paper order, it should embody making sure of the needs, the real problems and issues with the client, and foreseeing whether what is asked for will satisfy the need, and making sure the solution is not just delivered, but also tested, refined and in state of ‘go live’ with no errors. Furthermore, the ‘customer-back’ design doesn’t put prime on making profit for the company because of the assumption that if the clients are satisfied they will pay the agreed price and profit will be accomplished, so there is no compromising profit at all, it’s just a completely different paradigm of motivating action. The mechanism that led to the primary purpose has been the S&R “Who owes what to whom and why the constituent values this outcome” table that helps identify the primary purpose, the so called ‘reason for being’ (Forno 2012).

The group also concluded the biggest issue they were having were the ‘late requests for assigning consultants’, that disturbed existing projects, meant exhaustive communication on the level of project managers and team leads but resulted being resolved by someone with higher authority. The wave of negative effects cascaded throughout several projects, and these disturbances happened regularly. Finding the biggest problem in the existing setup before designing a new solution is implicitly incorporated in the S&R implementation roadmap. However, in this case, it was an important awareness that led to discuss better solutions that will overcome the biggest problems.

C. Governing Principles: The next step in the S&R implementation for tactical management was to discuss Governing Principles. Statements such as ‘always’ or ‘never’. These principles in the discussion group were stated as middle management awareness for things they ought to know, because they were streamlined top-down from the top management, and to some extent they were implicitly incorporated in the middle managers’ actions. Since the S&R framework is primarily a strategic ‘counselor’, when top managers discuss the structure to accomplish the strategy with S&R, they are almost completely free to design the governing principles. In the case of tactical management, the governing principles are more-or-less given and translated to all levels and positions.

D. Role-and-Accountability Diagram: The most important step in the binding of the S&R framework theoretical concepts with the actual business issues is the initial design of the Role-and-Accountability Diagram. Its system design and purposeful nature are generic enough to follow in any instance. However, the conceptual level of ‘roles’ is not bottom-line low as individual employees in job positions, it’s higher than that. It is somewhere in the middle, and is something not intuitive in a matrix organization. Achieving the mindset of a manager to think in terms of roles is quite a challenge – to explain and to implement. It is visible in the naming of the roles, that the confusion of

a role with a position exists for the reader; so it's important to note that sometimes there may be overlaps between the two categories because they are actually conceptualized in that manner in the organization. The design starts from the primary purpose as accountability to the customer role, and is going backwards to the roles and accountabilities necessary to fulfill the primary purpose. The end-result is a Role-and-Accountability Diagram (R&A Diagram) of a system that should produce an effect. It is not a process that delivers outputs; it has no time dimension, and it represents the initial setup that needs to be maintained towards the same purpose in time. Each interaction between two roles is defined with Conditions of Satisfaction (CoS) under which the accountability is valid. The incentives for the members populating any role are placed on successfully fulfilling the accountability (outcome) not on only producing output, which may or may not be what the client asked for. The 'judge' whether something has been accomplished is the customer role (not the provider role). The R&A diagram for the case in Company A is presented on Figure B.2.

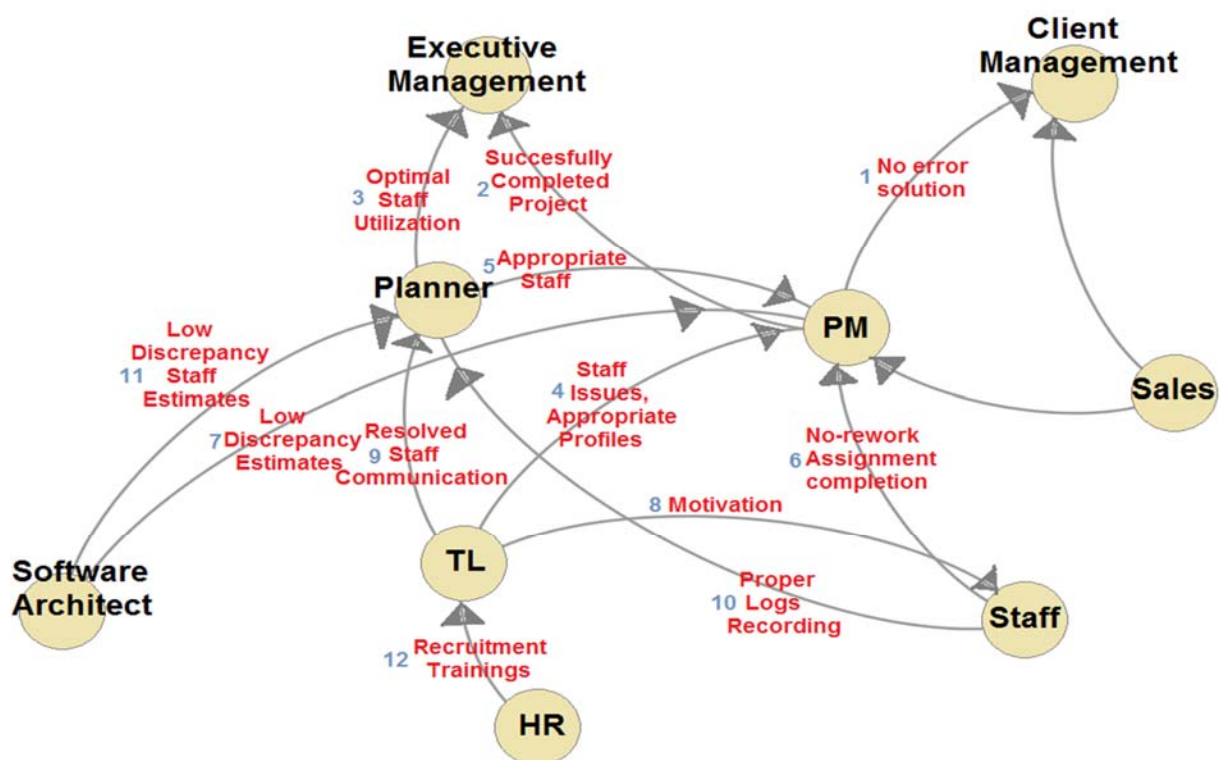


FIGURE B.2 ROLE-AND-ACCOUNTABILITY DIAGRAM FOR ACCOMPLISHING A NO-ERROR SOLUTION TO THE CLIENT (THE GRAPH IS DESIGNED IN GEPHI, BETA VERSION, MODIFIED IN CORELDRAW)

The Conditions of Satisfaction have been summarized in Figure B.4.

The main roles that needed to be clarified to the participants have been described in the worksheet, after the R&A diagram and the CoS (as in Figure B.3) along with brief introductory description for the end-user orientation.

<i>Intro</i>	In this diagram, there are Roles and Outcomes and every role is Accountable for an outcome, not output . The difference is that the Outcome's accomplishment is measured by the Client of that Role (for example, Staff owes to PM No-rework assignment completion, which is not only programming code according Requirements specification but an Outcome that needs No-rework, has little errors, and can be relied upon ...) The behavior of recognizing good work is putting accent on whether the next role is satisfied according agreed. The incentives could be placed here too. In order to fulfil any outcome any role is accountable for, it needs proper Authority and Conditions of Satisfaction (tools, deadlines, rules, budgets, ...)
Project Manager Role	Starting with the Client of Ad Ultima, the PM owes to the client Solution with no errors (1). The client is the judge of that. The PM owes to the Executive Management of Ad Ultima Completed Projects within adjusted Time/Budget/Scope (2). The Management is the judge of that. In order to fulfill these outcomes, the PM needs Assignment completion with few errors (6) by the staff, needs communication of staff issues and also proper staff profiles (trainings, capabilities) (4) by the Team Lead, needs Estimates that are re-adjusted during the lifecycle of the project (7) from the Solution Architect, and needs Appropriate staff according needs and changes (Planning and Adaptation) (5) by the Planner.
Planner Role	The Planner role should have good overview of the portfolio of projects, in order to be able to Deploy limited resources, Track relationships among projects, introduce tasks that add value across projects. As it is now, the planner is either TL or some higher level Manager when late requests are to be settled, or group of PMs on their bi-weekly meetings for regular requests. Additionally, a tool for planning and database of Personnel but also Capabilities is highly recommended. The flow of requests (timely or late) will be streamlined through this role, with appropriate view and authority. To accomplish this, the Planner role needs Initial and Re-calculated staff estimates from Software architect (or someone else who is doing the re-calculation) (11), needs Resolved staff communication (information, feedback, problems, staff issues that disturb planing, (9) ... from the TL and Honest recording of logs about their work (10) from the employees. The planner is accountable to Executive Management for the Outcome of Optimal staff utilization (3).
Team Lead Role	The Team Lead role in this system, is the staff issues - motivation (8), trainings (12), resolving staff communication (9) and communicating all this and providing proper profiles to PMs (4). For that he/she should be alert, communicator, in touch with HR, recruitment, training, incentives and most of all, with the employees.

FIGURE B.3 THE MOST IMPORTANT ROLES THAT NEEDED TO BE ELABORATED WHEN PROPOSING A SOLUTION FOR THE TACTICAL MANAGEMENT ISSUE IN CONTEXT 1

Conditions that Satisfy each Role for the appropriate Outcome				
Interaction	Supplier	Customer	Accountable for Outcome	Conditions of Satisfaction - what one should give to another and vice versa (direction Provider role>Customer role or <)
1	PM	Client Management	No error solution	<Feedback from Testing, Expectations, Problems >Implemented solution that really addresses the client's needs and problems
2	PM	Executive Management	Successfully Completed Project	<Authority, Funding, Communication lines, Tools >Agreed % of non-billable working hours, agreed % of over-budget, over-time, ... projects
3	Planner	Executive Management	Optimal Staff Utilization	>Optimal Staff Utilization (%) <Tools, Techniques training <Authority for overseeing project portfolio and making decisions on staff assignments and movements in order to provide optimal utilization
4	TL	PM	Staff Issues, Appropriate Staff Profiles	>Needs to communicate and resolve staff issues to PM, Provide needed profiles in terms of training, experience, ... <Proper requests for staff profiles, Communication for staff issues within a project
5	Planner	PM	Appropriate Staff	>Offer of staff that is appropriate to the request per profile, skills, capabilities, experience, ... <Proper Requests for appointing/changing staff, with priorities, agreed rules of submitting the requests, ...
6	Staff	PM	No-rework Assignment Completion	>Completion of assignments with low level of rework needed <Appropriate communication on project, expectations, status, feedback, verification, team-member
7	Software Architect	PM	Low Discrepancy Staff Estimates	>Estimates for resources within certain % of error, depending on the stage <Experience and consultation in adjusting the estimate
8	TL	Staff	Motivation	>High level of motivation, staff communication, early detection of problems, solved staff problems, Incentives, Training, Career path, % of max staff turnover <Communication for problems, expectations, conflicts within the team and the projects
9	TL	Planner	Resolved Staff Communication	>Properly communicated employees for changes and assignments <Staff appointments, Reasons for changes
10	Staff	Planner	Proper Logs Recording	>Honest recording of working hours in daily logs of activities <Software environment to record activities with least effort, without duplication
11	Software Architect	Planner	Low Discrepancy Estimates	>Estimates for working hours within certain % of error, depending on the stage <Average calculations per profile or per task, Individual calculations
12	HR	TL	Recruitment, Training	>Efficient Recruitment Process, Appropriate trainings <Proper requests for recruitment and training

FIGURE B.4 CONDITIONS OF SATISFACTION FOR THE ROLE AND ACCOUNTABILITY DIAGRAM, COMPANY A, END-USERS 1-9

In the following, we elaborate on the three most important and mostly changed roles in this system: the Project Management role (PM), the Planner role and the Team Lead role (TL).

Starting with the Client of Company A, the PM owes to the client Solution with no errors (1). The client is the 'judge' of that. The PM owes to the Executive Management of Company A completed projects within adjusted Time/Budget/Scope (2). The Management is the 'judge' of that. In order to fulfill these outcomes, the PM needs assignment completion with least errors (6) by the staff, needs communication of staff issues and also proper staff profiles (trainings, capabilities) (4) by the Team Lead, needs Estimates that are re-adjusted during the lifecycle of the project (7) from the Solution Architect, and needs appropriate staff according to needs and changes (planning and adaptation) (5) by the Planner.

The Planner role should have good overview of the portfolio of projects, in order to be able to deploy limited resources, track relationships among projects, introduce tasks that add value across projects. As it is now, the planner is either a Team Lead or some higher level manager when late requests are to be settled, or group of PMs on their bi-weekly meetings for regular requests. Additionally, a tool for planning and database of personnel but also capabilities is highly recommended. The flow of requests (timely or late) will be streamlined through this role, with appropriate view and authority. To accomplish this, the Planner role needs initial and recalculated staff estimates from Software architect (or someone else who is doing the recalculation) (11), needs resolved staff communication (information, feedback, problems, staff issues that disturb planning, (9) ... from the TL and reliable recording of logs about their work (10) from the employees. The planner is accountable to Executive Management for the outcome of optimal staff utilization (3).

The Team Lead role in this system deals with staff issues - motivation (8), trainings (12), resolving staff communication (9) and communicating all this and providing proper profiles to PMs (4). For that he/she should be alert, communicator, in touch with HR, recruitment, training, incentives and most of all, with the employees.

E. Conditions of Satisfaction: For all the outcomes accountable for, we specified the Conditions of Satisfaction (CoS) that every pair of roles (provider and customer) needs to agree upon in order to be held reliable for that specific outcome. If any change and inability to fulfill those occurs, the CoS are renegotiated to new grounds (Figure B.4).

F. Heads up Displays – addressed with our artifact: The last step of the initial design is the positioning of the information flows that will enable each role to produce what it is accountable for. In the S&R framework this is categorized as 'knowing earlier' and 'finding meaning in the apparent noise'(Haeckel 2004). In the strategic S&R this is on a conceptual level as 'Heads Up Displays' but for tactical management we addressed it to the utmost functionality. This aspect of the artifact will be elaborated in detail in the sub-section describing the BIE cycle performed in Context 2 (sub-section 0), because Context 2 and 4 have passed all the stages of detailed implementation of the DENICA method.

Commitment Management Protocol – addressed with our artifact (discussed in Chapter 5): In order to be able to bring to life the artifact and sustain it in time to produce the desired effect while providing adaptability, the S&R elements need a commitment management protocol – as “a universal and general protocol for assigning, negotiating, performing and assessing accountabilities has been developed that can be used to ensure consistency of execution and intent-i.e. organizational integrity” (Haeckel 1997) (Haeckel 2003) (Lehmann 2012) (Bella & Paulson 2006) (Highsmith 2004). As something being addressed in software solutions to some extent, we intend to provide for future use the component for commitment management that will complete the overall tactical management support.

G. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and effectuating adaptability to changes through the R&A diagram is the last step that initiates the system and maintains it to produce the effects it's designed for. In the Alpha-version where the S&R framework implementation for tactical problem is undertaken the artifact implementation terminates at this point.

B.2. CONTEXT 2

We are designating this section for introducing the complete method DENICA for tactical management information systems and adaptability. We perceived that after verifying how the Sense-and-Respond Framework was implemented in an appropriately difficult context of a matrix organizational structure with project management needs to addresses the identified tactical management issues (elaborated in 0), we can now conceptualize and implement the complete artifact as it was used in Context 2

A, B. Primary constituents and Reason for being: In this instance we firstly framed in words an outcome of the current setting as ‘Least time spent on remote communication for our practitioner’s client management’. The practitioner was consulting his client management in overseeing their project – software development and implementation for Antwerpen’s harbors, while outsourcing software developers from several European countries. The mechanism that led to the primary purpose and reason for being has been the S&R “Who owes what to whom and why the constituent values this outcome” table that helps identify the primary purpose, the so called ‘reason for being’ (Forno 2012). Briefly, by preserving confidentiality, we are presenting (Figure B.5) the most important three outcomes that have been discussed with the end-user 1 and have presented dilemmas which one to go with, ultimately, selecting the first one as primary purpose, that will serve as a design point of the system of roles and accountabilities.

