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MANAGERIAL DECISION MAKING AUGMENTATION THROUGHOUT INFORMATION SOLUTIONS: THE CONCEPTUAL SYSTEM

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The dynamism of the environment where decisions are being performed becomes ever more turbulent. Strategic thinker in order to drive his organization towards success and sustain it on a competitive level must take fast actions and consider vast number of complex factors. This requires deep insight into the organization and fast way of processing data in order to develop possibly unambiguous judgments. Human mind, without any support, would not cope with processing such amount of information what would lead to poor managerial decision. It is known that human requires support of his cognitive thinking processes and current technology harnessed in appropriate way would enable decision maker to perform fast, yet precise decisions that are crucial for enterprise to successfully compete on the turbulent market.

This thesis introduces a conceptual system of decision making augmentation. Such system would harness the modern processing power of computers within an ERP based infrastructure to collect data from across the organization and process it accordingly. Processed, grouped, and filtered data would be presented via graphical, interactive, and highly adaptive interface allowing decision maker to quickly analyze data and simulate possible opportunities in order to perform high quality decision making.

This concept is built on theory review synthetized in context of the idea; three propositions build a core of the further analysis which at last creates a foundation for the system development. This thesis does not introduce to technical aspects of the system but to an idea of how decision maker and organization could potentially benefit from it.

KEYWORDS ERP, Augmentation, Decision Making, Organizational Performance Optimization, Dynamic Strategy

1 INTRODUCTION

Every action that is being made, regardless of its complexity, requires decision making. The ultimate idea, in context of a firm, is that all actions performed are aimed to create value from assets and resources available (Grant, 1996: 110). Hence all decisions on managerial level in a firm should be aligned and dedicated either directly or indirectly to common goals – sustainability, expansion, and profitability.

1.1 Background of the study

The complexity of today's market escalates the decision making to a very subtle and demanding task (Grewal and Tansuhaj 2001; Hayashi 2001; Dane & Pratt 2007; Steptoe-Warren, Howat & Hume 2011). Each of top actions will require thorough consideration of such factors as: competition, dynamic behavior of customers, internal situation at the company, technological and economic advancement, political and global situation, and finally, interdependence of all these (Barney 1986; Morgan 1997; Tyagi, Cai, Yang & Chambers 2015). Additionally, the quantity of data generated and processed grows in hyperbolic manner (Keim 2013) – Dragland in 2013 has estimated that 90% of world's digital data have been generated in previous two years. Understanding the current situation, anticipation of possibilities, and reacting appropriately to all these external and internal factors of such amount engages vast knowledge – both tacit and explicit, experience, and agility and in the context of vast flows of data passing through an organization it becomes unmanageable without support of IT solutions. Managers need support of technology and the organization requires efficient transferability of knowledge within the company, which is a key for a successful firm (Barney 1986, Grant 1996).

> *As the size of datasets grows exponentially, there is increasing risk that much of the valuable and relevant information stored is being lost due to ineffective systems for data exploration and visualization* (Keim 2001)

In a company, executive manager is a mediator between internal activities at the company and external environment of market within which the company operates. Understanding both milieus and maintaining the activities appropriately is a key that will drive to success and benefits (Porter 2001). Nevertheless, with all abovementioned factors influencing the decision making, it is practically impossible to take each and every aspect into deep insight, thus, in great extent, it will be driven by managerial intuition – as it

enables the fastest reaction, an important aspect of today's dynamic market (Dane & Pratt 2007). Previous research suggests that intuition may be the most efficient way to make decisions involving high complexity in short time frame (e.g. Hayashi 2001; Dane & Pratt 2007). However, managerial intuition is a highly unstandardized way of decision making, it bases to a great extent on a person's experience, his cognition, and generally is vulnerable for mistakes (Isenberg 1984; Shirley & Langan-Fox 1996; Hayashi 2001)

Thus, we conclude that that strategic thinker must support his decision making with tools and rules in order to comprehend the extent of his scope and handle the dynamism of the operating environment. In this thesis, a concept of strategic decision making enhancement system will be developed. The research concept mainly concerns about what would be the end user, what such system could be, what data it should include, how such data could be processed and displayed, and how potentially organization could benefit from such framework.

In similar manner, as a part of information management optimization, business processes and organization of the firm should be simplified. Decisions performed by an executive manager are not effective if they cannot be implemented swiftly what requires high flexibility of the system (Kirikova 2005). The information that manager receives should be the key for structuring the flexible and agile organization structure. In order for a company to be efficient and hence competitive it must create an organization of relatively low complexity which would lead to high flexibility. The research concluded that this is a first step to be taken and specifically, this conceptual paper puts emphasis on internal application of the system of managerial decision augmentation.

1.2 Importance of the study

The concept, developed in this thesis is dedicated for enhancement of organization's driver – the strategic thinker or decision maker. Executive manager is responsible for seeing the enterprise in a holistic manner yet with insight to the details that might escalate to a major issues. The system, or a framework, which is conceptualized in this thesis aims to benefit decision maker in two ways, first by collecting all tacit and explicit information from all across the firm and second, processing it into form that will be clear, transparent, comprehensive, adjustable, and dynamic. This is an idea of enhancing human mind with potential of most recent technology.

There has been found no literature regarding such system or even concept of it. Enterprise resource planning (ERP) systems that are widely used within organizations do not include such system of direct support of decision making. Even most complex package of software cannot provide fulfillment to organization's needs (Wei, Chien & Wang 2005). Besides existing solutions focus only on all aspects related to supply chain management, procurement, warehousing, and other process-related support (Alpers, Becker, Eryilmaz & Schuster 2014). There is no evidence for existence of an IT system working on ERP collected data processing it into knowledge and displaying for strategic thinker in order to augment his decision making. Hence, the niche is vast what elevates the importance of this thesis which builds the foundations for aforementioned system.

1.3 Problem statement

Such conceptualization of managerial decision making augmentation requires consideration of three key elements: strategic thinker, organization, and interface between these two. The mediating questions standing as foundation for augmentation system concept are: how to standardize managerial decision making without losing precious flexibility, dynamism, and accuracy? How to enable manager to review whole picture of current situation, anticipate the future, and basing on those to make decisions that will drive his company to success? These are to be supported by an IT system but here comes the question of implementation, types of data to be included, and way of displaying it to the manager with understanding his cognition so that the decision making would be the most efficient.

> *The rate at which data can be collected and stored is outgrowing the rate at which it can be analyzed* (Keim, Mansmann, Schneidewind, & Ziegler 2006).

Above requires understanding of background behind managerial decision making, the way data is being developed and processed throughout organization, understanding what lies behind organizational success i.e. sustainable competitive advantage, and at last to understand how does manager drives organization to such success.

1.4 Organization of the study

In order to develop the concept a deep analysis of existing literature on three different domains is necessary. These three domains are: managerial decision making, organizational structure and knowledge management (KM), and interrelation between these two (Figure *1* Structure of theory review).

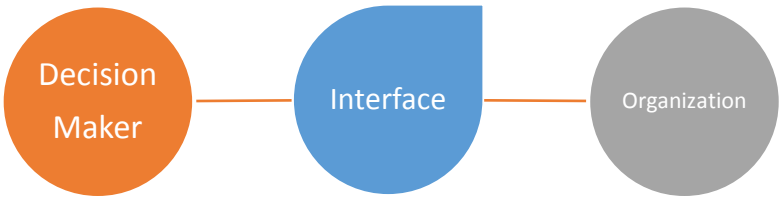

Figure 1 Structure of theory review

As explained above, these three aspects are considered in the creation of the conceptual system of managerial decision making augmentation. First, decision maker stands for managerial decision making – the individual's cognition, theory upon decision making, styles of decision making. This first element is proceeded with the first proposition. Second, organization is the environment, where the decision maker operates thus aspects affecting his performance must be considered – organizational structure, communication, organizational knowledge, flexibility of an organization, and contemporary approach on the information flow – communication. Here afterwards is introduced second proposition of the concept. At last, the interface between decision maker and organization is the most direct literature to the development of the concept. It aims to identify interrelation between the individual driving the organization and organization itself, and the techniques of optimizing organizational structure, and finally shows insight on existing IT solutions harnessed for running an organization. After this chapter third Proposition is introduced with sub-proposition included. Such literature review, with aspect to these three parts, includes classic articles from authors like Mintzberg, Grant, Porter, or Nonako that are accompanied by the most contemporary articles from recent years utilizing the former and developing most innovative ideas. As mentioned, followed by each of these three main topics will be Propositions drawn from the review of literature. These propositions will be a key elements of the concept that are suggested by author in order to develop the idea of managerial decision making augmentation system.

Basing on the information gathered throughout literature review the next step is to synthetize the idea into the concept which hereby is being created. This will create a basic foundation for the managerial decision making augmentation system. The concept will be developed both inductively as the ideas will be confronted against the existing theory and deductively, meaning that the concept is being developed and reshaped while reviewing the literature. Throughout the analysis the Propositions will be further explained in their position within the concept and supported by further evaluation. At last, the framework will be presented graphically basing on theoretical concept and propositions will be supported by theory synthesis and concept development. Graphical representation of the framework will be discussed and at last conclusions will summarize the framework and its potential for future research.

1.5 Research questions and propositions

The goal of this paper is to understand what information should be included in such system – what data does executive manager need to make a good decision and how could the process of decision making be augmented. Because of the vast size of topic this thesis will focus on the subject of internal decision making that is designing organizational structure of the company. It would include the input information, how process it with the reference to history, and represent it in a most comprehensive manner for the manager. The final dataset presented to the manager would only be a support for the decision making which bases on managerial intuition. Such end visualization (interface) would comprehend the highly structured mathematics, models, and other techniques of processing explicit, quantitative data, with qualitative information, for example comments from the decisional upstream.

The three propositions introduced in the first part of this thesis are following:

1. Users should be from all across organization, while end user should be in a form of a decision making team.
2. The system should be applied across whole organization with its hub at mid-management that will be directly responsible for knowledge database and the information flow.
3. The system should be incorporated into existing solutions rather than to be created from the ground as an autonomous system.

a. Standardized knowledge gained from implementation of the system shall allow efficient knowledge obtaining from external sources like professional service firms (e.g. Wagner, Hoisl & Grid 2014)

All above propositions will be introduced after each of three main topics (i.e. chapters 2, 3, and 4) and elaborated basing on the literature review. Afterwards, in analysis part of the thesis, they will be positioned within the whole concept and supported by the logical argumentation.

2 MANAGERIAL DECISION MAKING

This section will discuss the contemporary understanding of managerial decision making, review of current literature upon augmentation of the decision making, and potential lying in framework of dynamic enhancement of managerial decision making. Most of below text is in context of the system or framework which is being conceptualized in this thesis therefore any ambiguous sentences treating about any of these words should be understood in this setting.