WHO ACCOUNT EXEC (NAM)

OWES

WHAT Primary Outcome Owed This Constituent	TO WHOM Constituent Name	WHY Reason Constituent Values this Outcome
Least time spent on remote communication 	Customer management	Be able to focus on real strategic issues
Facilitating fast implementation of harbor-management solution	End-customers of the customers	Seeing immediate usefulness and pay next tranches
Intermediating staff, end-customers and management	Customer management	Take workload off because of inexperience and focus elsewhere

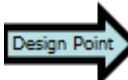
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FIGURE B.5 KEY CONSTITUENT ANALYSIS TABLE AND QUESTION (HAECKEL 2016A) TO ANSWER PRIMARY CONSTITUENTS AND PRIMARY PURPOSE

To briefly discuss the reasoning, one outcome was to facilitate fast implementation of harbor-management solution. This should have been done from our end-user 1 to the end-customers of the customers (meaning the harbor authorities). They would value this outcome because they would see immediate usefulness of the implemented modules and have grounds to go with the next tranches of payment, ultimately finishing the project, and providing smooth outsourcing funding through time for the customer management. Another significant outcome would be to intermediate and clarify the communication flows and channels among staff, end customers and management, because that intersection is always problematic and needs to be handled by experienced intermediary, while the inexperienced management hasn’t been in a position to do so. The first outcome has been taken as design point, our end-user 1 to provide least time spent on remote communication to his customer management, because the outsourcing internationally gave the management daily troubleshooting and problem solving activities which

distracted them from real strategic management issues such as portfolio growth and customer care in a very specialized domain of harbor management software solutions.

C. Governing Principles: The next step in the S&R implementation for tactical management was to discuss Governing Principles. Statements such as ‘always’ or ‘never’ the owner/manager had incorporated in every action because he was the one who introduced and enforced them. This is interesting specifically for a ‘lightweight’ implementation of the artifact in SMEs – having owner/senior/middle/project/operational manager in one person.

D. Role-and-Accountability Diagram: The Role and Accountability Diagram in this instance has been designed after three 2-hour discussions in person and remotely. The resulting system design has been a foundation for orientation of the manager. The discussions have been resulting with writings and sketches on white sheets of paper, that the researcher incorporated in Excel workbook afterwards, and provided the practitioner with them in electronic form. The Workbook consisted of Worksheets with the 4 main elements (visualizations and details): the initial System with Conditions of Satisfaction, the Information Sensors, the Information Emitters and the Risks. As introduced in Chapter 3, by ‘information sensor’ we denote an informational object that is placed (virtually, not physically) to receive information about something prescribed relevant. The information sensor has attributes such as source of the information, frequency of obtaining, manner of obtaining etc. The ‘information emitters’ are also informational objects that have own attributes, and contain information that is being invoked by the user answering a question: ‘what would I like to know that is not told to me, and is relevant for certain outcome?’. The Risks are managerial and informational objects because their content is in the first place risk management-oriented, while at the same time they are informational objects that follow the specific risk management issue. As a handy tool, a Poster with graphical explanation about the Research idea, goal, concepts, and Social Network Analysis graphs for the Tactical Management communication network has been given, in order to make it easier for end-user 1 to further explain to his collaborators (populating the other roles in the system) the change in behavior, communication and expectations during the research project; along with a printed version of the R&A Diagram (Figure B.6).

E. Conditions of Satisfaction: For all the outcomes we specified the Conditions of Satisfaction (CoS) that every pair of roles (provider and customer) needs to agree upon in order to be held accountable for that specific outcome (Figure B.7). They have been fully elaborated and the excerpt is from the actual Excel workbook. The visualization of the R&A diagram has assisted the practitioner to a great extent in communicating the accountabilities and the expectations with all the stakeholders, especially on negotiating Conditions of Satisfaction. The authority level of the Planner came to our viewpoint when populating it with a person from any of the existing departments – it needed a higher and decisive level of authority. This is in line with an important principle of S&R – the entities that are populating the roles need to be in position to fulfill them, otherwise there is no functional role in place. The informational initial adaptability components have been used in full, and some of the managerial adaptability components too. The **Sense-Interpret-Decide-Act Loop** has been activated continuously through the next months and observations and changes have been recorded by the practitioner and communicated with the researcher.

F. Heads up Displays and Commitment Management Protocol have found their realization in our artifact, more specifically in the Information Sensors and Emitters (described in the following paragraph).

By enhancing the existing roadmap of Sense-and-Respond framework; adjusting some of the components for tactical management needs and by introducing new components and sequences for tactical management use, we are offering construction and roadmap for DENICA.

The tactical management method for information systems and managerial adaptability consists of the following components, that complement and enhance the Sense-and-Respond framework of (Haeckel 2016b):

1. **A System of Roles and Accountabilities**, designed according to the Sense-and-Respond Framework principles (Figure B.6)
 - a. Having in mind the Purpose, the End, the Reason for Being
 - b. Visualizing the Role and Accountability Diagram
 - c. Specifying Conditions of Satisfaction for every negotiated outcome accountable for (Figure B.7)
2. **Information Sensors** – what the tactical manager would need to have as information (regardless of the current supply with reports) in order to have overview of his system (Figure B.8)
 - a. Visualizing the Information Sensors per Role and Accountability, around the role of the System Designer – the Tactical Manager (Figure B.9)

- b. Stating the necessary attributes of the Information Sensors which are:
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. the Entity where the tactical manager is placing the Information Sensor,
 - iii. the Type of information to be obtained (Progress feedback, Results, Issues, ...)
 - iv. the Way of obtaining the information (On demand or Event driven)
 - v. Type of content (Qualitative or Quantitative information)
 - vi. Frequency of obtaining the information (Hourly, Daily, Monthly, Quarterly, ...)
- 3. **Information Emitters** – what the tactical manager would like to have been told by the other roles in order to be aware on time for possible issues disturbing the agreed outcomes (Figure B.10)
 - a. Visualizing the Information Emitters per Role, around the role of the System Designer – the Tactical Manager (Figure B.11)
 - b. Stating the necessary attributes of the Information Emitters, which are:
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Emitter (the Role that should emit the specific information)
 - iii. Type of Information (Expectations, Personal issues, Not recording logs, ...)
- 4. **Risk Management** (along with Risk positioning and Information flows) (Figure B.12)
 - a. Visualizing the Risks per role, around the role of the System Designer but to some extent also around all other Roles too (Figure B.13)
 - b. Stating the necessary attributes for Risk Management, which are:
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Sensor, the actual Role or Entity or Business Process or general place where the tactical manager needs to point the 'radar' to in order to receive that signal
 - iii. Risk type (Experience of Management, Lack of knowledge for cross-checking, ...)
 - iv. Probability to happen (1 (low) – 5 (high))
 - v. Impact on the business (1 (low) – 5 (high))
 - vi. Risk Management approach (accept, avoid, transfer, mitigate, contingency plans)

The initial setting for Company B with End-user 1 is visualized in the next figures.

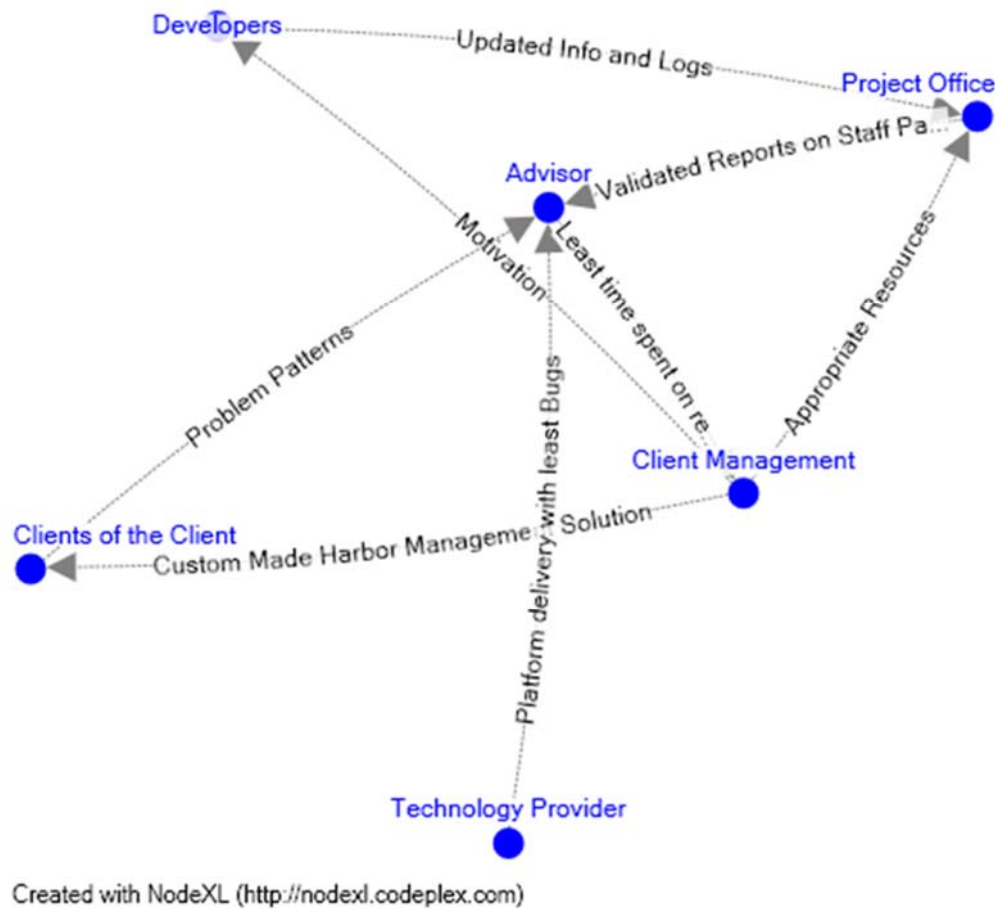


FIGURE B.6 ROLE-AND-ACCOUNTABILITY DIAGRAM FOR ACCOMPLISHING LEAST TIME SPENT ON REMOTE COMMUNICATION (THE GRAPH IS DESIGNED WITH NODEXL PLUGIN FOR EXCEL)

Conditions that Satisfy each Role for the appropriate Outcome				
Interaction	Supplier	Customer	Accountable for Outcome	Conditions of Satisfaction - what one should give to another and vice versa (direction Supplier>Customer or <)
1	Advisor	Client Management	Least time spent on remote communication	< Feedback on strategic change < Periodical Payments > Client Loss
2	Project Office	Advisor	Validated Reports on Staff Parameters	< Clear instructions < Resources, Tools > No flying blind
3	Technology Provider	Advisor	Platform delivery with least Bugs	> Quality platforms < Payment
4	Clients of the Client	Advisor	Problem Patterns	> Time > Feedback > Report on status < Indirect quality loss
5	Client Management	Project Office	Appropriate Resources	> Resources > Tools
6	Developers	Project Office	Updated Info and Logs	< Recording software < Prescribed timings and content
7	Client Management	Developers	Motivation	> Clear assignments > Salary, Incentives
8	Client Management	Clients of the Client	Custom Made Harbor Management Solution	< Money < Clear requirements

FIGURE B.7 CONDITIONS OF SATISFACTION FOR THE ROLE AND ACCOUNTABILITY DIAGRAM FOR COMPANY B, END-USER 1

Information Sensors Details			
Interaction	Interested	Sensor	Type of Information, Way of getting it (On demand/Event driven), Qualitative/Quantitative, Frequency
1	Advisor	Client Management 1	Progress Feedback, QA, On demand, Written/Oral, Bi-weekly
2	Advisor	Client Management 2	Results of TMS, QT, Event driven, Written, Monthly
3	Advisor	Client Management 3	Read between the lines, QA, On demand, Any contact
4	Advisor	Client Management 4	Strategy sessions, QA, on demand, Quarterly
5	Advisor	Advisor 1	Progress Feedback, QA, On demand, Written/Oral, Weekly
6	Advisor	Advisor 2	Meeting minutes, QA, On demand, Per meeting
7	Advisor	Advisor 3	Early warning sign, QA, event driven, per need
8	Advisor	Advisor 4	Improvement, QA, event driven, per need
9	Advisor	Project Office 1	People issues, QA, on demand, in person, weekly
10	Advisor	Project Office 2	Used Tools, QA, on demand, weekly
11	Advisor	Project Office 3	Used System, QT, on demand, logs, weekly
12	Advisor	Technology Provider 1	Updates, Forums, Experiences, QA, On demand, bi-weekly
13	Advisor	Technology Provider 2	Trainings, QA, On demand, bi-weekly
14	Advisor	Technology Provider 3	Colleague opinion on Microsoft, QA, monthly
15	Advisor	Technology Provider 4	Comparison sheets from Microsoft, QA, Event driven,
16	Advisor	Developers 1	Logs, QT, Weekly, on demand
17	Advisor	Developers 2	Mail Communication Cc, QA, Event driven, daily
18	Advisor	Developers 3	People issues, QA, on demand, in person, daily
19	Advisor	Developers 4	More elaborate detailed timesheets, QA, On demand,
20	Advisor	Clients of Client	Steering Committees, QA QT, Event driven, bi-monthly
NEW	Advisor	Developers	Introducing project methodology and follow up
NEW	Advisor	Developers	Depending on Project Daily or Weekly Stand Up meetings
NEW	Advisor	Developers	Resource management, correct allocation of resources

FIGURE B.8 INFORMATION SENSORS, COMPANY B, END-USER 1

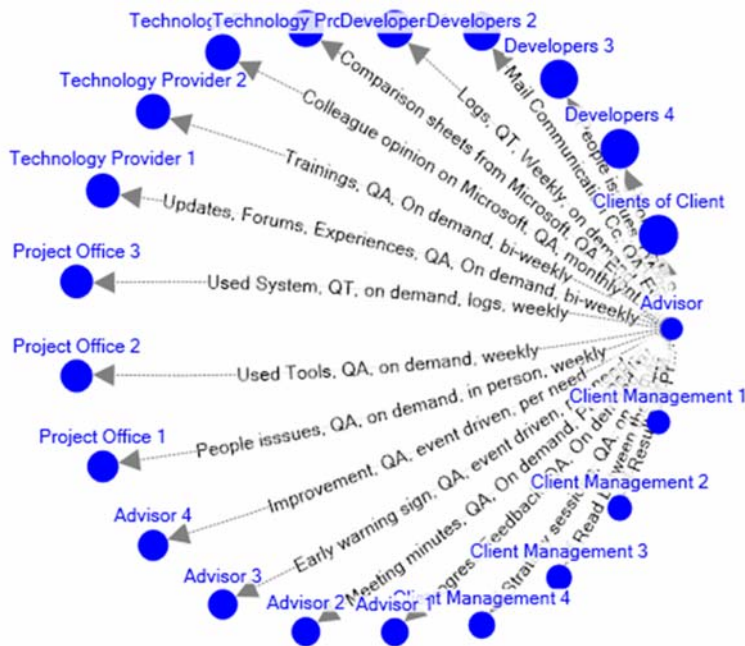


FIGURE B.9 VISUALIZATION (EGO-NETWORK) OF THE INFORMATION SENSORS FOR THE ROLE OF ADVISOR, COMPANY B, END-USER 1

Information Emitters Details			
Interaction	Interested	Emitter	Type of Information
	1	Advisor	Client Management 1
	2	Advisor	Client Management 2
	3	Advisor	Client Management 3
	4	Advisor	Advisor 1
	5	Advisor	Advisor 2
	6	Advisor	Project Office 1
	7	Advisor	Project Office 2
	8	Advisor	Project Office 3
	9	Advisor	Technology Provider 1
	10	Advisor	Technology Provider 2
	11	Advisor	Technology Provider 3
	12	Advisor	Developers 1
	13	Advisor	Developers 2
	14	Advisor	Clients of Client 1
	15	Advisor	Clients of Client 2
NEW	Advisor	Client Management	Financial Information
NEW	Advisor	Client Management	Short, Middle, Long term plan

FIGURE B.10 INFORMATION EMITTERS, COMPANY B, END-USER 1

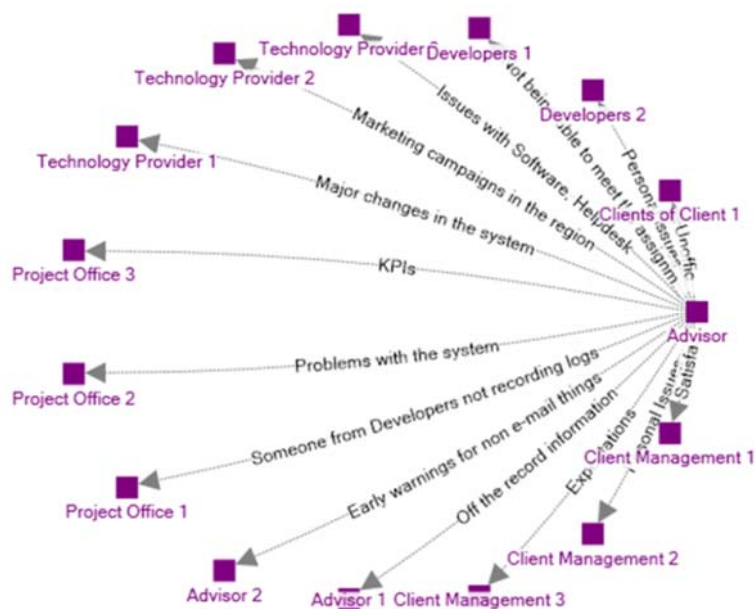


FIGURE B.11 VISUALIZATION (EGO-NETWORK) OF INFORMATION EMITTERS FOR THE ROLE OF ADVISOR, COMPANY B, END-USER 1

Risk Management Details - in view of every PM/TL and other concerned Stakeholders			
Interaction	Interested	Sensor	Risk, Probability to happen (1, 3, 5), Impact on the business (1, 3, 5), Risk Management approach (accept, avoid, transfer, mitigate (try to reduce as much as possible), contingency plans)
1	Advisor	Client Management 1	Experience of Management, 3, 5, Mitigate
2	Advisor	Client Management 2	Dependency on few funding customers, 3, 5, Mitigate
3	Advisor	Client Management 3	Commitment to advisor, 1, 5, Avoid
4	Advisor	Project Office 1	Wrong information in reports, 3, 5, Mitigate with cross-checks
5	Advisor	Project Office 2	Knowledge for producing reports, 1, 5, Contingency plans training
6	Advisor	Project Office 3	Technology in use, 1, 5, Contingency plan backup
7	Advisor	Technology Provider 1	Strategic product changes, 3, 5, can't influence, Accept and adapt
8	Advisor	Technology Provider 2	CRM online hosted, 1, 5, no influence, accept and backups?
9	Advisor	Technology Provider 3	Margins going down, 3, 3, Mitigate diverse business lines
10	Advisor	Clients of Client 2	Reputational, 2, 5, Mitigate
11	Advisor	Clients of Client 3	Withdrawal/On hold, 3, 3, Accept, keep sth smaller
12	Advisor	Developers 1	Commitment, 3, 4, Avoid quitting
13	Advisor	Developers 2	Under-performance, 1, 2, transfer
14	Advisor	Developers 3	Demotivation, 3, 3, Mitigate to keep on board
15	Advisor	Economy	Influencers
16	Advisor	Government	Influencers
17	Advisor	Competitors	Influencers
18	Advisor	Globalization	Influencers
19	Advisor	Market	Influencers
20	Advisor	Domain	Influencers
21	Advisor	Technology Provider 3	Technology transfer, 1, 5, Transfer
22	Advisor	Technology Provider 3	Updates on the system, 4, 2, Mitigate the triangle
23	Advisor	Clients of Client 1	Financials, 2, 5, Avoid by advance and early warning systems

FIGURE B.12 RISK MANAGEMENT (WITH RISK POSITIONING AND INFORMATION FLOWS), COMPANY B, END-USER 1

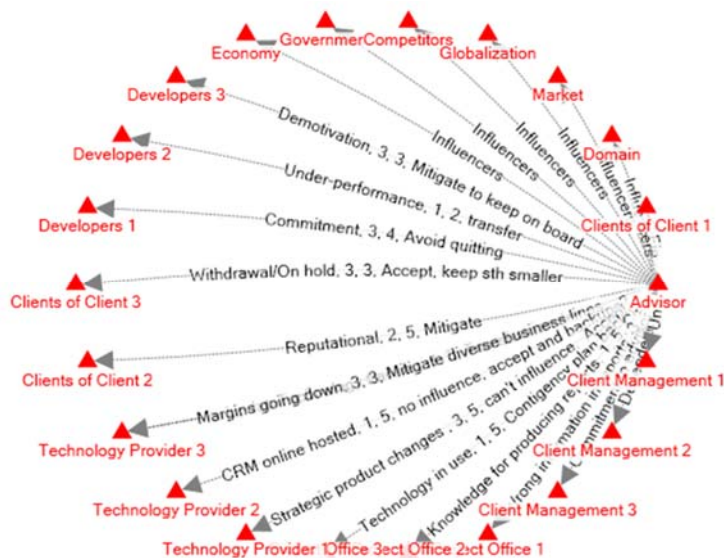


FIGURE B.13 VISUALIZATION (EGO-NETWORK) OF RISK MANAGEMENT FOR THE ROLE OF ADVISOR, COMPANY B, END-USER 1

Our end-user 1 practiced our method in the real business environment in Company B for the discussed tactical management issue for several months, while the entire research collaboration with this practitioner and this specific issue lasted 14 months. It is important to note that since then (almost 3 years in duration), end-user 1 is continuously and successfully implementing our method in real-life situations in several new contexts (organizations and projects).

B.2.1. DYNAMIC ASPECTS OF THE ARTIFACT IMPLEMENTATION IN CONTEXT 2

G. Performing the SIDA loop for continuous scanning of changes and introducing tactical management specific developments and mechanisms. Throughout the months, the practitioner recorded changes in the Excel workbook, and communicated with the researcher on an ongoing basis, via eMail, Skype, in person, ... , with monthly updates on the overall developments.

The first month of use, end-user 1 used the Workbook on a daily basis, trying to streamline the way of approaching everyday work according to the method underlined in the Workbook. After each month, the consolidation session between the researcher and the end-user clarified the necessary additions he needed to introduce, in order for the artifact to work, sustain and thrive in real life. To be more specific, end-user 1 next to every accountability in the R&A Diagram, added his way of micro-managing the SIDA loop, which actually involved planning in the form of a Plan-Do-Check-Act (PDCA) Loop (Figure B.14). This was a formative step (Remenyi & Sherwood-Smith 1999) in the artifact evolution towards a mature Beta-version. The refinement for the Beta-version of the artifact has been more visible in the following components: Information Sensors, Emitters, Risks.

Initial System Design and Conditions of Satisfaction Changes Comparison										
Ini	Supplie	Customer	Accountable for Outcom	Conditions of Satisfaction - what one should give to another and vice versa (direction Supplier>Customer or <)	PLAN	DO	CHECK	ACT	Status	Date
					Reduce inefficient communication between the different affiliates	Actions taken: set up a Single Point of Contact on both sides and make sure all communication is either seen or controlled between them	check on a bi-weekly basis if improvement can be noted (soft info), Check on a weekly basis the time spend on communication (should increase for SPOC, decrease for others)	Evaluate after 1 month, and reinforce message		
1	Advisor	Client Management	Least time spent on remote communication	< Feedback on strategic change < Periodical Payments > Client Loss						September
					Reduce inefficient communication between the different affiliates	Actions taken: set up a Single Point of Contact on both sides and make sure all communication is either seen or controlled between them	check on a bi-weekly basis if improvement can be noted (soft info), Check on a weekly basis the time spend on communication (should increase for SPOC, decrease for others)	Evaluate after 1 month, and reinforce message		
1	Advisor	Client Management	Least time spent on remote communication	< Feedback on strategic change < Periodical Payments > Client Loss					Ongoing	October
					Reduce inefficient communication between the different affiliates	Actions taken: set up a Single Point of Contact on both sides and make sure all communication is either seen or controlled between them	check on a bi-weekly basis if improvement can be noted (soft info), Check on a weekly basis the time spend on communication (should increase for SPOC, decrease for others)	Evaluate after 1 month, and reinforce message	Closed	November
1	Advisor	Client Management	Least time spent on remote	< Feedback on strategic change < Periodical Payments > Client Loss						
					Improve quality and reduce time needed to report	Evaluate current Quality and Businessprocess, start design new softwareprocess to give better support	Projectplan for this is in place, needs follow up in bi-weekly MT meetings			September
2	Project Office	Advisor	Validated Reports on Staff Parameters	< Clear instructions < Resources, Tools > No flying blind						
					Improve quality and reduce time needed to report	Evaluate current Quality and Businessprocess, start design new softwareprocess to give better support	Projectplan for this is in place, needs follow up in bi-weekly MT meetings			September
2	Project Office	Advisor	Validated Reports on Staff Parameters	< Clear instructions < Resources, Tools > No flying blind					Ongoing	October
					Improve quality and reduce time needed to report	Evaluate current Quality and Businessprocess, start design new softwareprocess to give better support	Projectplan for this is in place, needs follow up in bi-weekly MT meetings		Ongoing	
2	Project Office	Advisor	Validated Reports on Staff Parameters	< Clear instructions < Resources, Tools > No flying blind						November
					increase knowledge within own company at an early stage, to reduce "surprises" when software versions change.	Discuss whether it is a separate task that needs to be assigned to Product Management and budget needs to be allocated.				September
3	Technology Provider	Advisor	Platform delivery with least Bugs	> Quality platforms < Payment						
					increase knowledge within own company at an early stage, to reduce "surprises" when software versions change.	Discuss whether it is a separate task that needs to be assigned to Product Management and budget needs to be allocated.			Not Started	October
3	Technology Provider	Advisor	Platform delivery with least Bugs	> Quality platforms < Payment			Subject is Assigned to newly appointed Product Manager	Monthly Information to MT	Initiated	
					increase knowledge within own company at an early stage, to reduce "surprises" when software versions change.	Discuss whether it is a separate task that needs to be assigned to Product Management and budget needs to be allocated.				November
4	Clients of the Client	Advisor	Problem Patterns	> Time > Feedback > Report on status < Indirect quality loss						September
4	Clients of the Client	Advisor	Problem Patterns	> Time > Feedback > Report on status < Indirect quality loss					Initiated	October
4	Clients of the Client	Advisor	Problem Patterns	> Time > Feedback > Report on status < Indirect quality loss	Steering committees and informal phone calls to customer projectleader	For each ongiong project make sure the meetings and phonecalls are planned and executed	Check results with Projectleaders	Integrated part of project charter, resulats are already visible	Ongoing	November

5	Client Management	Project Office	Appropriate Resources	> Resources > Tools		Evaluate current Quality and Businessprocess, start design new softwareprocess to give better support	Projectplan for this is in place, needs follow up in bi-weekly MT meetings			September
5	Client Management	Project Office	Appropriate Resources	> Resources > Tools		Evaluate current Quality and Businessprocess, start design new softwareprocess to give better support	Projectplan for this is in place, needs follow up in bi-weekly MT meetings		Initiated	October
5	Client Management	Project Office	Appropriate Resources	> Resources > Tools		Evaluate current Quality and Businessprocess, start design new softwareprocess to give better support	Projectplan for this is in place, needs follow up in bi-weekly MT meetings		Ongoing	November
6	Developers	Project Office	Updated Info and Logs	< Recording software < Prescribed timings and content						September
6	Developers	Project Office	Updated Info and Logs	< Recording software < Prescribed timings and content					Closed	October
6	Developers	Project Office	Updated Info and Logs	< Recording software < Prescribed timings and content						November
7	Client Management	Developers	Motivation	> Clear assignments > Salary, Incentives	Create a healthy HR view that sees resources not only as that but also as individuals and create personalised plans for them.	Review current way of working and come up with a plan before next evaluation round.	Plan needs to be presented in MT meeting end of November beginning December.			September
7	Client Management	Developers	Motivation	> Clear assignments > Salary, Incentives	Create a healthy HR view that sees resources not only as that but also as individuals and create personalised plans for them.	Review current way of working and come up with a plan before next evaluation round.	Plan needs to be presented in MT meeting end of November beginning December.		Not Started	October
7	Client Management	Developers	Motivation	> Clear assignments > Salary, Incentives	Create a healthy HR view that sees resources not only as that but also as individuals and create personalised plans for them.	Review current way of working and come up with a plan before next evaluation round.	Plan needs to be presented in MT meeting end of November beginning December.	Present Plan to MT	Initiated	November
8	Client Management	Clients of the Client	Custom Made Harbor Management Solution	< Money < Clear requirements	Now that the funding clients are basically working on the solution it is time to formalise the procedures for the future. We are no longer in Projectphase, It is now operationsphase	Discuss with the clients the roadmap for the coming 2 years. Decide about the Change Requests that are on the table. Agree to enter the "Support" mode instead of the "Project" mode.	Meetings need to be planned in the coming 2 months and consensus needs to be reached about the priorities of both the customers and the supplier.			September
8	Client Management	Clients of the Client	Custom Made Harbor Management Solution	< Money < Clear requirements	Now that the funding clients are basically working on the solution it is time to formalise the procedures for the future. We are no longer in Projectphase, It is now operationsphase	Discuss with the clients the roadmap for the coming 2 years. Decide about the Change Requests that are on the table. Agree to enter the "Support" mode instead of the "Project" mode.	Meetings need to be planned in the coming 2 months and consensus needs to be reached about the priorities of both the customers and the supplier.		Initiated	October
8	Client Management	Clients of the Client	Custom Made Harbor Management Solution	< Money < Clear requirements	Now that the funding clients are basically working on the solution it is time to formalise the procedures for the future. We are no longer in Projectphase, It is now operationsphase	Discuss with the clients the roadmap for the coming 2 years. Decide about the Change Requests that are on the table. Agree to enter the "Support" mode instead of the "Project" mode.	Meetings need to be planned in the coming 2 months and consensus needs to be reached about the priorities of both the customers and the supplier.	Meetings have taken place, and negotiations are going on	Ongoing	November

FIGURE B.14 DYNAMIC DATA FOR CONDITIONS OF SATISFACTION WITH MONTHLY FOLLOW UP AND PDCA LOOP ADDITION IN CONTEXT 2

With this act, the end-user introduced the activities that enabled reinforcement of the stability of the system in order to perform properly and improve over time. The SIDA + the PDCA Loops initiated revisions for each entity, relationship or activity, ranging from daily to bi-monthly. This indicated the researchers that tactical managers need to obtain information suddenly in numerous occasions in order to see what is going wrong and correct it; but also on purpose – in order to enforce some planned improvement. In the next month, the manager had the need to monitor the status of the planned action so he introduced the ‘Status’ field (Initiated, Ongoing, Closed, Not Started). The dynamics of this field and actually of the content of Interpret-Decide-Act stages is visible in the comparison through three months on Figure B.15.

Regarding the Information Sensors, the End-user introduced a field to indicate whether each specific sensor is in place and working (Yes/No) and comments on the initially defined indicators for the sensor (Figure B.15). Also, during the second month, he clarified ‘Frequency of check’ and current ‘Status’. Our quest for latencies and pointing out the widest scope, content and manner of obtaining information has been revealed in this instance. Namely, some

of the sensors have been introduced, some have been disabled, some have changed frequency or have been specified more deeply. All the context facets (device, user, task, data source, document representation, time, geographic location) have recorded changes and changed category – which is one of the most important issues investigated in the research that the information needs for tactical management are not in the form of rigid report structure but are very dynamic and require a flexible informational structure and content.