2.1 Introduction

> *The aim of strategic thinking and decision making is to ensure survival of the organisation in a competitive marketplace.* (Steptoe-Warren, Howet & Hume 2011, 246)

There is big number of articles and books related to managerial decision making, its alignment to the organization, dependence upon circumstances, and cognitive/psychological background. Steptoe-Warren et al. (2011) have divided such literature into managerial and psychological. The split gives a broad review of strategic thinking and helps in creating big picture of it. These two approaches vary in many aspects as their perspectives are set from considerably different angles, nevertheless they agree that good strategic thinking, well aligned with organizational objectives will increase company's performance (Senge 1990; Kaplan & Norton 2000; Russell 2001; Steptoe-Warren et al. 2011).

Steptoe-Warren et al. (2011) pointed that nowadays organizations operate in the environment full of complex opportunities. Each of these opportunities include internal and external factors that must be taken into account. The turbulent characteristics of such environment lead to outcomes of change to be much less predictable, making the decision making much more difficult (Grewal & Tansuhaj 2001). In such complex, dynamic, and vast milieu decision maker must develop plan of reaching sustainability and development of enterprise – a strategy. Kaplan and Norton (2000) described strategy as an implication of movement from current position to the anticipated one and consists of hypotheses preparing to go through uncertainties of the future. They compare strategy of a company to planning a battle; without a detailed and specific map it will be chaotic and most likely unsuccessful. This develops an idea that the

decision maker must map organizational situation and capabilities in order to develop a solid strategy and operate smoothly on daily basis.

2.2 Five competencies of strategic decision making

Garavan and McGuire (2001) described a set of decision making competencies: business, knowledge management, technical, leadership, social, and intrapersonal competencies. Hogan (2003) argues that within these competencies, the most central one is the business competency as it includes sub-competencies of strategic cognition, decision making itself, and board management, which is the ability to think in terms of systems in addition to providing a vision, meaning and direction to the organization (Scholtes, 1999). This does not, however, mean that the latter competencies are not important to the quality of the decision making; their role is crucial and strictly interconnected – without either, the decision making can be considered to be of a poor performance (Steptoe-Warren et al. 2011).

In order to think strategically, strategic thinker needs up-to-date and relevant data so that they can produce hypothetical scenarios and solutions what suggests the need for a proper knowledge management. Leadership competencies also are required as they are necessary to communicate the decisions that have been made and envisioned throughout organization so that each and every individual will have proper understanding of it and solid motivation to perform his part in executing announced decision. Otherwise employees will not have common goal and what strongly impacts the overall performance of the organization (Feurer 1994; Ardichvili 2008; Al-Alawi et al. 2007).

Steptoe-Warren et al. (2007) suggest to divide competencies into two groups for their better identification: strategic thinking and decision making. The strategic thinking group includes competencies of: business, knowledge management, technic, leadership, social, and intrapersonal. The group of strategic decision making includes separate competencies. The latter group of competencies is an imperative aspect of strategic thinker's role as it is the one that enables him to steer the organization into the future.

The strategic decision making competency includes five key characteristics:

1. Holistic view on the organization as a way of appreciating how different parts interrelate with each other

2. Forming a fit between current resources and opportunities so that accommodation of these resources will be on place and time of necessity, in order for the vision to be implemented. The resources include people, processes, finances and technology.
3. Understanding the opportunity and relations between his organization and external environment including competitors and their limitations, so that opportunities can be revealed and cropped.
4. Hypothesizing and testing; this includes risk management for example in terms of what if a product or service will not work as anticipated? What actions should be performed in such situation? This characteristic is about looking at all the possible scenarios of changes implementation so that alternative schemes can be put in place for relevant outcomes.
5. Managerial cognition, which means an intelligent opportunistic view, enabling strategic decision maker to recognize and benefit from appearing opportunities.

2.3 Hierarchy of decision making

Since always hierarchy was accompanying organizational structure (Burgelman 1983; Mintzberg 1983; Steptoe-Warren et al. 2011). It has always been necessary for information flow and split of duties across the company. From the lowest level, a managerial individual must supervise daily tasks, including quality management, team management, and overall shop floor work maintenance. Up the ladder the responsibilities shift from such daily tasks into strategic errands and that require more broad or holistic thinking in regard to whole organization. Steiger et al. (2014) found that literature generally distinguishes three levels of management:

- C-level which is top executive management,
- mid-management which operate as a “bridge” relating to communication and strategic actions implementation,
- and non-managerial that includes individuals focused primarily on daily tasks just in accordance to guidance aligned with strategies determined from above

Each of these levels are responsible for different aspects of the company (Figure *2* – the three levels correspond to the ones listed above) and this requires transparent definition of their responsibilities, creation of efficient communication chain, and description of their hierarchy also in matter of potential approvals. Such interlinked division of management allows allocating matching individuals, basing on their

profession or experience, to appropriate position. Transparent hierarchy with efficient communication chain theoretically creates perfect management of organization where approach is two-directional and feedback is given from top to bottom and otherwise.

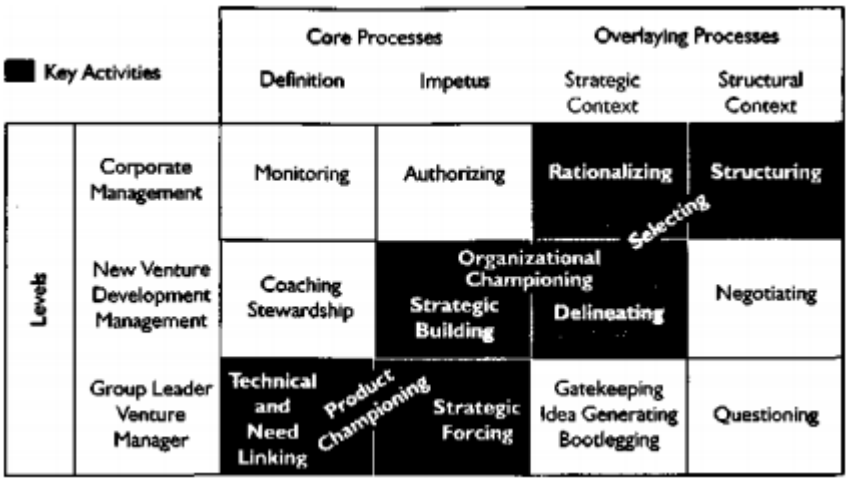

Figure 2 Matrix of key and peripheral activities (Burgelman 1983, 230)

Nevertheless such situation is only an idealistic theory and in practice there always is place of mistake. Failure related to decision making is often associated with miscommunication or misinterpretation. The longer the decision chain extends the bigger probability that either of above will occur and even the best developed ideas will fail in any steps (Hayashi 2001).

> *Very often, people will do a brilliant job through the middle management levels, where it's very heavily quantitative in terms of the decision making. But then they reach senior management, where the problems get more complex and ambiguous, and we discover that their judgment or intuition is not what it should be. And when that happens, it's a problem; it's a big problem* (Ralph Larsen, former CEO of Johnson & Johnson via Hayashi 2001, 61).

Above, Larsen gives a clue that as middle management are having more direct insight to the information and hence they might judge it more straightforward, while the senior management has already information of bigger ambiguousness. Their task is more demanding because it is not linked to a single

domain and it requires insight to each aspect of the whole situation. That is why intuition, which will be described below, is perceived by several top CEO's as most used thinking process on such managerial level. This gives a hint that what senior managers need is a support of their decision making e.g. by IT system, but about it later.

Managerial levels described above are interlinked and in matrix operational framework; they communicate in both directions according to holistic ideology of an enterprise. Each has different tasks and focuses on the same matter but from different perspective. Hence communication is of crucial importance (Chong, Chong, & Gan 2011) and this as well will be discussed in further sections of this thesis. Since there appears more voices against hierarchy and insist for collaboration instead (Mintzberg et al. 1998, Steiger et al. 2014), the chapter 3.1 *Importance of communication within the organization* will try to compare collaboration with hierarchy, especially in context of the concept.

2.4 Superiority of group decision making

Decision making, as already mentioned, is becoming highly sophisticated and complex task when considering ever more structured problems, turbulent and dynamic environment, and opportunities that often are not just at the arm's reach. Individual, regardless of his knowledge, experience, or intelligence, is still a human with his own cognition and hence place for biases; relying on one person's judgments may lead to biases and omissions as the data used for that judgment development has been collected and filtered by one's cognitive selection (Hussey 2001). Values of decision maker directly affect the choice, process called "perceptual screening" (Steptoe-Warren et al. 2011), which shapes his perception upon organization and its environment. In addition to cognitive reasons, Miller and Friesen (1983) state that insufficient share and delegation of decision making is one of the biggest causes for business failures.

This gives a hint that decisions made by only one individual are insufficient in regard to organization and strategy development. Hence strategic thinking should be performed in teams of managers and superiority of groups over individuals have been collected from across literature and described by Steptoe-Warren et al. (2011):

- Exchange of opinions, serving as bias and error avoiding system
- Social support as development of one's idea to a bigger concept with other's contribution

- Fair competition between members of the group that enhances motivation and energy for the contribution
- Feedback that is crucial for learning on mistakes and successes

Edge and Remus (1984), however, point that decision making team is only efficient when egalitarian. Once hierarchy is introduced into such exclusive group, some younger individuals will not show their potential while seniors will not receive necessary feedback – the overall cooperation would be limited to cautiousness and highly formal communication (Edge & Ramus 1984). Egalitarian teams, on the other hand, means experts working together with novices share their experience, cognitive patterns, style of working, and generally transfer the expertise (Collins 1982). This generally enhances knowledge creation and sharing which means boost of externalized tacit knowledge that is one of most valuable (Epstein 2002). In context of team decision making appropriate share of duties and tasks results in overall increase in productivity and efficiency (King 2006).

2.5 Intuition-based managerial decision making

"A classic trade-off noted by decision theorists is that decision accuracy is often inversely related to decision speed." (Dane & Pratt 2007, 33)

Above statement, widely known across researchers (Dane & Pratt 2007), was main motivation for understanding how to perform high quality decision making in relatively short period of time (e.g. Eisenhardt 1989; Hitt, Keats & DeMarie 1998; Perlow, Okhuysen & Repenning 2002). Across several papers it has been suggested that intuition may be a solution for this trade-off (e.g. Burke & Miller 1999; Khatri & Ng 2000; Hayashi 2001). Intuition may be described as genetically built-in cognitive system of quick and effective information synthesis and it is a skill that can be augmented by a more formalized systems (Dane & Pratt 2007). It has been classified as non-logical since its process cannot be described by symbols, language, or formulas simply because it is unconscious, usually very complex, and so rapid that it cannot be analyzed by the individual's mind within which it takes place (Bernerd 1938; Hayashi 2001; Dane & Pratt 2007). Across literature intuition is described as the most common decision making synthesis process (e.g. Hayashi 2001) what is a reason for us to analyze the intuition as the managerial decision making method in context of this thesis; the speed is crucial for contemporary decision making and the

idea of the augmenting system is that decision maker should make his decision fast and effortlessly – that what intuitive thinking is.

> *Often there is absolutely no way that you could have the time to thoroughly analyze every one of the options or alternatives available to you. So you have to rely on your business judgment.* (Ralph S. Larsen via Hayashi 2001, 61)

Contemporary research proposes that the application for intuition may be particularly useful for decision makers in organizations operating in turbulent environments (Khatri & Ng 2000). Hayashi (2001) interviewed several CEO's of top companies like John & Johnson or Wisconsin Energy Corporation who agreed that amount of data and time in which it should be analyzed disable rational analysis to be effective in these circumstances. Top management's decision making is far from cold analytical thinking as they base on prepared data and analyze it with their feelings. This would explain growing popularity and importance of intuitive decision making; milieu for managerial decision making is growing ever more complex and dynamic what makes rational thinking ineffective way of data synthesis (Dane & Pratt 2007). Generally, intuition is divided into two types: heuristic, which is domain independent and is suitable for simpler problem solving, and expert intuition which is bind to specific domains (e.g. professions) and is applicable for rapid decision making in complex situations - e.g. surgeon's decision while operating (Dreyfus & Dreyfus 1986; Prietula & Simon 1989; Simon 1996; Klein 1998, 2003). The latter one is recognized as "highly sophisticated, non-conscious cognitive structures that permit rapid and accurate responses to highly demanding situations" (Dane & Pratt 2007, 37). Intuition, regardless of complexity and type, is seen to undertake cases holistically and it operates throughout recognizing patterns gathered experientially (Shapiro & Spence 1997, Klein 1998, Epstein 2002). Dane & Pratt try explain it further: "in making holistic associations, individuals nonconsciously map stimuli onto cognitive structures or frameworks" (2007, 37).

What makes intuition a highly researched thinking process is that it is fast (Bernerd 1938; Bastick 1982; Burke & Miller 1999; Khatri & Ng 2000; Hogarth 2001; Myers 2002; Kahneman 2003). Its speed is perceived not only as when comparing to rational decision making process, but also in absolute. This non-conscious synthesis of patterns generates answers (in context of intuition they are called judgments) in short period of time is what arises as an important topic for contemporary researchers. This is based on considerations of the ever more dynamic environment managers operate within. Recent research in intuition has recognized that:

- Intuitive process is probably more applicable than rational thinking for integration of broad information into categories (Dane & Pratt 2007); for certain individuals, under specific circumstances intuition is recognized to be superior to other decision making techniques approaches (Hammond, Hamm, Grassia & Pearson 1987; Blattberg & Hoch 1990; Khatri & Ng 2000)
- Intuition is strongly affected by judgments and emotions of individual (Agor 1986); even more "intuitions and emotional appraisals appear to arise through similar neurological pathways." (Dane & Pratt 2007, 39)
- Intuition is not applicable for highly structured mathematical problems as it will lead to highly biased results, but it is recognized to be very suitable for decision making involving investment, strategy, or human resources management (Dane & Pratt 2007)
- Managerial intuition requires at least 10 years of tacit experience of specific domain in order to be effective for a proper decision making (Khatri & Ng 2000). This is the time for the individual to collect sufficient number of patterns for the further recognition (many researchers compare it to patterns that chess masters recognize on the board).
- Intuition-based decision making is much more effective when combined with decisions supported by IT systems (e.g. forecasting models) than either decision making technique in isolation (Blattberg & Hoch 1990)
- Intuition is often perceived either as a process or its output, Dane and Pratt (2007) hence clarified that the process is intuitive thinking process that results in intuitive judgments. These judgments are what drives the decision maker to take action
- Non-conscious way of decision making is the only known to be using heuristics and internalized patterns, unlike rational decision making which requires systematic procedures and conscious clarifications (Janis & Mann 1977)

Summarizing, research has recognized four, most core characteristics of the intuitive thinking: (1) it is non-conscious process (2) that involves holistic patterns (3) that are produced in relatively and absolutely short period of time, which (4) results in intuitive judgments. The concern, however, is when managers utilize intuitive thinking in the best manner i.e. what are requirements for developing the best judgments. Dane and Pratt (2007) have developed a framework (Figure *3*) displaying factors that affect so-called *effectiveness of intuitive decision making*. These mostly consist of internal factors of individual – his experience, mood, ability to learn from both types of information, and of course his focus. They build the domain relevant schemas. External conditions are just conceived as complexity of the task and

environmental dynamics, or the uncertainty. The authors of the framework proved that all below factors affect the effectiveness of intuitive thinking and hence the quality of its output – intuitive judgments.

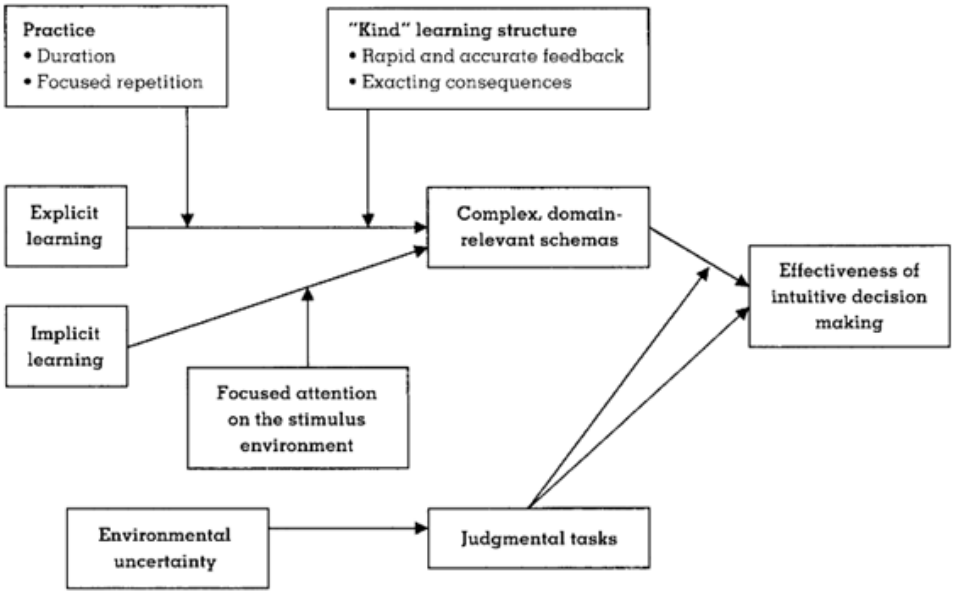

Figure 3 Factors Influencing the Effectiveness of Intuitive Decision Making (Dane & Pratt 2007, 41)

> *In fact, the veteran does not scan the environment and process information any faster than the inexperienced foreman; rather, he (or she) has learned to grasp the meaning of certain patterns of operations and activity on the plant floor. In a sense, the foreman does not need to think about this information; he simply reacts to it* (Prietula & Simon 1989: 121)

2.6 Emergent dynamic strategy

> *Organizations should change their competitive position faster than the rate at which the threshold line changes its position.* (Feurer and Chaharbaghi 1994: 51)

The dynamism of contemporary milieu affects also strategy of the organization itself. Bonn (2005), in regard to the traditional vision, argues that strategic decision making, in modern way, is concerned with thinking in a novel way what concludes that strategy is emerging over the time and evolves upon influence of circumstances. Strategy should be deriving from general mission and vision of the company and be aligned with it (Steiger et al. 2014), however even though two latter are rather fixed, the strategy should always evolve. "Competitiveness can only be maintained through continuous improvement of the offerings and capabilities of an organization." (Feurer and Chaharbaghi 1994: 51) Once initial strategy is developed, according to the mission and vision, the continuous circle of strategy adjustment will begin (Figure *4*). Adjusting strategy to the circumstances is not a rapid process but it requires ever higher level of flexibility within a company to enable it for more radical amendments since strategic changes that would affect organization on all levels. The strategy itself usually emerges from top down meaning that strategic thinker or strategic team evaluates the way company should achieve its goals. Nevertheless as organization operates, several strategy hypotheses might fail and new situations will arise what requires action in context of strategy update. Hence evolution of strategy upon the time would be influenced by reports in a bottom up manner since middle management and workers have more realistic and detailed insight into current situation within each of company's department (Mintzberg 1986). Such communication, however, requires channels and infrastructure for efficient knowledge exchange and capturing. Additionally, such dynamic strategy requires highly efficient knowledge management system which will, with use of communication channels, be base of any amendments for strategic goals.

> *Technology and people encompass those factors which define the strategic capabilities of an organization that cannot be measured in financial terms. Technological Innovation can be regarded as the driver for changes in a competitive environment. The competitive position of an organization hinges on its ability to drive or at least keep abreast with such changes.* (Feurer and Chaharbaghi 1994: 56)

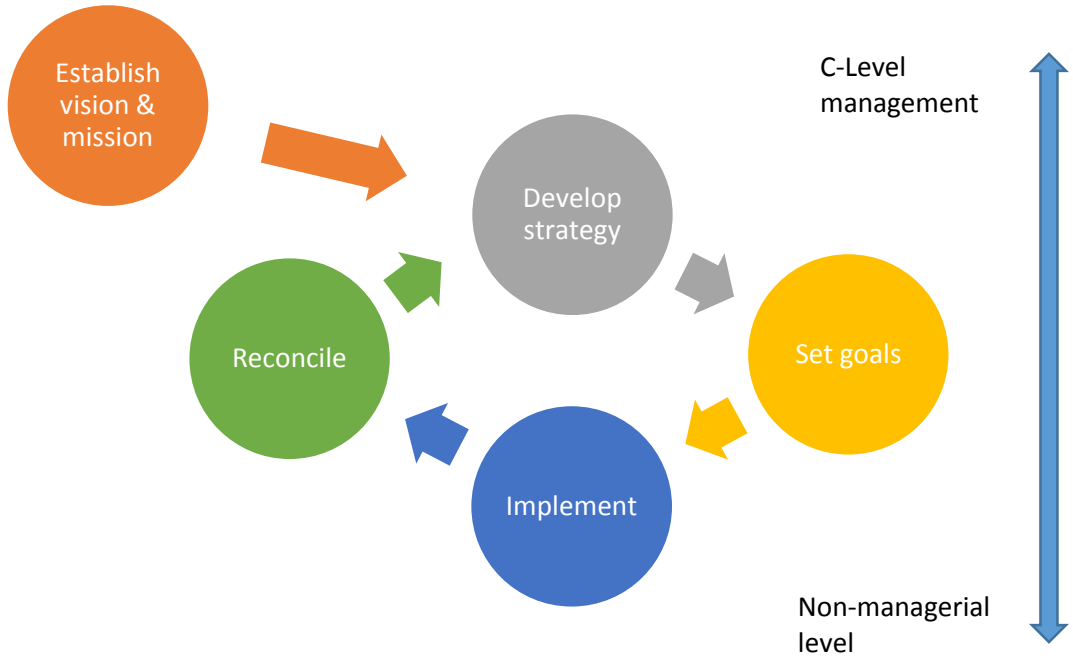

Figure 4 Cycle of continuous strategy development

2.7 Proposition 1 – users should be from all across organization, while end user in a form of a decision making team

End users of the managerial decision augmentation system should be from all across the organization; each should have different accesses yet input from each hierarchical level is important for senior management's role. As for the top managers they are generally performing their decision making basing on intuitive judgments that derive from intuitive thinking. Intuition, shortly, is a process of mapping, relating, and synthetizing patterns of reviewed explicit knowledge by their experience – this leads to proposition that interface in which strategic thinker should operate must be aligned with the way intuition works and hence it should strongly rely on patterns represented in graphical form. Because of highly individual way in which each person processes thinking and hence the patterns he or she recognizes the interface must be adjustable for the highest convenience and efficiency of use. The interface should not only allow user to adjust it for his needs but also should have several possible interface setups with different data displayed allowing strategic thinker for holistic view upon the organization. The data should be displayed rather in graphical form than text to make it more comprehensive and viewable allowing end user to read the information in very fast manner. Having that the system should allow user to simulate