Information Sensors Comparison									
Interaction	Interested	Sensor	Type of Information, Way of getting it (On demand/Event driven), Qualitative/Quantitative, Frequency	Working Y/N	Comments	Frequency of Check	Status	Date	
1	Advisor	Client Management 1	Progress Feedback, QA, On demand, Written/Oral, Bi-weekly		Bi-weekly			September	
1	Advisor	Client Management 1	Progress Feedback, QA, On demand, Written/Oral, Bi-weekly	Y	Increase frequency to weekly		Initiated	October	
1	Advisor	Client Management 1	Progress Feedback, QA, On demand, Written/Oral, Bi-weekly	Y	Increase frequency to weekly	Weekly	Ongoing	November	
2	Advisor	Client Management 2	Results of TMS, QT, Event driven, Written, Monthly					September	
2	Advisor	Client Management 2	Results of TMS, QT, Event driven, Written, Monthly	Y	first Meeting Held, finetuning needed		Initiated	October	
2	Advisor	Client Management 2	Results of TMS, QT, Event driven, Written, Monthly	Y	first Meeting Held, finetuning needed	Bi-Weekly	Ongoing	November	
3	Advisor	Client Management 3	Read between the lines, QA, On demand, Any contact					September	
3	Advisor	Client Management 3	Read between the lines, QA, On demand, Any contact	Y				October	
3	Advisor	Client Management 3	Read between the lines, QA, On demand, Any contact	Y		Daily	Ongoing	November	
4	Advisor	Client Management 4	Strategy sessions, QA, on demand, Quarterly					September	
4	Advisor	Client Management 4	Strategy sessions, QA, on demand, Quarterly	N	not involved yet		Not Started	October	
4	Advisor	Client Management 4	Strategy sessions, QA, on demand, Quarterly	N	not involved yet	Quarterly	Initiated	November	
5	Advisor	Advisor 1	Progress Feedback, QA, On demand, Written/Oral, Weekly					September	
5	Advisor	Advisor 1	Progress Feedback, QA, On demand, Written/Oral, Weekly				Closed	October	
5	Advisor	Advisor 1	Progress Feedback, QA, On demand, Written/Oral, Weekly					November	
6	Advisor	Advisor 2	Meeting minutes, QA, On demand, Per meeting					September	
6	Advisor	Advisor 2	Meeting minutes, QA, On demand, Per meeting				Closed	October	
6	Advisor	Advisor 2	Meeting minutes, QA, On demand, Per meeting					November	
7	Advisor	Advisor 3	Early warning sign, QA, event driven, per need					September	
7	Advisor	Advisor 3	Early warning sign, QA, event driven, per need				Closed	October	
7	Advisor	Advisor 3	Early warning sign, QA, event driven, per need					November	
8	Advisor	Advisor 4	Improvement, QA, event driven, per need					September	
8	Advisor	Advisor 4	Improvement, QA, event driven, per need				Closed	October	
8	Advisor	Advisor 4	Improvement, QA, event driven, per need					November	
9	Advisor	Project Office 1	People issues, QA, on demand, in person, weekly					September	
9	Advisor	Project Office 1	People issues, QA, on demand, in person, weekly	Y	in place and working		Initiated	October	
9	Advisor	Project Office 1	People issues, QA, on demand, in person, weekly	Y	in place and working	Weekly	Ongoing	November	
10	Advisor	Project Office 2	Used Tools, QA, on demand, weekly					September	
10	Advisor	Project Office 2	Used Tools, QA, on demand, weekly	N	postponed until 2015		Closed	October	
10	Advisor	Project Office 2	Used Tools, QA, on demand, weekly	N	postponed until 2015			November	
11	Advisor	Project Office 3	Used System, QT, on demand, logs, weekly					September	
11	Advisor	Project Office 3	Used System, QT, on demand, logs, weekly	Y	in place and working		Initiated	October	
11	Advisor	Project Office 3	Used System, QT, on demand, logs, weekly	Y	in place and working	Weekly	Ongoing	November	
12	Advisor	Technology Provider 1	Updates, Forums, Experiences, QA, On demand, bi-weekly					September	
12	Advisor	Technology Provider 1	Updates, Forums, Experiences, QA, On demand, bi-weekly	Y	frequency fluctuates		Initiated	October	
12	Advisor	Technology Provider 1	Updates, Forums, Experiences, QA, On demand, bi-weekly	Y	frequency fluctuates, general newsletter created	Monthly	Ongoing	November	
13	Advisor	Technology Provider 2	Trainings, QA, On demand, bi-weekly					September	
13	Advisor	Technology Provider 2	Trainings, QA, On demand, bi-weekly	Y	Trainingplan for personnell has been set up		Initiated	October	
13	Advisor	Technology Provider 2	Trainings, QA, On demand, bi-weekly	Y	Trainingplan for personnell has been set up	Monthly	Ongoing	November	
14	Advisor	Technology Provider 3	Colleague opinion on Microsoft, QA, monthly					September	
14	Advisor	Technology Provider 3	Colleague opinion on Microsoft, QA, monthly	N	Need to implement this			October	
14	Advisor	Technology Provider 3	Colleague opinion on Microsoft, QA, monthly	N	Need to implement this		Closed	November	
15	Advisor	Technology Provider 4	Comparison sheets from Microsoft, QA, Event driven,					September	
15	Advisor	Technology Provider 4	Comparison sheets from Microsoft, QA, Event driven,	N	obsolete		Closed	October	
15	Advisor	Technology Provider 4	Comparison sheets from Microsoft, QA, Event driven,	N	obsolete			November	
16	Advisor	Developers 1	Logs, QT, Weekly, on demand					September	
16	Advisor	Developers 1	Logs, QT, Weekly, on demand	Y	in place and working		Initiated	October	
16	Advisor	Developers 1	Logs, QT, Weekly, on demand	Y	in place and working	Weekly	Ongoing	November	
17	Advisor	Developers 2	Mail Communication Cc, QA, Event driven, daily					September	
17	Advisor	Developers 2	Mail Communication Cc, QA, Event driven, daily	N	still a lot of bidirectional contacts		Initiated	October	
17	Advisor	Developers 2	Mail Communication Cc, QA, Event driven, daily	N	still a lot of bidirectional contacts	Daily	Initiated	November	
18	Advisor	Developers 3	People issues, QA, on demand, in person, daily					September	
18	Advisor	Developers 3	People issues, QA, on demand, in person, daily	N	distance (ANTW/KIEV), need to find better solution for this.		Initiated	October	
18	Advisor	Developers 3	People issues, QA, on demand, in person, daily	N	distance (ANTW/KIEV), need to find better solution for this.	Monthly	Ongoing	November	
19	Advisor	Developers 4	More elaborate detailed timesheets, QA, On demand,					September	
19	Advisor	Developers 4	More elaborate detailed timesheets, QA, On demand,	Y	in place, takes lot of time to guard		Initiated	October	
19	Advisor	Developers 4	More elaborate detailed timesheets, QA, On demand,	Y	in place, takes lot of time to guard	Weekly	Ongoing	November	
20	Advisor	Clients of Client	Steering Committees, QA QT, Event driven, bi-monthly					September	
20	Advisor	Clients of Client	Steering Committees, QA QT, Event driven, bi-monthly	Y	Just started, first experiences are good !		Initiated	October	
20	Advisor	Clients of Client	Steering Committees, QA QT, Event driven, bi-monthly	Y	Just started, first experiences are good !	Monthly	Ongoing	November	
new	Advisor	Developers 5	Introducing project methodology and follow up	Y	Monthly meetings to increase knowledge	Monthly	Initiated	November	
new	Advisor	Developers 6	Depending on Project Daily or Weekly Stand Up meetings	Y	Daily or Weekly project meetings	Daily	Initiated	November	
new	Advisor	Developers 7	Resource management, correct allocation of resources	Y	Weekly planning and resource meeting	Weekly	Initiated	November	

FIGURE B.15 DYNAMIC DATA FOR INFORMATION SENSORS WITH MONTHLY FOLLOW UP IN CONTEXT 2

Regarding Information Emitters, the situation has been developing similarly to the Information Sensors (Figure B.16).

The Information Emitters Worksheet has received additional fields for whether the end-user 1 is Receiving information from that Emitter (Yes/No), what Action is taken to introduce or maintain that Emitter, and Status of the Emitter.

Information Emitters Comparison							
Interaction	Interested	Emitter	Type of Information	Receiving Information (Y/N)	Action	Status	Date
1	Advisor	Client Management 1	Satisfaction from the Advisor	Y			September
1	Advisor	Client Management 1	Satisfaction from the Advisor	Y		Closed	October
1	Advisor	Client Management 1	Satisfaction from the Advisor	Y			November
2	Advisor	Client Management 2	Personal Issues	N	Requested informal dinner		September
2	Advisor	Client Management 2	Personal Issues	N	Requested informal dinner	Initiated	October
2	Advisor	Client Management 2	Personal Issues	Y	Requested informal dinner	Ongoing	November
3	Advisor	Client Management 3	Expectations	Y			September
3	Advisor	Client Management 3	Expectations	Y		Closed	October
3	Advisor	Client Management 3	Expectations	Y		Initiated	November
4	Advisor	Advisor 1	Off the record information	N	Relationship needs to develop in the coming months		September
4	Advisor	Advisor 1	Off the record information	N	Relationship needs to develop in the coming months	Initiated	October
4	Advisor	Advisor 1	Off the record information	Y	Relationship needs to develop in the coming months	Ongoing	November
5	Advisor	Advisor 2	Early warnings for non e-mail things	N	Relationship needs to develop in the coming months		September
5	Advisor	Advisor 2	Early warnings for non e-mail things	N	Relationship needs to develop in the coming months	Initiated	October
5	Advisor	Advisor 2	Early warnings for non e-mail things	N	Relationship needs to develop in the coming months		November
6	Advisor	Project Office 1	Someone from Developers not recording logs	Y	Simple xls report has been created on a daily basis		September
6	Advisor	Project Office 1	Someone from Developers not recording logs	Y	Simple xls report has been created on a daily basis	Ongoing	October
6	Advisor	Project Office 1	Someone from Developers not recording logs	Y	Simple xls report has been created on a daily basis	Ongoing	November
7	Advisor	Project Office 2	Problems with the system	Y/N	Project plan for improvement has been started		September
7	Advisor	Project Office 2	Problems with the system	Y/N	Project plan for improvement has been started	Initiated	October
7	Advisor	Project Office 2	Problems with the system	Y/N	Project plan for improvement has been started		November
8	Advisor	Project Office 3	KPIs	N			September
8	Advisor	Project Office 3	KPIs	N		Not Started	October
8	Advisor	Project Office 3	KPIs	N	Plan has been made	Initiated	November
9	Advisor	Technology Provider 1	Major changes in the system	N	Internal discussion on best way to handle this		September
9	Advisor	Technology Provider 1	Major changes in the system	N	Internal discussion on best way to handle this	Not Started	October
9	Advisor	Technology Provider 1	Major changes in the system	N	New Product Manager has been assigned	Initiated	November
10	Advisor	Technology Provider 2	Marketing campaigns in the region	Y	made inventory on all newsletters everybody is receiving and redirected them to a separate mailbox		September
10	Advisor	Technology Provider 2	Marketing campaigns in the region	Y	made inventory on all newsletters everybody is receiving and redirected them to a separate mailbox	Initiated	October
10	Advisor	Technology Provider 2	Marketing campaigns in the region	Y	made inventory on all newsletters everybody is receiving and redirected them to a separate mailbox	Ongoing	November
11	Advisor	Technology Provider 3	Issues with Software, Helpdesk	N	not clear yet		September
11	Advisor	Technology Provider 3	Issues with Software, Helpdesk	N	not clear yet	Not Started	October
11	Advisor	Technology Provider 3	Issues with Software, Helpdesk	N	not clear yet		November
12	Advisor	Developers 1	Not being able to meet the assignment	Y	By improving communication (SPOC) we have a much better idea on what is going on (in theory, this needs to be proven by experience)		September
12	Advisor	Developers 1	Not being able to meet the assignment	Y	By improving communication (SPOC) we have a much better idea on what is going on (in theory, this needs to be proven by experience)	Initiated	October
12	Advisor	Developers 1	Not being able to meet the assignment	Y	By improving communication (SPOC) we have a much better idea on what is going on (in theory, this needs to be proven by experience)	Ongoing	November
13	Advisor	Developers 2	Personal issues	N			September
13	Advisor	Developers 2	Personal issues	N		Closed	October
13	Advisor	Developers 2	Personal issues	N			November
14	Advisor	Clients of Client 1	Unofficial wrong things with the project	N	Information is given but directly to CEO in stead of me (COO)		September
14	Advisor	Clients of Client 1	Unofficial wrong things with the project	N	Information is given but directly to CEO in stead of me (COO)	Not Started	October
14	Advisor	Clients of Client 1	Unofficial wrong things with the project	Y	Information is given but directly to CEO in stead of me (COO)	Initiated	November
15	Advisor	Clients of Client 2	Personnel team changes (ex. PM)	Y	Is now part of the project charter and as such addressed. Need to see how this will work in practise		September
15	Advisor	Clients of Client 2	Personnel team changes (ex. PM)	Y	Is now part of the project charter and as such addressed. Need to see how this will work in practise	Initiated	October
15	Advisor	Clients of Client 2	Personnel team changes (ex. PM)	Y	Is now part of the project charter and as such addressed. Need to see how this will work in practise	Ongoing	November
NEW	Advisor	Client Management	Financial Information	N	Need to know more to make correct decisions	Initiated	November
NEW	Advisor	Client Management	Short, Middle, Long term plan	N	Need to know more to make correct decisions	Initiated	November

FIGURE B.16 DYNAMIC DATA FOR INFORMATION EMITTERS WITH MONTHLY FOLLOW-UP IN CONTEXT 2

The Risks management component of the method, which provides awareness of what may go wrong with what a role is accountable for, is also exhibiting genuine additions (Figure B.17). Throughout the period of working with the method, end-user 1 introduced the field 'Change in Risk Probability to Happen' and 'Impact to Business' as something very important to follow; 'Comment' on the actions and 'Status' on the sensor and the actual risk. Also, content-wise in this category, there is a type of risk called 'Influencers', which are entities and developments one can't change or influence, but they are influencing to a large extent the business and the outcomes of the company. These information flows are broadening the scope usually observed by tactical managers, because of being treated as something out-of-scope. However, these information flows are of big importance to our research trying to map the broadest scope of information entities for tactical management purposes. Throughout the months, the variations in the risk sensors have been from: not initiated, initiated, ongoing, closed, but also reopened.