output with different inputs for testing his strategic hypotheses and more efficient opportunity harvesting. Elasticity of the system and the interface should allow for continuous adjustment in regard to circumstances and development of strategy upon time. Eventually, the end user which is the strategic thinker should rather be considered as decision making team for improved decision making and feedback. Such a team would be egalitarian and each of the members should have equal access, if not the display should be shared for all members.

3 ORGANIZATIONAL STRUCTURE

This chapter elaborates on organizational structure and important aspects related to it. All the information is in filtered to match context of system of managerial decision augmentation and hence big emphasis is placed on knowledge management and creation, and flexibility in relation to complexity.

3.1 Importance of communication within the organization

> *A business that fails to communicate properly will be misunderstood and in the absence of proactive, clear messages, risks its lenders forming their own judgments on the basis of incomplete or inaccurate information.* (Davies 2002, 20)

Well-developed strategy means nothing if it is not known to others that contribute to organizations performance, meaning anybody working at the company. Often managers develop a great strategy but pass only partial information to employees what results in poor implementation and further failure (Kaplan and Norton 2000). This stresses, especially in context of contemporary turbulent environment, the importance that each and every individual contributing to the company should have common understanding of corporative goals, strategy, and vision (Marr et al 2004; Vigoda-Gadota & Meiri 2008). Otherwise conflicts arise and overall the organization lacks of momentum – comparing to force vectors: if all are aligned in the same direction the summation is greater than in situation of vectors each pointing to a different void. Processes at the firm are interdependent so are its employees what creates a highly complex system where everybody are, to a bigger or smaller extent, influential. Organizations hence need effective tools for communication of both processes and strategic decisions for enhancement of common understanding, exchange of tacit knowledge, and immediate correction of misunderstandings with the possibility of transparent feedback. The framework of real-time organizational map would allow employees to align by efficient, two-directional communication, exchange of ideas, and passing them to the top management for the decision making and strategy development.

There exist two types of communication - formal and informal (Steiger et al. 2011). The formal type of communication usually only shifts upwards, downwards, and horizontally (Brownell 1991) (refer to Figure *9*). Informal type of communication aside from such movements, may also include any fathomable course in which information will pass. Commonly, in a classic hierarchy, information filters up the organizational

network to the top management (Ashkenas et al. 2002). In more contemporary, collaborative settings, the horizontal and vertical lines of communication cross at the mid-management level, placing on them the responsibility to properly route that information (Costanzo & Tzoumpa 2008).

Mintzberg, Ahlstrand, and Lampel (1998) state that communication and control is the only part of organizational structure that, if necessary, could be standardized – codified, elaborated, translated into ad-hoc programs and routine plans. On the other hand, they point that learning organization is, in theory, decentralized, promotes open communication, and individuals to work in teams. Collaboration, in this sense, replaces hierarchy with its stiffness, and increases, important in contemporary market context, values of risk taking, honesty, and trust. Communication within organization is hence important binder that influences on how "collective learning of the organization, especially how to coordinate diverse production skills and integrate multiple streams of technology" Prahalad and Hamel (1990, 88) which eventually consequences in competences (Mintzberg et al. 1998).

There is big influence of knowledge management and creation on the quality of communication – these two, theoretically independent, aspects of organizational management are in fact heavily interdependent where one affects another for good or bad.

“Stream of autonomous strategic initiatives may be one of the most important resources for maintaining the corporate capability or renewal through internal development.” (Burgelman 1983)

“Managers also need to be able to communicate and guide employees towards the new strategic vision by changing policies, providing additional resources and by articulating the vision in terms of its aims and objectives and vision and mission statements”

3.2 Knowledge creation and management

Besides communication of processes and strategy development all kinds of organizations require intangible assets of explicit and tacit knowledge. In fact, any kind of information created and maintained by an organization is a foundation of organization’s existence and it has major effect on its competitive advantage – without knowledge the company could not exist (Davenport & Prusak 1998; Cortada & Woods 1999; Alavi & Leidner 2001; Nevo & Chan 2007; Ardichvili 2008; Liebowitz 2009; Sinha & Date 2013). Already over two decades ago Abramovitz (1989) expressed direct connection between knowledge

management and organizational economic growth. Generally, literature recognizes two types of knowledge: explicit– knowing about – information in a shared form like data and facts must interplay in a symbiotic coexistence with the second type: tacit knowledge – knowing how – like experience of the individuals within the organization in order to create holistic idea of knowledge management (Tyagi et al. 2015). Both types of knowledge directly ignite innovation and promote competitive advantages hence, in contemporary turbulent environment, they are of even bigger importance than tangible assets of the organization (Jacobson 1992, Kaplan & Norton 2000, Johannessen 2008, Steiger, Hammou & Galib 2014, Tyagi et al. 2015). The knowledge-driven innovation directly affects competitive advantage which can only be sustained when capabilities created by an organization cannot be easily replicated by competition (Hart 1995, 988). Archibugi and Michie (1995) recognized that the awareness of importance of knowledge management is growing and organizations become ever more knowledge intensive. Thompsson (1996) reported that the management of intangible assets (knowledge) has become critical at both levels of the organizations – strategic and operational.

> *Continuous changes in the state of knowledge produce new disequilibrium situations and, therefore, new profit opportunities, and they do so at an increasing pace.* (Johannessen 2008, 404)

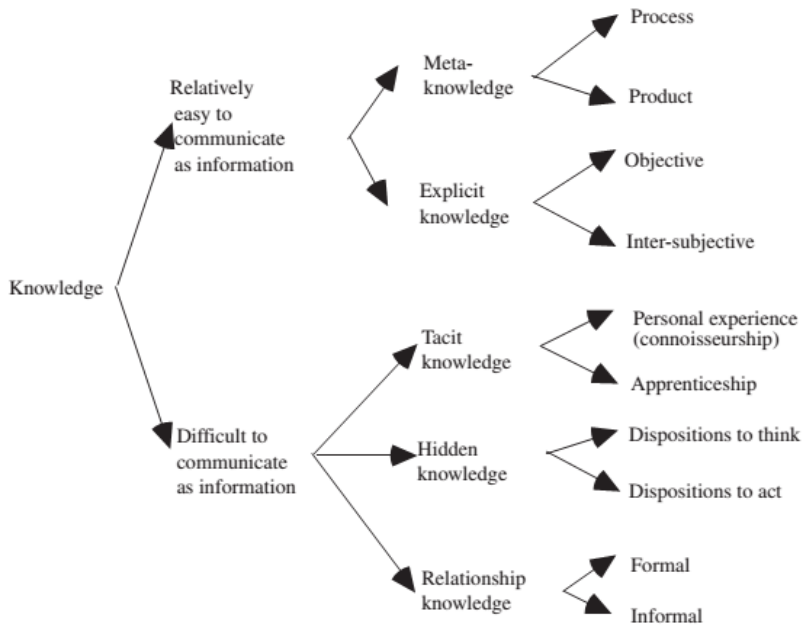

Figure 5 Categorizations of Knowledge (Johannessen 2008, 409)

3.2.1 Socialization, Externalization, Combination, and Internalization (SECI)

Knowledge independent of the individuals can only be stored in explicit form. Tyagi et al. (2015) evaluated contemporary use for SECI modes of knowledge management within organization and their *ba's* – a term used for describing the environments of these modes. Both of these terms and concepts were introduced by Nonaka (1994) as a framework for understanding dynamism of knowledge in organization. SECI stands for: Socialization, Externalization, Combination, and Internalization. These modes describe a journey of knowledge, the way it is being transferred, ways it requires to be done, and the shifts between tacit and explicit knowledge. *Ba* is an expression introduced by the Japanese philosopher Kitaro Nishida (Tyagi et al. 2015) and it defines a space and time nexus. Further applied in the knowledge management context *ba* is an environment within which particular knowledge exchange mode may occur. According to Tyagi et al. (2015) such environment is something without which any knowledge exchange could occur.

Socialization describes mode of knowledge dynamics where individuals sharing tacit information; their cognition, ideas, experience, knowledge, skills, and opinions. They collaborate, develop mutual perception and grow their understanding in a social way. The information within the socialization mode creates knowledge assets of know-how and skills of employees regarding the processes, organization, products, assets, technologies, suppliers, customers, and so on. *Ba* for socialization mode is any location where individuals may interact with one another, for example offices, online conferences, or virtual realities.

Externalization mode describes the process of tacit knowledge's transformation into explicit, sharable information. The know-how knowledge in the form of concepts, assumptions, analogies, relations, and models, morphs into more tangible and generic forms through demonstration, comparison, and experimentation (Salmador & Bueno, 2007). Externalization is a step of creating conceptual knowledge and it converts abstract ideas into an explicit form of data expressed by text and symbols. Hence the assets of this mode are texts, images, designs, and symbols. Such data are existing in *ba* of text processing software (e.g. MS Office), tools capturing processes, and meeting rooms for conceptualization.

Combination mode is a process of standardization of output explicit knowledge from externalization. These data are "integrated, classified, reclassified, and synthesized with various existing explicit notions possessed by employees, to form a cluster of organized knowledge resulting in 'systemic explicit knowledge'" (Tyagi et al. 2015, 211). In this mode are created intangible assets of systemized explicit knowledge like documentations, specifications, manuals, patents, etc. Within combination mode Tyagi et al. (2015) suggest visual tools for presentation of data in most comprehensive manner e.g. A3, where data

like diagrams and tables are presented in an area of A3 sheet of paper - “one picture worth 1000 words”. The most appropriate *ba* for these assets is an IT system of (knowledge) database, corporate intranet, or collaborative tools (Nonaka, Toyama, & Konno 2000).

Internalization as the last mode of dynamic knowledge transformation occurs when an individual morphs the explicit data into tacit knowledge (Vaccaro, Veloso, and Brusoni 2009). It requires access to explicit knowledge, in best case “the systemic explicit knowledge” by *ba’s* from combination mode, or by trainings, conferences, workshops, and so forth. It is the crucial stage of the knowledge journey since tacit knowledge acquired here is added to individual’s experience necessary for daily and other pragmatic use (Tyagi et al. 2015). Internalization requires additional actions related with knowledge requisition; one cannot gain experience just from reading or viewing as it requires action so the skills and knowledge would ‘sink in’ (Nonaka et al. 2000). According to Tyagi et al. (2015) *ba* for internalization are collaborative knowledge networks, neural networks, and notes databases. However, we would argue that tacit knowledge acquiring occurs most in individual’s cognitive space, where synthesis of data transforms it into one’s experience. Assets created from this mode are know-how of practices and actions, routines, and organizational culture (Tyagi et al. 2015).

3.2.2 Externalization of tacit knowledge

> *Keeping experts, however, is only one challenge in utilizing experts in a knowledge economy (Matusik & Hill, 1998). Ideally, the information experts can be captured by the organization (Hammer, Leonard, & Davenport, 2004; Osterloh & Frey, 2000).* (Dane & Pratt 2007, 39)

Unlike explicit knowledge tacit one is highly intangible; it is skill based, people intensive and hence it is difficult to share and cannot be purchased (Jacobson 1992, Hart 1995, Johannessen 2008, Tyagi et al. 2015). Even with possibility of gaining know-how from other companies from within the industry, it still is a form of an explicit knowledge that must be internalized in order to be what tacit knowledge is – the experience. Thus, it is only stored in human resources that, by definition, are not fixed to the organization. Employees, when leaving company, take with themselves their precious experience, ideas, and knowledge. In Figure *6* Johannessen describes the way corresponding types of knowledge can be externalized, shared, and what media could possibly be used for each type.

> *Knowledge building for an organisation occurs by combining people's distinct individualities with a particular set of activities.* (Barton 1995, 8)

Types of knowledge	Learning by	What is learned	How to share it	Media
Meta-knowledge	Reflection	Know why	Communication	Books, lectures, databases etc.
Explicit knowledge	Listening/ reading	Know what	Communication	Books, lectures, databases etc.
Tacit knowledge	Using/ doing	Know how	"Brainstorming camps" structured as apprenticeship	Practical experience; Apprenticeship-relationship
Hidden knowledge	Socialization	Knowing how we know	Focus groups	Questioning underlying assumptions and mental models
Relationship knowledge	Interacting	Know who	Partnership and teamwork	Social settings

Figure 6 Types of Knowledge (Johannessen 2008, 410)

Tacit information independent of personnel rotation which is accessible for those who need it will increase company's performance and it is viewed even as necessity for survival in nowadays turbulent environment (Smith 2006; Lerro & Schiuma 2009; Cantner, Koel & Schmidt 2009; Mtega, Dulle, & Benard 2013). Therefore, appropriate storing of knowledge and ability to access it and share within the organization has a crucial impact on company's competitive sustainability regardless of its size, or structure (Nicolas 2004; Sandhu, Jain & bte Ahmad 2011; Steiger et al. 2014).

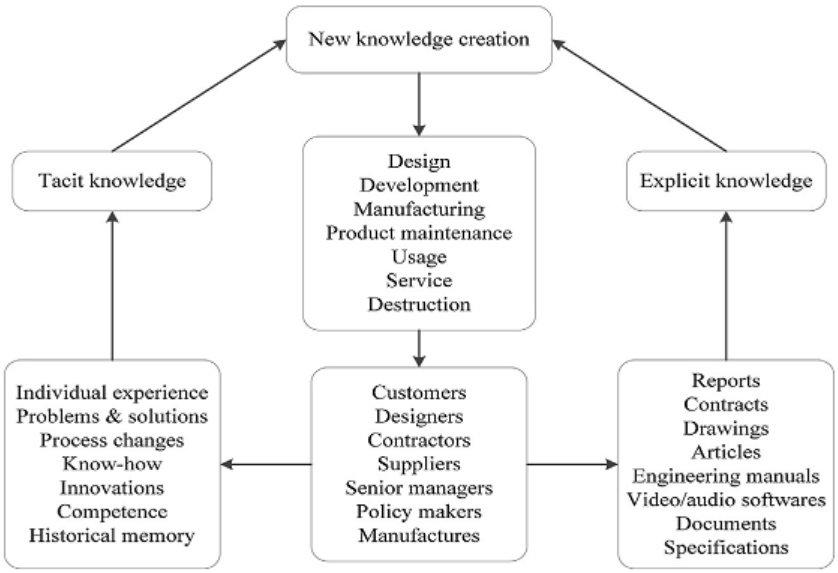

Figure 7 Schematic representation of knowledge creation in real world (Tyagi et al. 2015, 205)

> *Knowledge sharing, as referred as individuals' sharing of practices and knowledge (Lin, 2007) in terms of procedures and job practices (Barson, Foster, Struck, Pawar, Ratchew, Weber, & Wunram, 2000) is one the important and also challenging parts in the of success of KM implementation (Lee & Ahn, 2005).* (Chong and Besharati 2014 2014, 172)

In above scheme (Figure *7*) Tyagi et al. presented how tacit knowledge is utilized in the process of its externalization in context of new knowledge creation. It is clear that it is independent of explicit knowledge but they both are in par when developing organizational knowledge. Constructing knowledge database should be approached with awareness of organization's characteristics and with regard to several of its aspects. Chong and Besharati (2014) have distinguished 6 boundaries related to knowledge management (Figure *8*):

1. Lack of trust, meaning employees being afraid of sharing their knowledge due to competition and lack of recognition from the organization (Goh 2002)
2. Fear of losing power and job security, where individuals perceive their experience and knowledge as privilege and superiority in the organization and are concerned with losing these when sharing their tacit information with the others (King 2006)

3. Lack of communication, in context of ability of employees to communicate, express, and listen (Al-Alawi, Al-Marzooqi, & Mohammed, 2007) but also their willingness, attitude, and channels (Lindsey 2006)
4. Organizational hierarchy, which has a negative impact on knowledge sharing (Huotari & Iivonen 2005) since formal interactions and bureaucracy disable individuals to freely exchange the information and ideas
5. Lack of rewards, not only in context of recognition from the organization but also awareness that the effort spent on sharing the knowledge will affect also one's performance (McDermott & O'Dell 2001)
6. Technological barriers, which in context of our paper will be of biggest focus, for the well-developed IT infrastructure is crucial for seamless exchange of knowledge across the organization regardless of geographical distances and type of knowledge, what depends on department (Hendriks 1999).

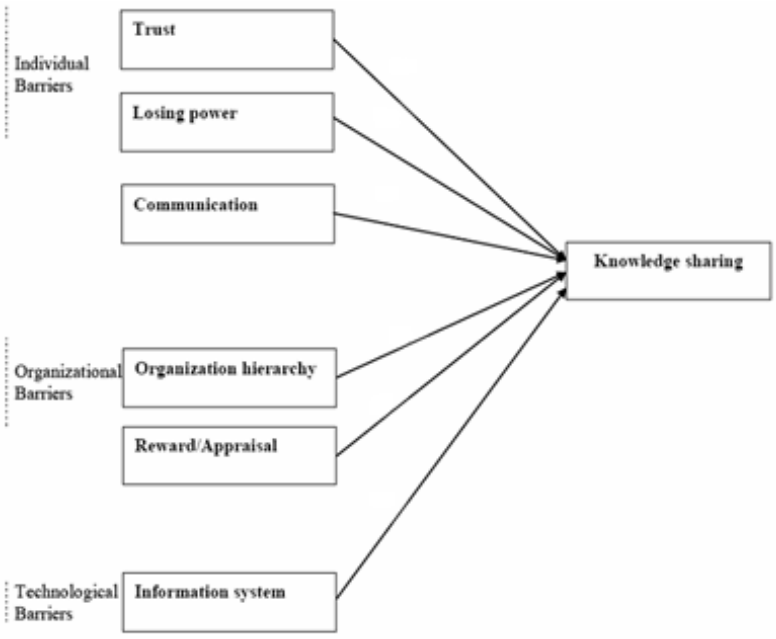

Figure 8 Knowledge sharing boundaries (Chong and Besharati, 2014)

Each of above boundaries Chong and Besharati (2014) have proven to be statistically considerably influential on performance of knowledge management within company, hence they all should be taken into account when designing a knowledge database. The importance of above boundaries can be shown as a sequence with mean value from respondents, in descending order: communication (3.66), trust (3.5), knowledge as power (3.49), information system (3.33), hierarchy (3.16), and lastly reward (2.78). Noteworthy is fact that even rewarding employees for sharing the knowledge has been considered significant when considering KM. Also important notice is that the responses are only from within petrochemical industry and application for other industry is not proven. (Chong and Besharati 2014)

> *Conner and Prahalad argue that "a knowledge-based view is the essence of the resource-based perspective" (1996: 477). Thus a firm should be seen, not as an eclectic bundle of tangible resources, but as a hierarchy of intangible knowledge and processes for knowledge creation* (Mintzberg et al. 1998, 279)

3.3 Organizational structure – influence on knowledge management approaches

Apart from the boundaries, organizational structure also plays significant role in knowledge management; Steiger et al. (2014) investigated the influence of organizational structure types and knowledge management approaches. They, basing on research of Mintzberg (1983), introduced five refreshed organizational structure types: adhocracy, strategic business unit, divisional, functional, and matrix (Steiger et al. 2014: 44). Their research proved significant influence of aforementioned types upon knowledge management and its practices: knowledge transfer, information filtering, and knowledge culture. Only knowledge-sharing training has been found not to be influenced by organizational structure type (Steiger et al. 2014). Accodring to Maksimovic and Lalic (2008) a functional structure of an organization consists of functional groups of the enterprise (Figure *9*). Organizational structures are determined by the structure of the other functions of an enterprise: top management, marketing, development, commerce, financial, administration, and logistic support.