Risks Comparison							
Interaction	Interested	Sensor	Risk, Probability to happen (1, 3, 5), Impact on the business (1, 3, 5), Risk Management approach (accept, avoid, transfer, mitigate (try to reduce as much as possible), contingency plans)	Change	Comment	Status	Date
1	Advisor	Client Management 1	Experience of Management, 3, 5, Mitigate	3,5			September
1	Advisor	Client Management 1	Experience of Management, 3, 5, Mitigate	3,3	External counseling in place now	Ongoing	October
1	Advisor	Client Management 1	Experience of Management, 3, 5, Mitigate	3,3	External counseling in place now	Ongoing	November
2	Advisor	Client Management 2	Dependency on few funding customers, 3, 5, Mitigate				September
2	Advisor	Client Management 2	Dependency on few funding customers, 3, 5, Mitigate	same	Takes a lot of Management time	Ongoing	October
2	Advisor	Client Management 2	Dependency on few funding customers, 3, 5, Mitigate	3,5	Takes a lot of Management time	Ongoing	November
3	Advisor	Client Management 3	Commitment to advisor, 1, 5, Avoid				September
3	Advisor	Client Management 3	Commitment to advisor, 1, 5, Avoid	same	In depth conversations about future role	Ongoing	October
3	Advisor	Client Management 3	Commitment to advisor, 1, 5, Avoid	1,5	In depth conversations about future role	Closed	November
4	Advisor	Project Office 1	Wrong information in reports, 3, 5, Mitigate with cross-checks	3,5			September
4	Advisor	Project Office 1	Wrong information in reports, 3, 5, Mitigate with cross-checks	3,3	lower impact due to in place cross reference	Closed	October
4	Advisor	Project Office 1	Wrong information in reports, 3, 5, Mitigate with cross-checks	3,3	low impact due to in place cross reference		November
5	Advisor	Project Office 2	Knowledge for producing reports, 1, 5, Contingency plans training	1,5			September
5	Advisor	Project Office 2	Knowledge for producing reports, 1, 5, Contingency plans training	1,3	first 2 trainingsessions have taken place	Ongoing	October
5	Advisor	Project Office 2	Knowledge for producing reports, 1, 5, Contingency plans training	1,3	first 2 trainingsessions have taken place	Ongoing	November
6	Advisor	Project Office 3	Technology in use, 1, 5, Contingency plan backup	1,5			September
6	Advisor	Project Office 3	Technology in use, 1, 5, Contingency plan backup	3,5	increased due to postponing till next year	Ongoing	October
6	Advisor	Project Office 3	Technology in use, 1, 5, Contingency plan backup	3,5	increased due to postponing till next year	Ongoing	November
7	Advisor	Technology Provider 1	Strategic product changes , 3, 5, can't influence, Accept and adapt				September
7	Advisor	Technology Provider 1	Strategic product changes , 3, 5, can't influence, Accept and adapt	same	Status Quo	Closed	October
7	Advisor	Technology Provider 1	Strategic product changes , 3, 5, can't influence, Accept and adapt	3,5	Status Quo		November
8	Advisor	Technology Provider 2	CRM online hosted, 1, 5, no influence, accept and backups?				September
8	Advisor	Technology Provider 2	CRM online hosted, 1, 5, no influence, accept and backups?	same	Status Quo	Closed	October
8	Advisor	Technology Provider 2	CRM online hosted, 1, 5, no influence, accept and backups?	1,5	Status Quo		November
9	Advisor	Technology Provider 3	Margins going down, 3, 3, Mitigate diverse business lines				September
9	Advisor	Technology Provider 3	Margins going down, 3, 3, Mitigate diverse business lines	same	First customer in new market is scored -)	Ongoing	October
9	Advisor	Technology Provider 3	Margins going down, 3, 3, Mitigate diverse business lines	3,3	First customer in new market is scored -)	Ongoing	November
10	Advisor	Clients of Client 2	Reputational, 2, 5, Mitigate				September
10	Advisor	Clients of Client 2	Reputational, 2, 5, Mitigate		Not enough feedback yet	Ongoing	October
10	Advisor	Clients of Client 2	Reputational, 2, 5, Mitigate		Not enough feedback yet	Ongoing	November
11	Advisor	Clients of Client 3	Withdrawal/On hold, 3, 3, Accept, keep sth smaller				September
11	Advisor	Clients of Client 3	Withdrawal/On hold, 3, 3, Accept, keep sth smaller		Not enough feedback yet	Ongoing	October
11	Advisor	Clients of Client 3	Withdrawal/On hold, 3, 3, Accept, keep sth smaller		Not enough feedback yet	Ongoing	November
12	Advisor	Developers 1	Commitment, 3, 4, Avoid quitting	3,4			September
12	Advisor	Developers 1	Commitment, 3, 4, Avoid quitting	3,3	New recruits hired to spread risk	Closed	October
12	Advisor	Developers 1	Commitment, 3, 4, Avoid quitting	3,3	New recruits hired to spread risk	Reopened	November
13	Advisor	Developers 2	Under-performance, 1, 2, transfer				September
13	Advisor	Developers 2	Under-performance, 1, 2, transfer	same	Not enough feedback yet	Initiated	October
13	Advisor	Developers 2	Under-performance, 1, 2, transfer	1,2	Not enough feedback yet	Ongoing	November
14	Advisor	Developers 3	Demotivation, 3, 3, Mitigate to keep on board				September
14	Advisor	Developers 3	Demotivation, 3, 3, Mitigate to keep on board	same	Presenting adjusted Business Plan & Personell Development plan in December	Initiated	October
14	Advisor	Developers 3	Demotivation, 3, 3, Mitigate to keep on board	3,3	Presenting adjusted Business Plan & Personell Development plan in December	Ongoing	November
15	Advisor	Economy	Influencers				September
15	Advisor	Economy	Influencers			Closed	October
15	Advisor	Economy	Influencers				November
16	Advisor	Government	Influencers				September
16	Advisor	Government	Influencers			Closed	October
16	Advisor	Government	Influencers				November
17	Advisor	Competitors	Influencers				September
17	Advisor	Competitors	Influencers			Closed	October
17	Advisor	Competitors	Influencers				November
18	Advisor	Globalization	Influencers				September
18	Advisor	Globalization	Influencers			Closed	October
18	Advisor	Globalization	Influencers				November
19	Advisor	Market	Influencers				September
19	Advisor	Market	Influencers			Closed	October
19	Advisor	Market	Influencers				November
20	Advisor	Domain	Influencers				September
20	Advisor	Domain	Influencers			Closed	October
20	Advisor	Domain	Influencers				November
21	Advisor	Technology Provider 3	Technology transfer, 1, 5, Transfer				September
21	Advisor	Technology Provider 3	Technology transfer, 1, 5, Transfer			Not Started	October
21	Advisor	Technology Provider 3	Technology transfer, 1, 5, Transfer	1,3	With appointing new Product Manager more control	Initiated	November
22	Advisor	Technology Provider 3	Updates on the system, 4, 2, Mitigate the triangle				September
22	Advisor	Technology Provider 3	Updates on the system, 4, 2, Mitigate the triangle				October
22	Advisor	Technology Provider 3	Updates on the system, 4, 2, Mitigate the triangle				November
23	Advisor	Clients of Client 1	Financials, 2, 5, Avoid by advance and early warning systems				September
23	Advisor	Clients of Client 1	Financials, 2, 5, Avoid by advance and early warning systems			Not Started	October
23	Advisor	Clients of Client 1	Financials, 2, 5, Avoid by advance and early warning systems	1,5	Contacts with credit control buro have been signed	Initiated	November

FIGURE B.17 DYNAMIC DATA FOR RISK MANAGEMENT WITH MONTHLY FOLLOW-UP IN CONTEXT 2

The real essence of the adaptability supported by the S&R framework can be observed in the evolution of the R&A diagram (Figure B.18). Namely, throughout time, a new role (Financial consulting) was introduced, and accountabilities it owed to other roles (Figure B.19). Another significant event has been that after sustaining of the system adapting throughout the year, when the primary purpose of the system changed from Least time spent on remote communication to Know before the client (proactivity) and serve with high quality (retention) because the Advisor maintained the business relation with the same clients but needed to enlarge the advising role with new content – the system had to be redesigned completely (Figure B.20)(Figure B.21).

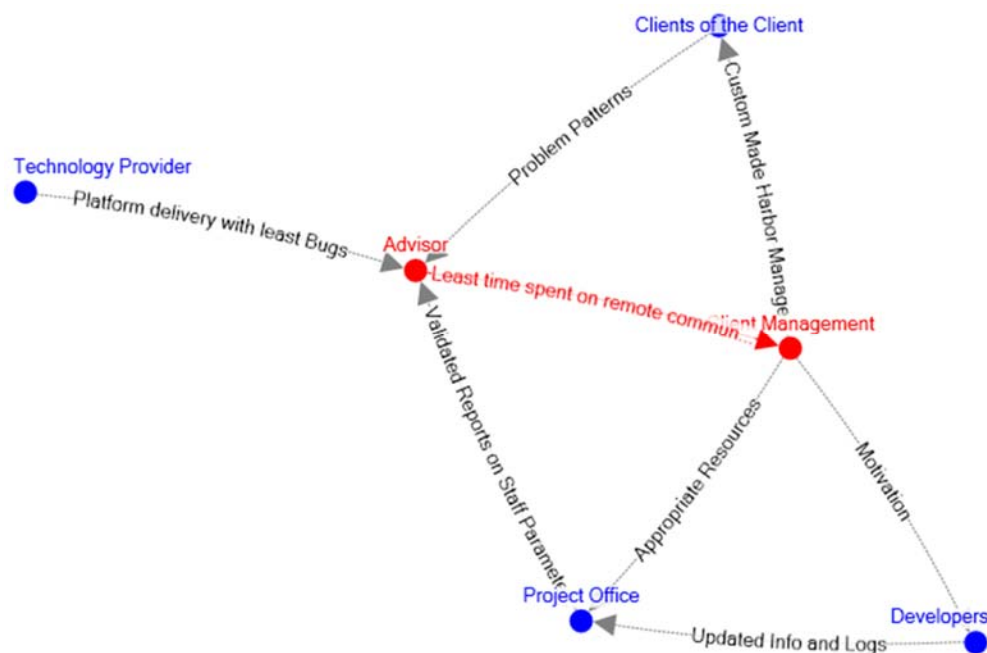


FIGURE B.18 ROLE AND ACCOUNTABILITY DIAGRAM – INITIAL VERSION, COMPANY B, END-USER 1 (AUTOMATIC DESIGN IN NODEXL)

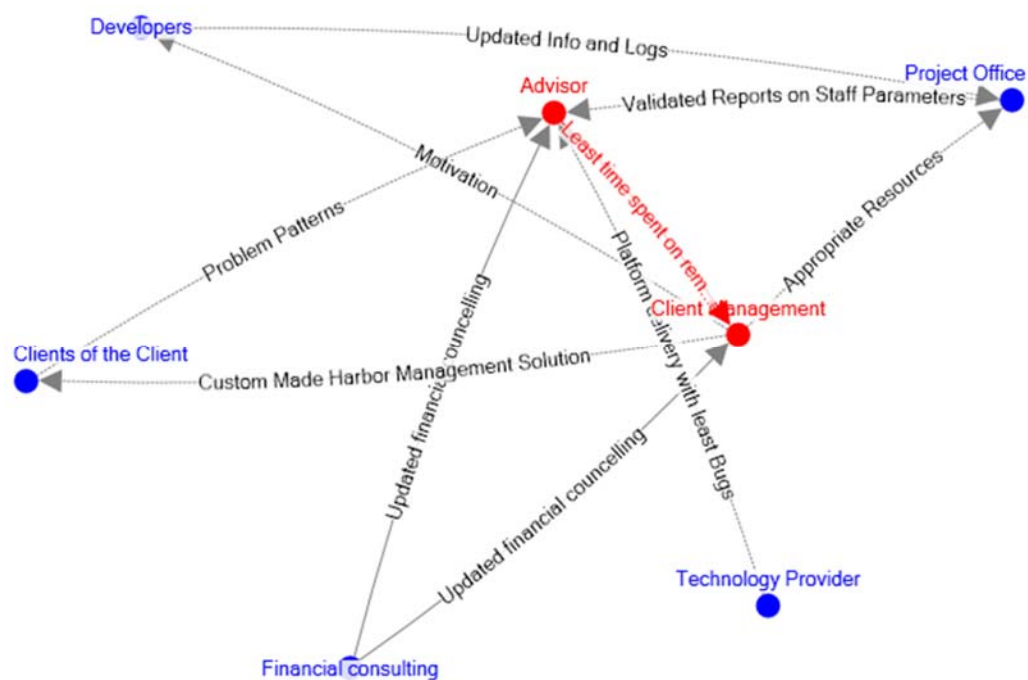


FIGURE B.19 ROLE AND ACCOUNTABILITY DIAGRAM – INTRODUCED NEW ROLE (FINANCIAL CONSULTING) WITH TWO ACCOUNTABILITIES, COMPANY B, END-USER 1 (AUTOMATIC DESIGN IN NODEXL)

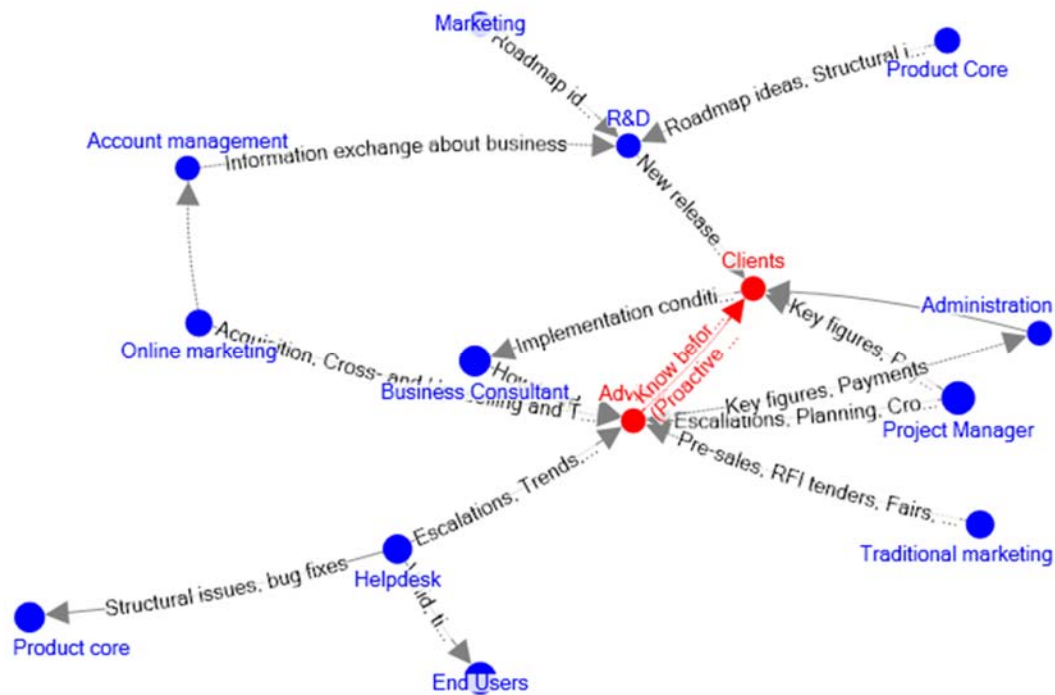


FIGURE B.20 ROLE AND ACCOUNTABILITY DIAGRAM – WITH CHANGED PRIMARY PURPOSE, COMPANY B, END-USER 11 (AUTOMATIC DESIGN IN NODEXL)