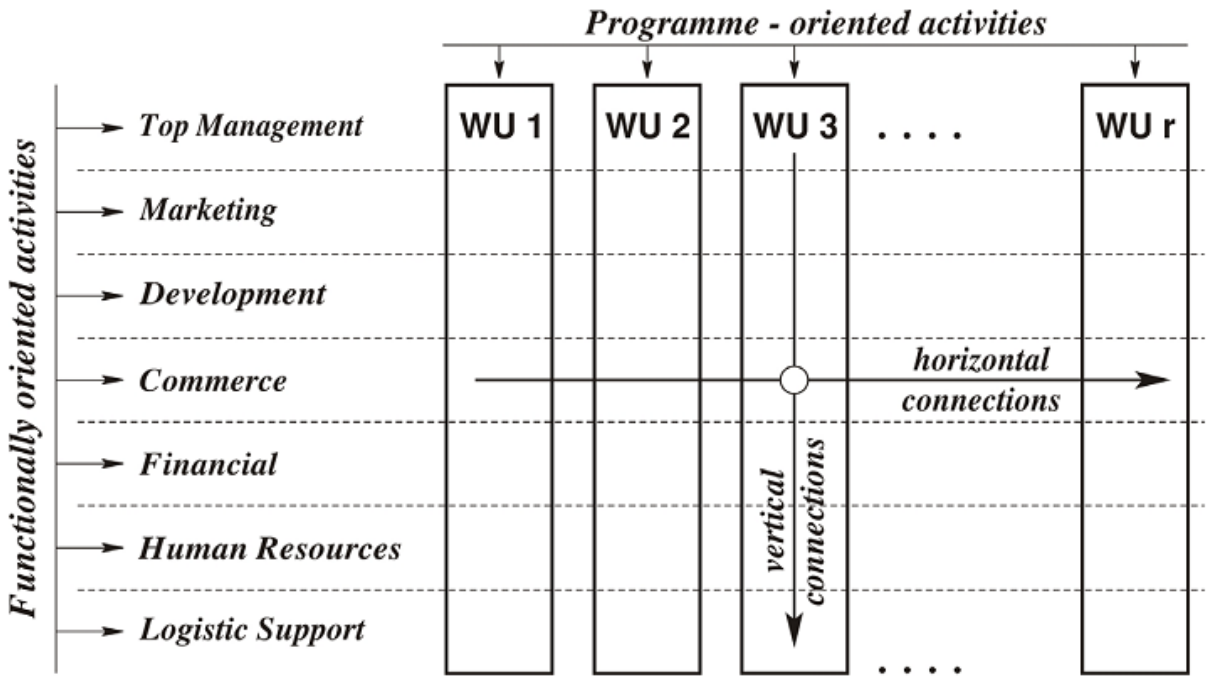

Figure 9 The Variety of Connections in Organizational Structure (Maksimovic & Lalic 2008, 775)

Since the type of organization's structure affects significantly the ability of company to efficiently manage their knowledge it is reasonable to find which type is most advantageous for companies to adapt when thinking of implementation of the system of managerial decision augmentation.

Matrix structure mixes characteristics of former organization structure types and it is strongly engaged with technology. It enables organization to be agile and flexible in their actions Steiger et al. 2014). Its emphasis on education and risk taking makes it very up to date and suitable for today's complex, competitive, and dynamic environment. "The true benefit of a matrix structure is in its ability to create and manage knowledge efficiently" (Steiger et al. 2014, 46) what is very strong factor in competitive advantage sustaining – as already mentioned, knowledge creation and management is essential for innovation generation. However, because matrix organizational structure is highly liberal it requires strong emphasis on coordination and standardization of skills in regard of the communication what may cause additional challenges (Ashkenas, Ulrich, Jick, & Kerr 2002).

3.4 Flexibility vs. complexity – Mass Customization

Adjustment of strategy upon circumstances would certainly be more effective and efficient in a flexible system. Usually growth and development of a company leads to increased complexity which decreases flexibility what makes the organization less adjustable; with higher complexity company will naturally be less flexible, adjustable, and hence less responsive for current situations (Maksimovic and Lalic 2008). Maintaining flexibility is also considered as an important part of strategic thinking competency (Steptoe-Warren et al. 2011).

What is flexibility – it is an ability of a system to swiftly adjust its settings to new circumstances (Schulz & Fricke 1999; Maksimovic & Lalic 2008). This swift changes, in a flexible system, should be also executed at possibly lowest cost, time, and effort (Upton 1994). Hence it is an "ability of enterprises to adapt to changes in the surroundings and to the disorders in the work process" (Maksimovic & Lalic 2008, 770). Research mostly distinguishes three main types of flexibility: technological, capacity, and flexibility of flows. The first type determines the ability of an organization for adoption of a new technologies into processes and the time, cost, and effort it requires (Zelenovic & Maksimovic 1999). Capacity flexibility regards to the ability of the system and its elements for fulfillment of production requirements, capacity in this sense is a potential remaining for utilization (Zelenovic & Maksimovic 1999). Flexibility of flows concerns potential number of flows in regard to maximum complexity determined by number of elements in the system.

Flexibility is a considerably important subject in contemporary literature. It is because with ever more dynamic market, i.e. more developed competition and more demanding customer, the time spans of any adjustments should be minimized in order to remain competitive (Maksimovic & Lalic 2008). However, with ever more structured companies' flexibility requires more sophisticated approach. Organization structure development has been found to have a very big impact on the level of complexity (measured by number of information flows) and Maksimovic & Lalic (2008) have investigated which organization type leads to lowest level of complexity. Within all they found that the lowest complexity is achieved with an orchestra type where management is conductor telling the orders directly to each function of an organization. However, since orchestra type is fictional (Maksimovic & Lalic 2008) it has not yet been empirically verified. From within the organizational types that actually are commonly implemented project one has been found to have relatively low complexity (Maksimovic & Lalic 2008). It is a variant

that considers divisional organization, with installed principles of team work and demands group connections between elements.

The demand of the market, even thou turbulent, may be more or less projected by understanding previous patterns and reading the current situation. This enables companies to implement an intelligent system for forecasting and designing the organization in a way to implement any changes due to the requirements. Here, in this context, arises a definition of mass customization as a concept that provides necessary flexibility in industrial firms. Mass customization is a manufacturing technique that conglomerates the flexibility and wide variety of customization while keeping low unit costs associated with mass production (Pine 1992). This concept is regarded as one that requires close relation with customer (Maksimovic & Llilc 2008). However, a much bigger amount of information has to be processed and shared between the organizational function units (Figure *9*). Thus, the implementation of a mass customization strategy requires new production equipment, definition of a new work organization, and the implementation and integration of information technologies. Finally, there are certain constraints for implementation of mass customization what Zipkin described: “Any company considering a mass-customization strategy should carefully analyze its ability to deliver three elements of such a strategy – elicitation, process flexibility, and logistics – and to integrate them.” (2001, 86—87).

3.5 Importance of treating organization holistically

An idea of the framework for augmentation of managerial decision is sustained by the viewpoints of Sange (1990) and Kaufmann (1991); according to them an organization works at its best when it is treated as holistic system, integrating each procedure, policy, organization’s culture, individual employees, and the decision maker himself. While they found that within cased firms this rarely is a case, the framework discussed in this thesis would create an environment that would naturally lead for such perception. This provides a conclusion that the decision making should be performed centrally to see the organization as a whole but the source of the information, both explicit and tacit, should originate from lower levels. Floyd and Wooldrigde (1994) asserted that strategies formulated by knowledge from middle management are superior to strategies developed by strategic thinkers. It derives from fact that middle management has more direct perspective on resources and processes therefore middle managers are more aware or up-to-date and actual situation. Further, it allows them to have more direct and precise ideas regarding the

planning and such ideas passed to the management would be crucial when reviewing explicit data collected by the system.

By above it is meant that the system would only be useful if treated holistically with all information included, both explicit data, figures, numbers, and graphs; and tacit comments talking through experience of lower management and, possibly also, workers. Kaplan and Norton (2000: 10) stress out that any key performance indicators (KPI's) are secondary and supplementary to the decision making and strategy development. As they also mentioned, decision making and strategic thinking is a form of art; we would compare it to an allegory of the world's greatest instrument and poorly performing musician in a concert hall – all potential of the instrument and the location go to waste and create poor output as the player is all in all what matters even more. System of decision making augmentation has, theoretically, a vast potential but enhancement of poor manager's performance will make it useless. This should illustrate importance of each element in the system and vulnerability of organization's performance upon poor quality of any of its elements, especially the *performer* – decision maker.

[Paragraph regarding importance of centralized decision making and strategy development in context of strategic amendments]

3.6 Proposition 2 – the system should be applied across whole organization with its hub at mid-management

In regard to organizational structure the proposition drawn is that the system of managerial decision making augmentation system should be incorporated in all levels of the enterprise within all organizational functions. This requires efficient communication network and solutions allowing individuals for efficient share of information and knowledge creation regardless of their geographical location. Such communication network shall be flowing through knowledge database that will group as externalization of knowledge and its further combination: filtering, standardizing, and organizing so that it further will be accessible for the end users – the decision making team. Because mid-management is perceived as communication hub, their role also will remain in the concept and they would maintain the knowledge database and route the information. This especially applies to processing tacit information, which unlike explicit one, requires human cognition in order to be shareable and standardized. Obviously each mid-manager would be restricted to his or her domain of professional expertise for efficiency

reasons. This would require labeling of data, assigning it to explicit data, and standardizing for further use across the organization – step of combination in SECI. Because the organizational structure type has been found influential and matrix type is elected by few authors as one of most flexible, yet requiring high level of IT incorporation this type is strongly suggested to be implied by the organization interested in application of the conceptual system.

4 INTERCONNECTION BETWEEN MANAGERIAL DECISION MAKING AND ORGANIZATIONAL STRUCTURE

4.1 Introduction

> *Organizations need tools for communication both their strategy and the processes and systems that will help them implement that strategy (Kaplan & Norton 2000, 4)*

Today's technology enables us to process vast amount of data and enhance managerial mind; since long ago human supported his actions with tools – even while making notes it still is a combination of a mind and its inventions like paper and pencil. A human mind and its great processing and cognitive power, still requires a support from technology to store and review information (Shirley & Langan-Fox 1996). With ever growing complexity of our world we must not forget about simultaneous technological advancement. Computers processing power doubles every 18 months (Schaller, 1997) what opens great possibilities to harvest the power in context of enhancing human thinking. As a good example of compromising digital computing power with cognitive support for decision making is a project called Watson Explorer which focuses on the idea of supporting human in fields concerned with massive amount of information – like doctors or lawyers (Taft, 2014). It combines the potential of cloud's ability to store vast amount of data accessible remotely with processing power able to find contextual relationship of the data to be cognitively available to the end user. The application of such system could be found anywhere, *including managerial decisions*.

4.2 Map of organizational processes, knowledge, and capabilities

Literature generally speculates much about managerial decision making, its cognitive backgrounds and influence on the overall company's performance, however, there is little number of articles concerned with using that knowledge for enhancement of the decision making using frameworks and technology. Kaplan and Norton (2000) developed an idea of drawing a map of organization's objectives, employee knowledge and competencies, and available technology and tools. Nevertheless they only developed a static idea of drawing such map which drawn is just like a snapshot and would develop a solid strategy for

the particular moment but would lack of flexibility and dynamism so crucial for updating upon the data changes.

Such visual representation of current situation would, however, make a solid base for development of more sophisticated framework that would be more flexible and update with most current data to create. Nevertheless such framework would be a broad and highly detailed image of current situation at an organization and thus would be incomprehensive for decision maker to operate with it - it would require simplification to be displayed in a meaningful way. Or categorized appropriately for convenient navigation within the system.

Both, continuous updating of the system and its processing to a comprehensive end user interface, require considerable processing power of vast number of data collected everyday by an organization. With current technology and ever growing computing power this is within arm's reach. Data processed by computers, displayed at the strategic thinker's convenience would enable him to focus on developing the best strategy and adjust it to the current situations. As already mentioned in the introduction there are ongoing projects of such human thinking augmentation; well-known Siri available on each iDevice is rather simple implication of the idea where user may be supported with easiest of tasks like questions about the weather or definition of a word. It uses the resources available online like Wikipedia or Foreca (Sullivan 2013; Assuncao et al. 2013), but already makes daily tasks more efficient and smooth. IBM's Watson Explorer on the other hand is an ongoing project that is ongoing already for few decades (IBM 2014) that has more professional and complex objective – to create highly intelligent system with access to databases of knowledge that requires processing and precise answering. Its suggested operational fields are law and medicine, but it as well would fit into the idea of the framework of managerial decision augmentation.

Feurer and Chaharbaghi (1994) have concluded that competitiveness may be measured by so called mapping process (Figure *10*). Such map reflects the tradeoff between shareholder values and satisfying customer while maintaining financial performance. By mapping the competitive environment of an organization it is possible to picture organization's situation in a context of competitiveness. This allows strategic decision maker to notice competitive gaps and hence it to develop sound basis for business strategy development.

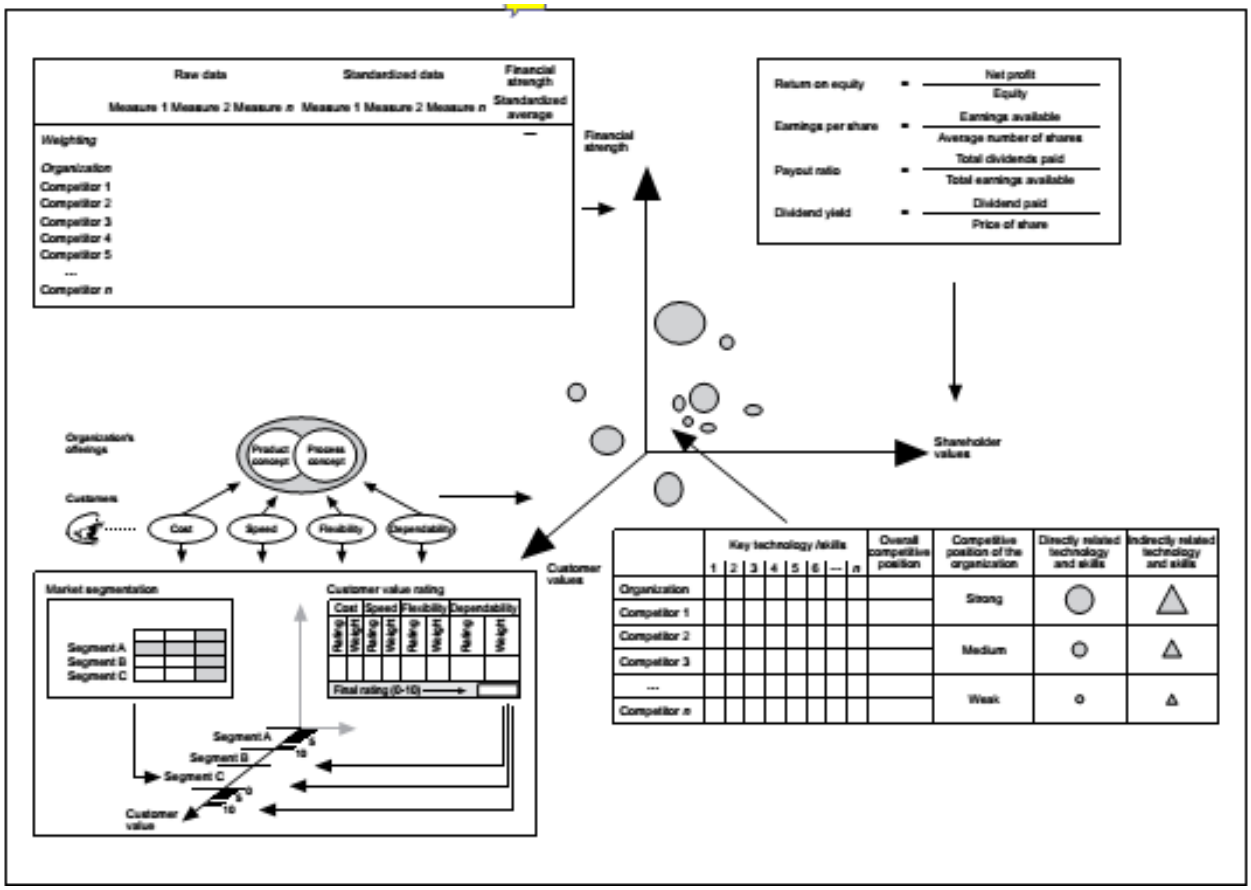

Figure 10 Competitive mapping process (Feurer & Chaharbaghi 1994)

4.3 Managerial decision making against technology

Generally, strategic decision maker, submerged in the sea of complex and often ambiguous opportunities, will be too confused to perform any proper decision making without aid of technology. Such aid includes even a sheet of paper and pencil which can support brainstorming, visualization of the situation, and limitless other applications. Human, since development of civilization, has always supported his thinking with tools, frameworks, and eventually IT systems. The very existence of the latter has appeared very recently as first computer has been constructed in June 1941 (Raul & Hashagen 2000) so just barely over half of a century. However, the influence of computers onto whole spectrum of aspects we live in, including business management, has been unbelievably powerful. The automation of production or intelligent warehousing are no more science fiction but a reality that soon will be necessity for survival on the ever more demanding market. Computer's processing power could hence also be harnessed in order

to support strategic decision making. Certainly there already is number of solutions like mind maps, all kinds of office tools, and obviously widely popular Enterprise Resource Planning ERP solutions (e.g. SAP).

Human mind, even though powerful (refer to chapter 2.5), requires support for management of the explicit data it operates within. Firstly, because visualization of data in comprehensive way obviously allows individual to recognize patterns, interdependencies, and hence reveal opportunities more efficiently. Secondly, it is necessary for avoidance of so called *cognitive gears.* Louis and Sutton (1991) divided thinking processes into *habits of the mind* and *active thinking* and described them as a newly introduced term of cognitive gears. Decision making through strategic thinking involves these two distinct thinking processes – gears: planning – habits of the mind and thinking – active thinking. Planning employs explicit knowledge, which is the shared information available for review like data from systems. Thinking on the other hand is a tacit and cognitive process of synthesis; it encourages intuitive, innovative and creative thinking (Mintzberg 1994). Switching from one type of processing data to another requires a great change in a way of processing data and hence require big effort, loss of concentration, and losing the track of thoughts (Mossick 1984). Concluding, working only on one cognitive gear means that strategic thinker would only need to process the data presented by the system what eventually means that his thinking process would be enhanced, or augmented, by the processing power of computers. Such enhancement would not only increase efficiency of strategy development and daily decision making but would also allow to decrease number of mistakes and omissions. There is, unfortunately, very little number of literature found in regard of effect of IT solutions onto managerial decision making.

4.4 Perspective of managers on theoretical approaches

Since the general goal of strategic thinking and decision making is to sustain the firm on a competitive position on the market (Steptoe-Warren et al. 2011) awareness of ever growing complexity of the market is critical that one should possess. Unfortunately, many managers are still unaware of importance of remaining up to date with most current trends, both on the market they operate on and within the managerial literature (Shirley & Langan-Fox 1996; Steptoe-Warren et al. 2011). Most probably it derives from fact that managers, busy with their daily tasks, are too occupied to deepen into researches and theoretical approaches what naturally requires considerable amount of time so valuable for everybody. Even if they would, they mostly would find them too apart from their actual situation as well as too

unsupported empirically. This may conclude that well established framework with fine interface would enable managers to benefit from such theories, frameworks, and formulas as they would be included in a tangible system they would operate on.

4.5 Analytical tools

There are number of available formulas and techniques to process and analyze explicit data in order to develop some conclusions. Examples of well-known Pareto chart, Porter's competitive forces, SWOT analysis, PESTEL are only very basic techniques that may be drawn without much of experience and necessity of extensive data mining. Nevertheless with observed complexity of the enterprises the necessity of using more sophisticated analyzing techniques and formulas goes beyond one's capacity and hence it should be performed by computers.

Since the focus of this thesis is on the production industry, it is reasonable to include the consideration on the influence of strategic planning on the master scheduling. In enterprises having a tangible products in their portfolio the importance of correct manufacturing setup is of critical importance in context of competitive sustainability; wrong estimations and poor forecasting lead to either overproduction, high cost of storing and waste or to underproduction with lost potential of the assets what means higher flexible cost per unit produced. "The problem with determining the size of production capacities is ever more based on the estimates of future needs rather than on the simple calculations determined by an exact project task" (Maksimovic 2012: 354).

4.6 Optimization of organizational structure and existing ERP solutions

Successfully implemented ERP system in an organization reduces cycle time, enables faster business transactions, facilitates better management, and enables e-commerce integration (Davenport 2000). ERP solutions allow organization to create autonomous departments without losing holistic view on the organization. They create an infrastructure for seamless, simultaneous, and continuous information exchange between these departments keeping even most remote locations up to date with activities ongoing currently at the organization (Morton & Hu 2008). Especially in today's environment of digital

data generated in incomprehensive volumes data management via IT systems begins to be inevitable (Grierson, Corney & Hatcher 2015).

Organizational activities may usually be recognized as, going upstream: marketing, market analysis and sales, client relationship management, procurement, manufacturing, logistics (including warehousing), financial department, supplier relationship management, reversed logistics management (Rummles & Brache 2013 – refer to Figure *11*). They do not represent separate departments of an organization; it is up to the company's layout where these activities are allocated (Rummles & Brache 2013). Each requires different knowledge and approach, nevertheless each are interdependent and create holistic network (Rummles & Brache 2013). This supports two previous statements: first saying that the information for daily and strategic decision making should originate from middle management, and second stating that the organization should be managed from a central point with the most coherent viewpoint.