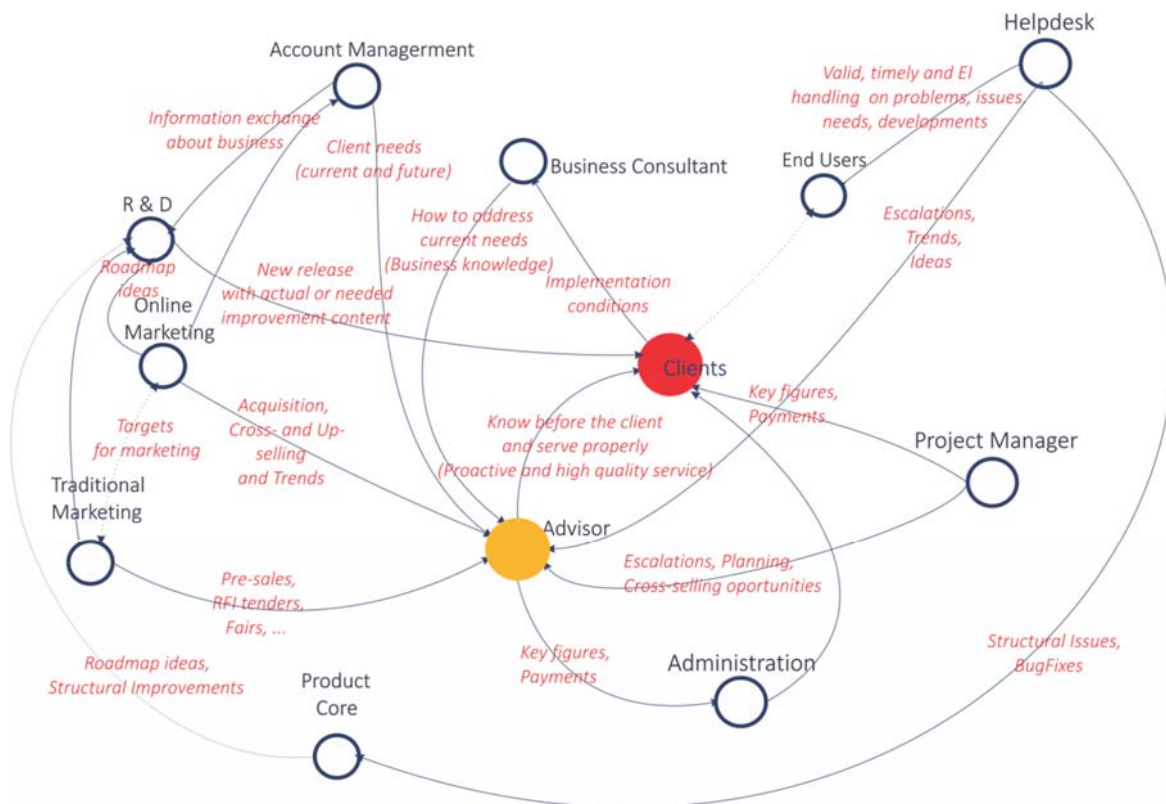


FIGURE B.21 ROLE AND ACCOUNTABILITY DIAGRAM – WITH CHANGED PRIMARY PURPOSE, COMPANY B, END-USER 1 (DESIGNED IN COREL, FOR MANAGERIAL USE)

B.3. CONTEXT 3

A, B. Primary constituents and Reason for being: The third organizational tactical management issue for which we implemented the initial version of our artifact, founded on the managerial framework Sense-and-Respond, has been: Achieve client recognition of the company as full ‘Engineering and Geodesic services bureau’. The practitioner’s wishes as well as the S&R paradigm of customer-backed system design guided the primary purpose expectation in terms of achieving customer reference for any of the engineering and geodesic services to this bureau – which is reflected in the design of the R&A Diagram (Figure B.22). Namely, from the founding of the company, up to recently, the owner has been the one who attracts and cares for the clients, while the employees have specialized in their technical expertise fulfilling operational tasks. With the growth of the company, the activities the owner needed to complete have been growing in number and type. By not growing the employees’ managerial capabilities, they have been taking care only for their part of the service, while the clients overall satisfaction and up-selling, cross-selling and retention have been nobody’s and everybody’s obligation. With the expansion of domains that the company could serve from geodesic services to engineering, intermediary consultation, construction and project management the number of employees grew but the managerial and customer relationship management function resided only with the owner, who micromanaged numerous other things too. The growth of the service offer targeted the existing clients to a large portion, and new ones to be attracted. However, since the owner couldn’t manage everything anymore, the idea was to achieve awareness in the clients for the broad range of services, by various advertisements but primarily by appointing someone in the role of ‘business generator’ that will welcome, take care of and check-out each client that enters the business, coordinating the operations in between, but also making sure each client exits with the new information on the service offer expansion.

C. Governing Principles: The next step in the S&R implementation for tactical management was to discuss Governing Principles. As with Company B, statements such as ‘always’ or ‘never’ the owner/manager had incorporated in every action because he was the one who introduced and enforced them. In the case of Company C, the owner had to communicate the governing principles with the employees, in order to clarify the governance of the company. This was one of the weakest points in this company observed and suggested by the researcher to be overcome.

D. Role-and-Accountability Diagram: The R&A Diagram (Figure B.22, Figure B.23, Figure B.24) in this instance too, has been designed after three 2-hour discussions in person and remotely. The resulting system design has been a foundation for orientation of the manager, but also of the employees who populated different roles, some of which more than one role per employee, due to the small number of employees in this SME. After discussing, writing and sketching on white sheets of paper that the researcher incorporated in Excel workbook afterwards, and provided the practitioner with the support tool workbook in electronic form. The struggle to find and use the most appropriate social network analysis tool to visualize the Role-and-Accountability diagram can be viewed on Figure B.22, Figure B.23, Figure B.24. Firstly, Figure B.22 is the graph used with the end-user, designed in Gephi, beta version, but the layout consistency is missing, as are the directed edges with arrows between the provider and supplier role. This figure is with Macedonian titles for some of the roles and all the accountabilities. Next, Figure B.23, is the second attempt with translated expressions, but still visually not sound. Finally, Figure B.24, the NodeXL layout of the graph is somewhat understandable and comprehensive, denoting the primary purpose as edge between the provider role ‘business generator’ and ‘client’, along with the other roles and accountabilities.

E. Conditions of Satisfaction: For all the outcomes we specified on Conditions of Satisfaction (CoS) that every pair of roles (provider and customer) needs to agree upon in order to be held reliable for that specific outcome. They have been fully elaborated and the excerpt is from the actual Excel workbook .

F. Heads up Displays and Commitment Management Protocol have found their realization in our artifact in the Company B and Company D instances of the ADR.

G’. Continuous performance of the Sense-Interpret-Decide-Act (SIDA) Loop and the Plan-Do-Check-Act (PDCA) Loop and effectuating adaptability to changes through the R&A diagram as the last step that initiates the system and maintains it to produce the effects it’s designed for has been only established but not continued, as this context contributed to the Alpha-version of the artifact, similarly as Context 1.

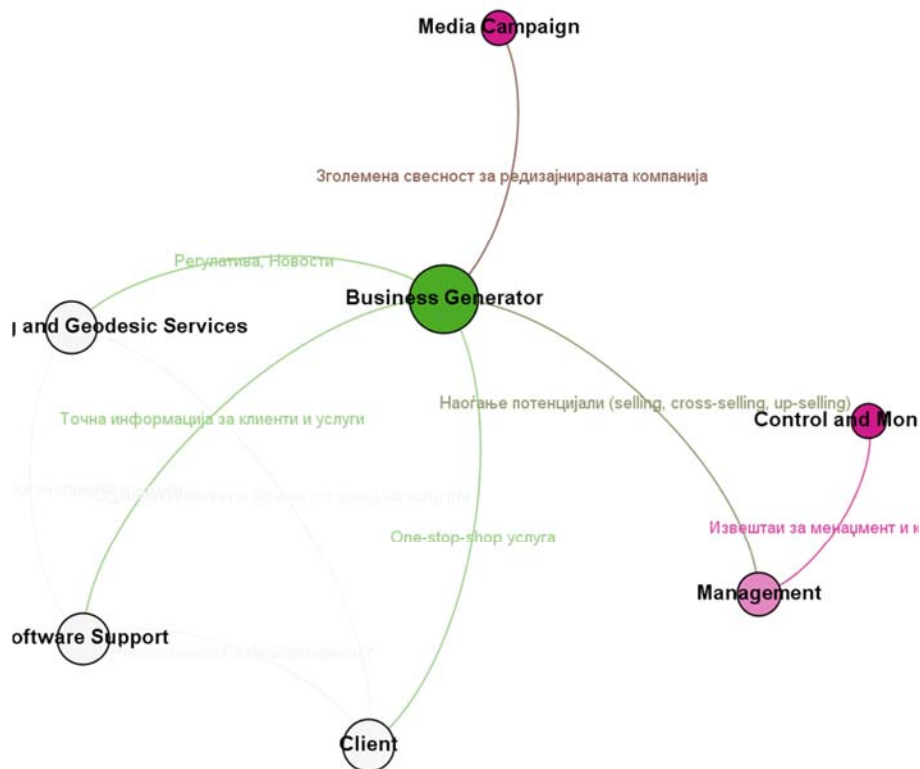


FIGURE B.22 ROLE-AND-ACCOUNTABILITY DIAGRAM FOR ACHIEVING CLIENT RECOGNITION OF THE COMPANY AS FULL 'ENGINEERING AND GEODESIC SERVICES BUREAU' – AS USED WITH THE CLIENT (WITH MACEDONIAN ELABORATIONS) (DESIGNED IN GEPHI, BETA VERSION)

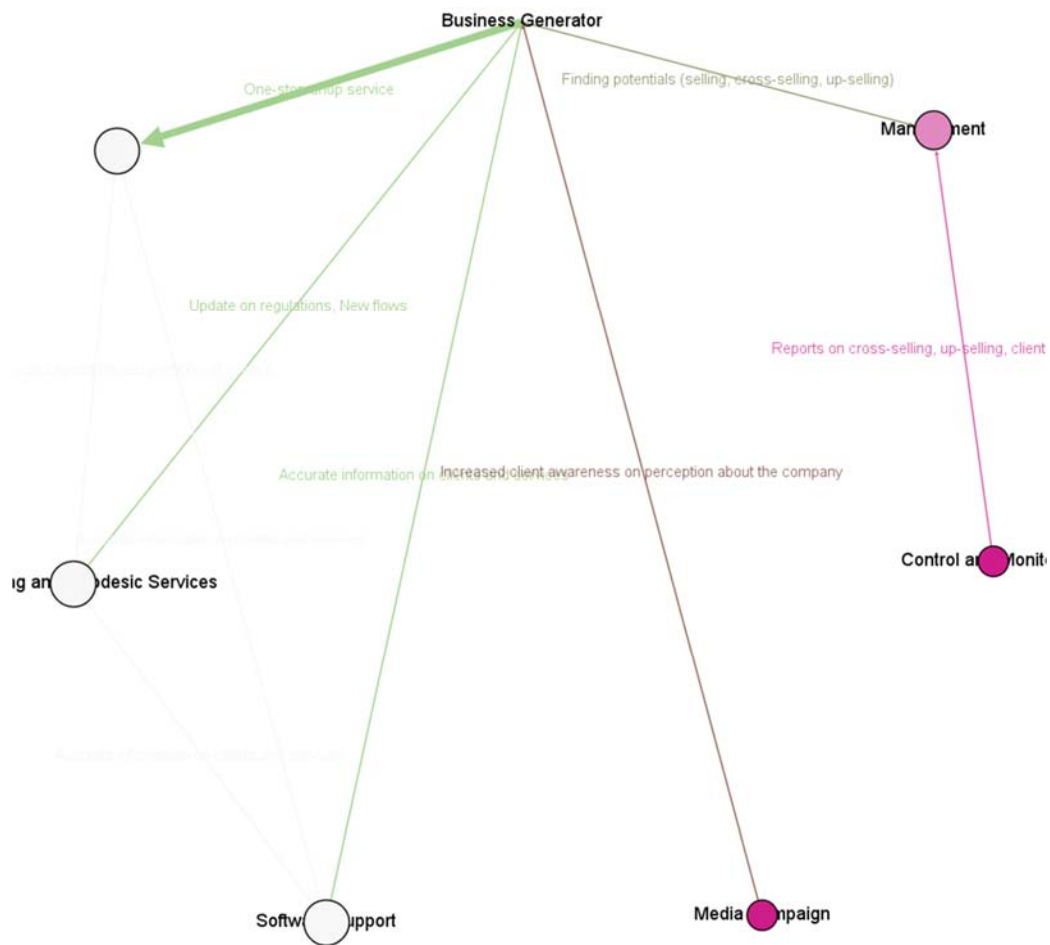


FIGURE B.23 ROLE-AND-ACCOUNTABILITY DIAGRAM FOR ACHIEVING CLIENT RECOGNITION OF THE COMPANY AS FULL 'ENGINEERING AND GEODESIC SERVICES BUREAU' – (WITH ENGLISH ELABORATIONS) (DESIGNED IN GEPHI, BETA VERSION)

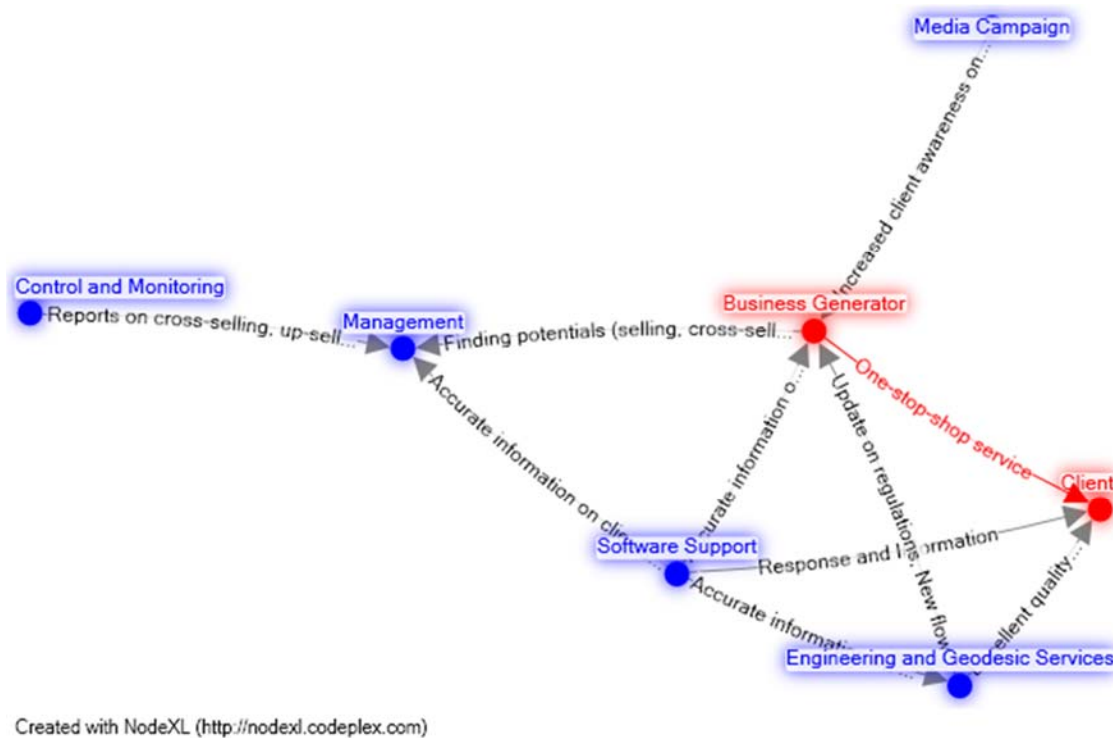


FIGURE B.24 ROLE-AND-ACCOUNTABILITY DIAGRAM FOR ACHIEVING CLIENT RECOGNITION OF THE COMPANY AS FULL 'ENGINEERING AND GEODESIC SERVICES BUREAU' – (RE-DESIGNED WITH NODEXL)

Interaction	Supplier	Customer	Accountable for Outcome
1	Engineering and Geodesic Services	Client	Excellent quality and speed (priced properly) of service
2	Business Generator	Client	One-stop-shop service
3	Business Generator	Management	Finding potentials (selling, cross-selling, up-selling)
4	Software Support	Business Generator	Accurate information on clients and services
5	Software Support	Engineering and Geodesic Services	Accurate information on clients and services
6	Software Support	Management	Accurate information on clients and services
7	Software Support	Client	Response and Information
8	Engineering and Geodesic Services	Business Generator	Update on regulations, New flows
9	Control and Monitoring	Management	Reports on cross-selling, up-selling, clients being informed
10	Media Campaign	Business Generator	Increased client awareness on perception about the company

FIGURE B.25 CONDITIONS OF SATISFACTION FOR THE ROLE AND ACCOUNTABILITY DIAGRAM, COMPANY C, END-USER 10

B.4. CONTEXT 4

In this section we will elaborate on the implementation of the artifact in Company D, with end-user 11.

A, B. Primary constituents and Reason for being: The identification of the primary purpose of the new system of roles and accountabilities has been relatively easy, when communicating with the top manager and the project manager: Provide earliest information for status and discrepancies to management in a new factory construction and equipment alignment project. In the new project, there have been many issues on different levels – however, as described in the previous chapters, the company decisions are mostly streamlined through the top manager, so the idea of the artifact use is to make the earliest possible communication sharing between the project manager and the top manager.

C. Governing Principles: The next step in the S&R implementation for tactical management was to discuss Governing Principles. Statements such as ‘always’ or ‘never’ have been remarkably well familiarized and practiced. The dedication to the governing principles has been to a very high extent, as well.

Since this was a big company and the need for stating clear governing principles was of utmost importance, so that the top managers ensure governance throughout the entire company, we will provide them with certain level of genericity, to preserve the confidentiality obliged for. As expected and instructed by the S&R framework, most of them contain the words ‘always’ or ‘never’:

- The quality of the products must be impeccable. It can never be allowed for the customers to receive discussable quality, even if losses are high
- Always, there should be transparency in the relationships and communication
- The obligations towards the collaborators (external and internal) always have to be timely served
- There is zero tolerance for dishonesty
- There is always a strive to minimize surprises (events that haven’t been considered or thought of)

As it can be observed, the essence of the last governing principle has been translated into a specific primary purpose for our tactical management issue which we helped pursue with our end-user 11, even though almost each of these are incorporated in the content of designing the system of roles and accountabilities.

D. Role-and-Accountability Diagram: The R&A Diagram in this instance has been designed after three 2-hour discussions in person and remotely. The resulting system design has been a foundation for orientation of the manager – he also had it printed out and on his desk – enabling small notes, writing and drawing on the paper. The discussions have been resulting with writings and sketches on white sheets of paper, that the researcher incorporated in Excel workbook afterwards, and provided the practitioner with them in electronic form. The Workbook consisted of Worksheets with the 4 main elements (visualizations and details): the initial System with Conditions of Satisfaction, the Information Sensors, the Information Emitters and the Risks.

E. Conditions of Satisfaction: For all the outcomes we specified Conditions of Satisfaction (CoS) that every pair of roles (provider and customer) needs to agree upon in order to be held reliable for that specific outcome (Figure B.28). The visualization of the R&A diagram has assisted the practitioner to a great extent in communicating the accountabilities and the expectations with all the stakeholders, especially on negotiating Conditions of Satisfaction and communicating with the employees who needed to orient themselves for what they were expected to accomplish (not just do (output) and be careless what the outcome is). The adaptability components have been used in full. The **Sense-Interpret-Decide-Act Loop** has been activated continuously through the next months and observations and changes have been recorded by the practitioner and communicated with the researcher.

F. Heads up Displays and Commitment Management Protocol have found their realization in our artifact in the components presented below. The practitioner – tactical manager involved in this project, whose perspective we are taking here, is responsible for project delivery. That means he is taking a helicopter view and designing each of the DENICA method components according own needs for facilitating the system of roles and accountabilities towards accomplishment of purpose. Complementary to the implementation of the steps of S&R framework, we (together with the practitioner) designed all components of the DENICA method:

1. **A System of Roles and Accountabilities**, designed according the Sense-and-Respond Framework principles (Figure B.26)
 - a. Having in mind the Purpose, the End, the Reason for Being
 - b. Visualizing the R&A Diagram
 - c. Specifying Conditions of Satisfaction for every negotiated outcome accountable for (Figure B.28)

2. **Information Sensors** – what the tactical manager would need to have as information (regardless of the current supply with reports) in order to have overview of his/her system (Figure B.29)
 - a. Visualizing the Information Sensors per Role and Accountability, around the role of the System Designer – the Tactical Manager (Figure B.30)
 - b. Stating the necessary attributes of the Information Sensors
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. the Entity where the tactical manager is placing the Information Sensor,
 - iii. the Type of information to be obtained (Progress feedback, Results, Issues, ...)
 - iv. the Way of obtaining the information (On demand or Event driven)
 - v. Type of content (Qualitative or Quantitative information)
 - vi. Frequency of obtaining the information (Hourly, Daily, Monthly, Quarterly, ...)
3. **Information Emitters** – what the tactical manager would like to have been told by the other roles in order to be aware on time for possible issues disturbing the agreed outcomes (Figure B.31)
 - a. Visualizing the Information Emitters per Role, around the role of the System Designer – the Tactical Manager (Figure B.32)
 - b. Stating the necessary attributes of the Information Emitters
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Emitter (the Role that should emit the specific information)
 - iii. Type of Information (Expectations, Personal issues, Not recording logs, ...)
4. **Risk Management** (along with Risk positioning and Information flows) (Figure B.33)
 - a. Visualizing the Risks per role, around the role of the System Designer but to some extent also around all other Roles too (Figure B.34)
 - b. Stating the necessary attributes for Risk Management
 - i. Interested party (usually the tactical manager for his/her system; but also any other role for her outcome's respective system)
 - ii. Sensor, the actual Role or Entity or Business Process or general place where the tactical manager needs to point the 'radar' to in order to receive that signal
 - iii. Risk type (Experience of Management, Lack of knowledge for cross-checking, ...)
 - iv. Probability to happen (1 (low) – 5 (high))
 - v. Impact on the business (1 (low) – 5 (high))
 - vi. Risk Management approach (accept, avoid, transfer, mitigate, contingency plans)

The initial setting for Company D with End-user 11 is visualized in the next figures.

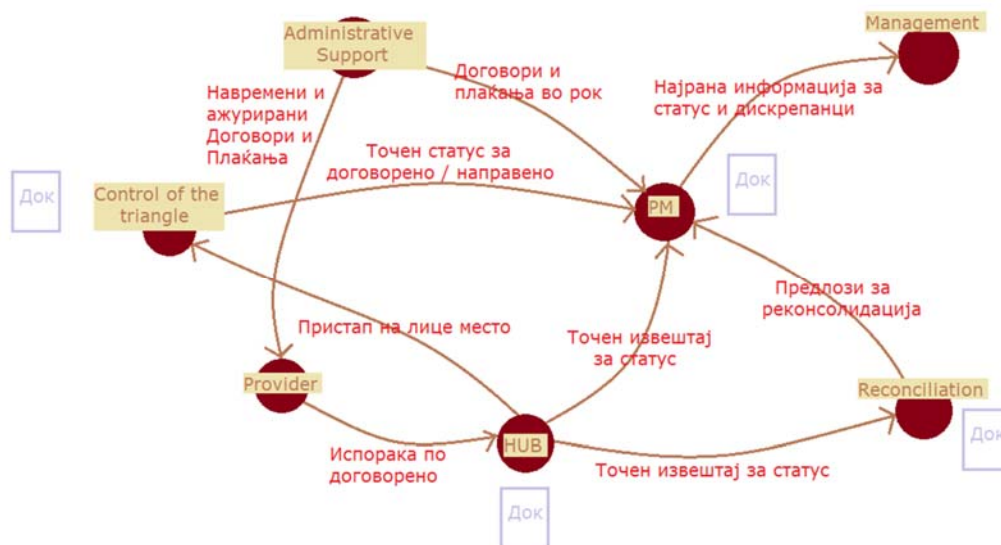


FIGURE B.26 ROLE-AND-ACCOUNTABILITY DIAGRAM FOR PROVIDING EARLIEST INFORMATION FOR STATUS AND DISCREPANCIES TO MANAGEMENT IN A NEW FACTORY CONSTRUCTION AND EQUIPMENT ALIGNMENT PROJECT (THE GRAPH IS DESIGNED IN PAINT, MACEDONIAN LABELS)

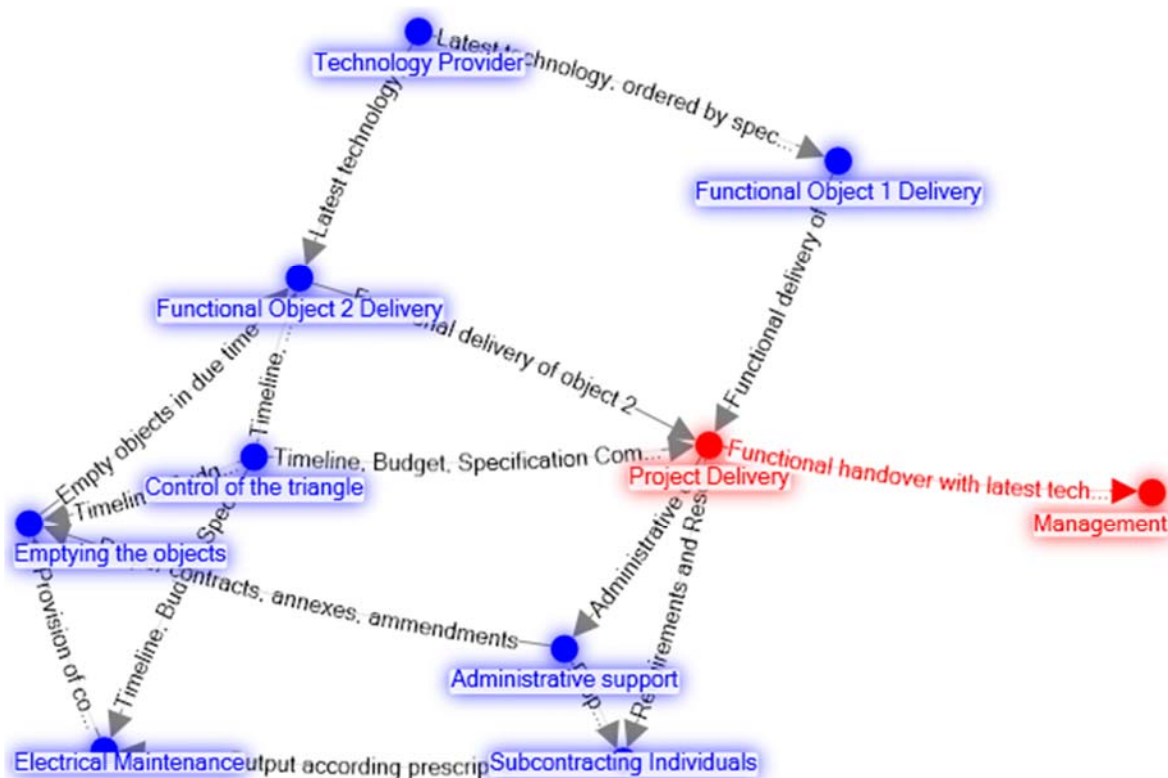


FIGURE B.27 ROLE-AND-ACCOUNTABILITY DIAGRAM FOR PROVIDING EARLIEST INFORMATION FOR STATUS AND DISCREPANCIES TO MANAGEMENT IN A NEW FACTORY CONSTRUCTION AND EQUIPMENT ALIGNMENT PROJECT (THE GRAPH IS DESIGNED IN NODEXL, ENGLISH LABELS)

Interaction	Supplier	Customer	Accountable for Outcome
1	Functional Object 1 Delivery	Project Delivery	Functional delivery of object 1
2	Functional Object 2 Delivery	Project Delivery	Functional delivery of object 2
3	Project Delivery	Management	Functional handover with latest technology
4	Technology Provider	Functional Object 1 Delivery	Latest technology, ordered by specification 1
5	Technology Provider	Functional Object 2 Delivery	Latest technology, ordered by specification 2
6	Administrative Support	Project Delivery	Administrative contracts and amendments, within 3 c
7	Project Delivery	Subcontracting Individuals	Requirements and Resources
8	Administrative Support	Emptying the objects	Proper contracts, annexes, ammendments
9	Emptying the objects	Functional Object 2 Delivery	Empty objects in due time
10	Electrical Maintenance	Emptying the objects	Provision of constant electrical system
11	Control of the Triangle	Emptying the objects	Timeline, Budget, Specification Information
12	Control of the Triangle	Functional Object 2 Delivery	Timeline, Budget, Specification Information
13	Control of the Triangle	Electrical Maintenance	Timeline, Budget, Specification Information
14	Control of the Triangle	Project Delivery	Timeline, Budget, Specification Communication
15	Administrative Support	Subcontracting Individuals	Proper contracts, annexes, ammendments
16	Subcontracting Individuals	Electrical Maintenance	Output according prescription

FIGURE B.28 ACCOUNTABILITIES AND CONDITIONS OF SATISFACTION FOR THE ROLE AND ACCOUNTABILITY DIAGRAM FOR COMPANY D, END-USER 11

Information Sensors Details			
Interaction	Interested	Sensor	Type of Information, Way of getting it (On demand/Event driven), Qualitative/Quantitative, Frequency
1	Project Delivery	Management	Instructions, On demand, Qualitative/Quantitative, Weekly
2	Project Delivery	Functional Object 1 Delivery	Reporting, Event driven and On demand, Qualitative, Hourly
3	Project Delivery	Functional Object 2 Delivery	Reporting, Event driven and On demand, Qualitative, Daily
4	Project Delivery	Administrative Support	Summarized and drill-able report, Event driven, Quantitative, Daily
5	Project Delivery	Subcontracting Individuals	Oral, On demand, Qualitative, Per need-daily
6	Project Delivery	Control of the Triangle	Report (oral and written), Event driven-non urgent, On demand-urgent, Qualitative/Quantitative, Weekly
7	Project Delivery	Electrical Maintenance	Information, Event driven, Qualitative, Per hiring
8	Project Delivery	Emptying the objects	Visual, e-mail, Event driven, Qualitative, Per occurrence
9	Project Delivery	Contractor Company	Satisfaction information and Problems, On demand, Qualitative, Weekly
10	Project Delivery	Technology Provider	Updates and Status, Event driven, Qualitative/Quantitative, Monthly

FIGURE B.29 INFORMATION SENSORS, COMPANY D, END-USER 11

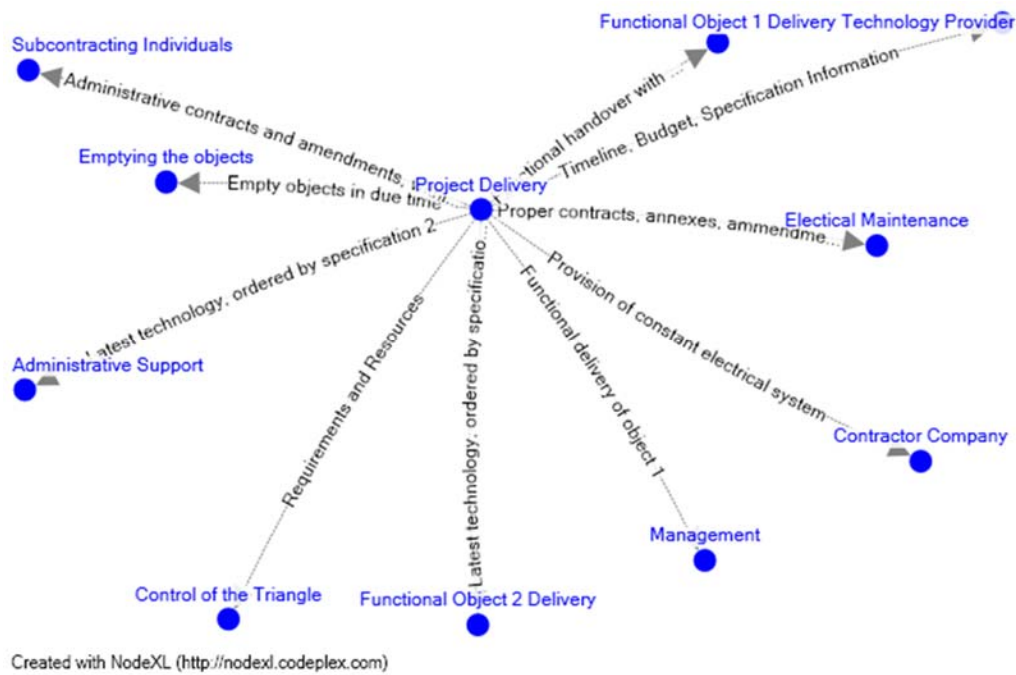


FIGURE B.30 VISUALIZATION (EGO-NETWORK) OF THE INFORMATION SENSORS FOR THE ROLE OF PROJECT DELIVERY, COMPANY D, END-USER 11

Information Emitters Details			
Interaction	Interested	Emitter	Type of Information
1	Project Delivery	Management	Satisfaction from the PM
2	Project Delivery	Functional Object 1 Delivery	Personal Issues
3	Project Delivery	Functional Object 2 Delivery	Expectations
4	Project Delivery	Administrative Support	Off the record information
5	Project Delivery	Subcontracting Individuals	Early warnings for non e-mail things
6	Project Delivery	Control of the Triangle	Someone from Developers not recording logs
7	Project Delivery	Electrical Maintenance	Problems with the system
8	Project Delivery	Emptying the objects	KPIs
9	Project Delivery	Contractor Company	Major changes in the system
10	Project Delivery	Technology Provider	Marketing campaigns in the region

FIGURE B.31 INFORMATION EMITTERS, COMPANY D, END-USER 11



FIGURE B.32 VISUALIZATION (EGO-NETWORK) OF INFORMATION EMITTERS FOR THE ROLE OF ADVISOR, COMPANY D, END-USER 11

Risk Management Details - in view of every PM/TL and other concerned Stakeholders			
Interaction	Interested	Sensor	Risk, Probability to happen (1, 3, 5), Impact on the business (1, 3, 5), Risk Management approach (accept, avoid, transfer, mitigate (try to reduce as much as possible), contingency plans)
1	Project Delivery	Management	Changing priorities, 4, 5, accept
2	Project Delivery	Functional Object 1 Delivery	Being late, 4, 5, mitigate and capture as early as possible to solve as soon as possible to have least damage and
3	Project Delivery	Functional Object 2 Delivery	Not completing according plans, 4, 5, mitigate
4	Project Delivery	Administrative Support	Not reporting unpaid contractors, 3, 4, avoid
5	Project Delivery	Subcontracting Individuals	Not performing as agreed, 5, 5, contingency plans
6	Project Delivery	Control of the Triangle	Make improper assessment for Time/Money/Functionality accomplishment, 2, 4, avoid and double-check
7	Project Delivery	Electrical Maintenance	Comes late and delays everything else, 5, 5, mitigate - keep eye on the workers and ask constantly
8	Project Delivery	Emptying the objects	Not done on time and in full, 4, 5, contingency plans, extra people, earliest detection
9	Project Delivery	Contractor Company	Unsatisfied from technical/payments/other issues, 3, 4, avoid
10	Project Delivery	Technology Provider	Delivery on time - we are not ready yet, 4, 5, transfer to insurance company for the penalties

FIGURE B.33 RISK MANAGEMENT (WITH RISK POSITIONING AND INFORMATION FLOWS), COMPANY D, END-USER 11

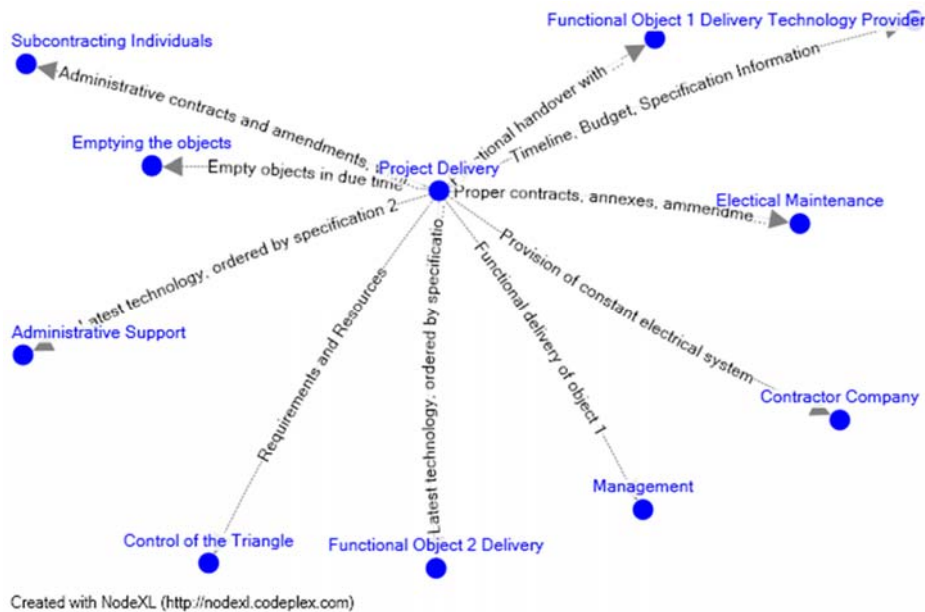


FIGURE B.34 VISUALIZATION (EGO-NETWORK) OF RISK MANAGEMENT FOR THE ROLE OF ADVISOR, COMPANY D, END-USER 11

B.4.1. DYNAMIC ASPECTS OF THE ARTIFACT IMPLEMENTATION IN CONTEXT 4

With regards to dynamic analysis of the usage of the artifact, in the collaboration with Company D, end-user 11, we have encountered the following developments.

G’. Behavior when **performing the SIDA loop and PDCA loop**. The system of Roles and Accountabilities needed to change according to changes in the context, and upon managerial action. In this case, the initial R&A diagram has been changed almost immediately because the manager estimated that the first one was too generic and needed to increase the level of detail of the roles and accountabilities. In the first instance, the system of roles and accountabilities around the purpose of ‘providing earliest information on project status and discrepancies’ to management has been consisted of the roles: HUB – populated by various persons and departments that had to have and report updated status information to the project manager, this role communicated with the ‘provider’ role populated by various internal and external workers, companies, ... to acquire the information; while the project management wanted to cross-check the deeds and actions with contracts, agreements and the generic time-quality-money triangle on continuous basis. At the same time, the importance of the governing principle ‘The obligations towards the collaborators (external and internal) always have to be timely served’ was enforced so that the people populating the ‘administrative support’ role made sure suppliers, contractors and staff are paid on time, to avoid preventable delay due to payment reasons. The PM was the one who reasons, balances and settles the issues among these roles, before ‘waving a flag’ to management when necessary. In a private company, the executive management needs to know almost everything and micro-manages daily operations and activities. However, the PM was gaining trust and was being delegated more responsibility, simply because the possibility to micro-manage the company as usual and this new big project was impossible, for top management. Due to this, what is described next has occurred.

Since the accountability of the manager increased and the primary purpose for the system has broadened towards: ‘Functional handover (of objects and infrastructure) with latest technology’. This primary purpose incorporates the previous one: ‘Providing earliest information on project status and discrepancies’ that have been executive management requirements so that they can negotiate and re-negotiate with partners (the German technology provider, the Banks, the prospective buyers of the products, ...) to facilitate project execution. But, the expanded ‘handover’ accountability also means the PM should take care of many problems and issues that occurred on the

ground, and filter only those that impacted the outcome of handover of the objects and equipment to be deployed for production. In terms of the roles-and-accountabilities, there have been two objects (old and new one) with separate construction projects for the premises and single provider for the equipment that should add up on synchronized object construction and reconstruction, the manager needed not just generic system of how to maintain earliest info to management for discrepancies in plans and actual developments that need to be resolved further on, but specific roles that somehow decomposed from the generic ones and reached a lower level of roles. The lower level of roles have been the roles designating the objects (functional object 1 and 2 delivery), the equipment (technology provider accountable to both functional object 1 and 2 roles) and the most important roles at that point in time: empty objects, electrical maintenance along with the most ‘burning issue’ of the non-accountability – the role populated by subcontracting individuals. The PM adhered the activity of making reconciliation of planned vs done because he felt that it can’t be delegated to others – there were too many delays in information flows and when thinking of information emitters it turned out that there are many he needs to invoke and it would be best not to be ‘lost in translation’.

For the purpose of comparison, the initial (Figure B.35) and the changed R&A diagram (Figure B.36) are presented with the same tool (NodeXL).

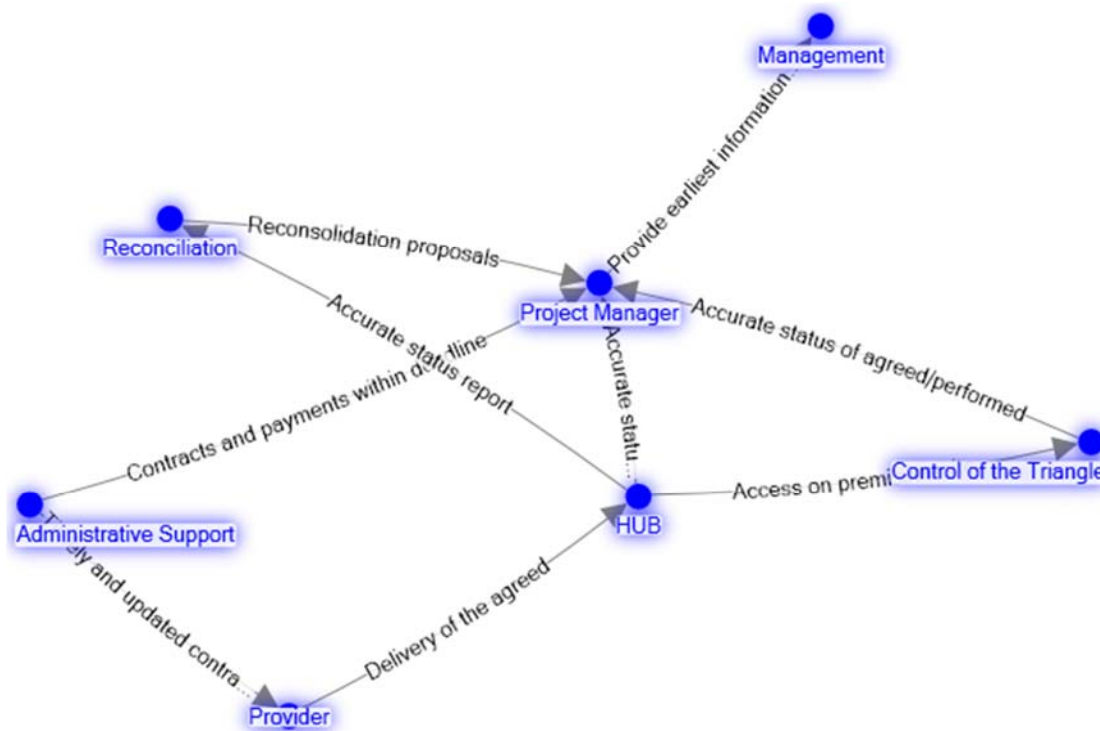


FIGURE B.35 INITIAL ROLE AND ACCOUNTABILITY DIAGRAM, COMPANY D, END-USER 11

The Information Emitters Worksheet has received additional fields early in Context 2 for whether the end-user 11 is receiving information from that emitter (Yes/No), what action is taken to introduce or maintain that emitter, and status of the emitter. In this context the worksheet has been offered as ready to use.

Information Emitters Details					
Interaction	Interested	Emitter	Type of Information	RECEIVING INFORMATION Y/N	ACTION
1	Project Delivery	Management	Satisfaction from the PM	Y	
2	Project Delivery	Functional Object 1 Delivery	Personal Issues	Y	
3	Project Delivery	Functional Object 2 Delivery	Expectations	N	Problematic
4	Project Delivery	Administrative Support	Off the record information	N	Have to ask them daily
5	Project Delivery	Subcontracting Individuals	Early warnings for non e-mail things	Y/N	For some, you have to have a coffee and investigate
6	Project Delivery	Control of the Triangle	Covering for somebody	N	Find the persons you can rely on
7	Project Delivery	Electrical Maintenance	Problems with the system	N	Call electricity company asap
8	Project Delivery	Emptying the objects	Deadlines awareness	Y	Weekly briefing with the managers
9	Project Delivery	Contractor Company	Major changes in the system	Y	For some, you have to have a coffee and investigate
10	Project Delivery	Technology Provider	Marketing campaigns in the region	Y	German provider, reliable and professional

FIGURE B.38 DYNAMIC DATA FOR INFORMATION EMITTERS WITH 3-MONTHS FOLLOW-UP IN CONTEXT 4

The risks management component of the method, which provides awareness of what may go wrong with what a role is accountable for, is interesting for observation, especially since some risks occurred in reality (Figure B.39). To comment some of the risks, self-positioned by the tactical manager – we can start with the one he deemed with highest probability to happen and impacts his work maximally. That is the management changing priorities, which he has to accept and adapt – such as cutting budget for an activity, phase or changing deadline. These are ‘givens’ that are out of the tactical manager’s influence, in spite of his feedback and opinion given to management, such reality exists in many businesses. The risk management approach was to accept and adapt. The other one of the high risks is the functional object 1 delivery risk which was previously mitigated by re-negotiating with the German equipment producer, but those measures have been exhausted, and the next best possible risk management approach to the tactical manager seemed to capture earliest possible signals for problems and manage in a manner that leaves least damages and delays, even if that meant that the other two components of the triangle – money and quality suffered. The risk of the ‘burning issue’ of not enough professionalism and accountability of the subcontracting individuals resulted with activity of activating money penalties for unfinished or not-properly finished work. The electrical maintenance became such a big issue because of frequent shortages of power that resulted with everyone else on the site not being able to do anything until the electricity is back. How the manager mitigated this risk – by finding a person that works in the electricity company and being informed asap on possible power shortages and when the electricity will come back, so that he can cancel the contractors and reschedule them for times when the electricity is available. The other risks of not receiving important info on time unless he makes the call to ask, and other communication issues, the approach to discuss, include top management intervention with employees and increase personal awareness and accountability have resulted in positive behavior.

Risk Management Details - in view of every PM/TL and other concerned Stakeholders					
Interaction	Interested	Sensor	Risk, Probability to happen (1, 3, 5), Impact on the business (1, 3, 5), Risk Management approach (accept, avoid, transfer, mitigate (try to reduce as much as possible), contingency plans)	Change	Comment
1	Project Delivery	Management	Changing priorities, 4, 5, accept	5, 5	Has happened to change the budget, and the deadline for one activity
2	Project Delivery	Functional Object 1 Delivery	Being late, 4, 5, mitigate and capture as early as possible to solve as soon as possible to have least damage and delay	5, 5	Tried to reschedule and negotiate with provider. No more chances
3	Project Delivery	Functional Object 2 Delivery	Not completing according plans, 4, 5, mitigate	Ok	
4	Project Delivery	Administrative Support	Not reporting unpaid contractors, 3, 4, avoid	3, 5	After regular meetings and informing the top manager
5	Project Delivery	Subcontracting Individuals	Not performing as agreed, 5, 5, contingency plans	4, 5	Included money penalties
6	Project Delivery	Control of the Triangle	Make improper assessment for Time/Money/Functionality accomplishment, 2, 4, avoid and double-check	Ok	Check myself
7	Project Delivery	Electrical Maintenance	Comes late and delays everything else, 5, 5, mitigate - keep eye on the workers and ask constantly	4, 5	Receive insights from the electricity company
8	Project Delivery	Emptying the objects	Not done on time and in full, 4, 5, contingency plans, extra people, earliest detection	3, 5	Half is fulfilled now
9	Project Delivery	Contractor Company	Unsatisfied from technical/payments/other issues, 3, 4, avoid	2, 4	Having some mutual trust by now
10	Project Delivery	Technology Provider	Delivery on time - we are not ready yet, 4, 5, transfer to insurance company for the penalties	4, 5	Still many issues happening

FIGURE B.39 DYNAMIC DATA FOR RISK MANAGEMENT WITH 3-MONTHS FOLLOW-UP IN CONTEXT 4

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