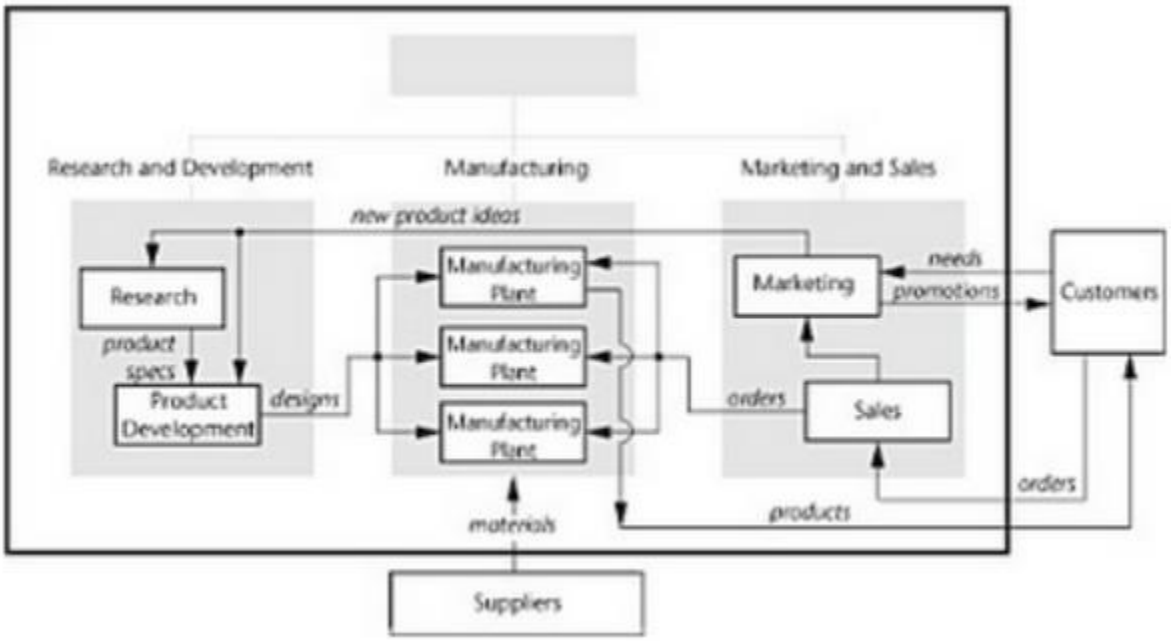

Figure 11 Horizontal view of an organization (Rummles & Brache 2013)

There already are number of solutions for IT implementation into company management like for example popular and well known SAP. This system enables for highly efficient in exchange of information within organizational silos creating transparent and dynamic interface. For instance manufacturing will be kept

updated with information from procurement regarding volume of orders and forecasting, and will reconcile it with level of stocks passed from warehouses in order to schedule the production in manner most suitable for current situation. SAP and other systems, however, only enable non-managerial and middle management levels for their daily decision making and potentially top management for analysis of historical data (Wei, Chien & Wang 2005). It does not process the data in a way to create a strategic decision making tool. Existing systems lack of collecting all explicit KPI's and tacit comments from middle management and displaying it in one coherent interface available for top management.

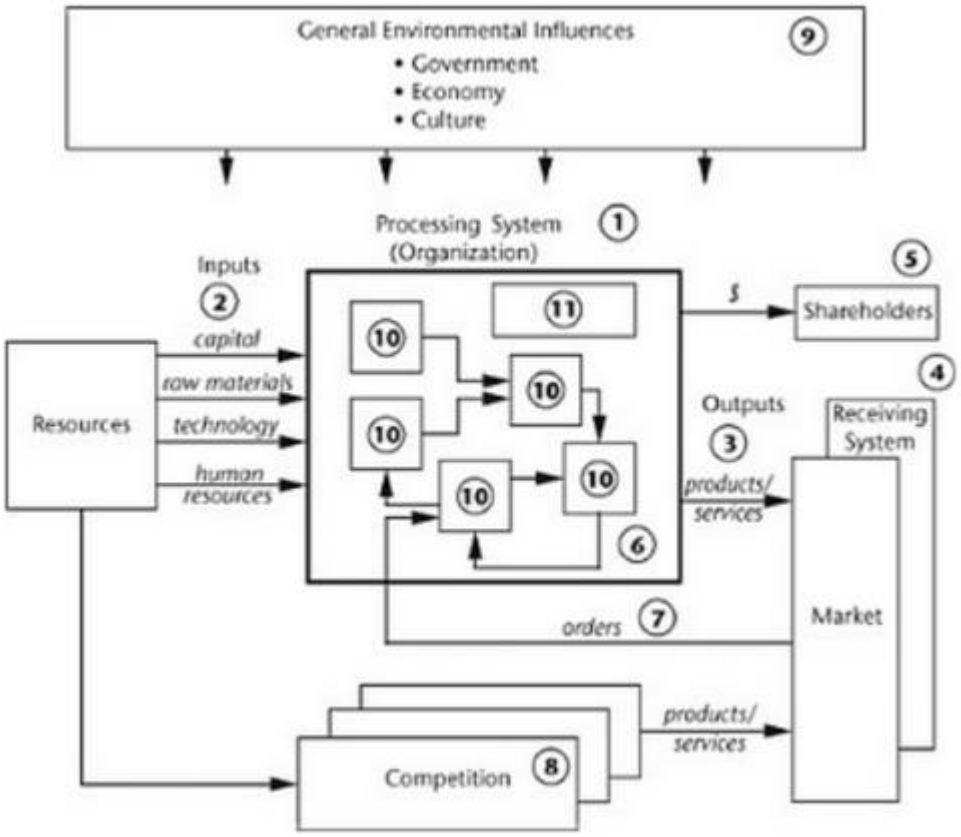

Figure 12 an organization as an adaptie system (Rummles & Brache 2013)

Morton & Hu (2008) have recognized strong interconnection between ERP characteristics and organizational structure types developed by Mintzberg (1983). They point that success of its implementation strongly depends on the structure and its alignment with the requirements ERP systems

place for organizations. These requirements are interdependence, efficient coordination and cooperation between functional departments, and general data standardization (Morton & Hu 2008). Some vendors offer their solutions to be adjusted for current situation of a company to avoid its structure re-organization, nevertheless across most researchers it is not suggested course of action (Benders et al., 2006; Davison, 2002; Hong & Kim, 2002). Former requirements provide conclusion that companies with bureaucratic machine or matrix structures will be most successful with harvesting the opportunities given by ERP systems (Morton & Hu 2009, Steiger et al. 2014).

Grierson et al. (2015) have analyzed most contemporary approach to data management system which uses visual representations for the searching and browsing of large, complex, multimedia data sets. Basing on up-to-date literature, they say that as 2D environment, with charts, plots, and diagrams, is much easier and intuitive for humans than text and text or numbers. However, in face of complexity, dynamism, and volume of data incorporated within an organization even 2D system start becoming insufficient (Grierson et al. 2015). On the other hand, 3D has been found too unfamiliar and impractical. They hence introduced and analyzed empirically the concept of 2.5D system which harnesses the user-friendly 2D interface but virtually adds the third axis by manipulating zoom that works in contextual manner bringing data together depending on the context raised by the multi search (Grierson et al. 2015). The system has been found to be highly intuitive and efficient especially due to the ability of analyzing context between subjects and multi search (Grierson et al. 2015).

Above system is called “the SIZL (Searching for Information in a Zoom Landscape) system was created to evaluate user interaction and experience with data in 2.5D environments, and enable the researchers to evaluate the effectiveness of this method. This software prototype combines a zooming user interface (ZUI) and a timeline—a zooming interface to a visual information landscape—and was designed with the capability to extract data from numerous document types such as word documents, spreadsheets, PDFs and image files. The software has a multi-search functionality, allowing users to search within the dataset for multiple keywords or phrases that are highlighted simultaneously using different colours. Captured data can then be moved to the ‘lightbox’ area to be compared and contrasted, enabling the user to identify document relationships.” (Grierson et al. 2015)

SAS and other statistical tools are also widely applied across enterprises for analysis of the data that could enable them for anticipation of market, the competition, and customer behavior. Statistical software processes input data into very comprehensive form of diagrams, scatters, plots, and other types of quantitative data displaying forms. Such visual representation of big amount of data supports managerial

(human in general) cognitive perspective onto the situation what boosts effectiveness – “pictures worth more than a thousand words”.

4.7 Proposition 3 – incorporation into existing solutions rather than creating autonomous system

We propose that the system would best be implemented onto already existing infrastructure and incorporate already existing solutions. Firstly, this would be more efficient and time plus cost saving as it would require just amendments and reorganization within existing systems rather building it from the scratch. Secondly, maintenance and use will be more efficient as professionals working on it will be more familiar with the way the whole system works and how it should be utilized and how to approach any malfunctions. The continuous and real time flow of information will work just as in existing ERP systems, however the way the data would be processed would differ considerably, making much more use throughout whole organization. The system would hence rely strongly on computers, servers (KM), telecommunication infrastructure, routers, and peripherals – which most of organizations already have incorporated.

4.7.1 Proposition 3a – standardized knowledge shall allow efficient knowledge obtaining from external sources

At last, the *Proposition 3a* includes the part of external knowledge obtaining possibility – purchasing from external professional companies the data which provides ready solutions in sense of strategic thinking but also for any other levels. This will be allowed as the knowledge would be standardized (potentially some inter-corporative standards could be developed) and hence more easily exchange between independent entities.

5 RESEARCH METHODOLOGY

This thesis aims to develop a concept of a system for augmentation of managerial decision making through IT and ERP solutions. Such system, most efficiently, can be conceptualized by synthesis of contemporary knowledge in regard to managerial decision making, organizational structure, and interface of these two (referring to chapter 1.4 Organization of the study and Figure *1*). All the classic information supported and enhanced by most recent one will be foundation for development of the framework. In this case we can say that both, deductive and inductive approaches are applied; theory choice was set deductively since it was made for the needs of framework (theory) and three main topics – decision maker, organization structure, and interrelation of these – have been discussed to fit the needs in best manner. End user is the decision maker, environment is the organization, and the system is the interface. On the other hand, while reviewing the literature, the idea has been developed seemingly what eventually makes the framework to be a result of inductive research – the observation of current solutions, knowledge upon these three elements, and suggestions from authors have shaped this idea in the greatest extent.

5.1 Research questions

As mentioned in the introduction, development of the system of managerial decision making augmentation requires insight on three key elements: strategic thinker, organization, and interface between these two. The mediating questions standing as foundation for augmentation system concept are: how to standardize managerial decision making without losing precious flexibility, dynamism, and accuracy? How to enable manager to review whole picture of current situation, anticipate the future, and basing on those to make decisions that will drive his company to success? These are to be supported by an IT system but here comes the question of implementation, types of data to be included, and way of displaying it to the manager with understanding his cognition so that the decision making would be the most efficient.

Above requires understanding of background behind managerial decision making, the way data is being developed and processed throughout organization, understanding what lies behind organizational success i.e. sustainable competitive advantage, and at last to understand how does manager drives

organization to such success. What should be the interrelation between decision maker and the organization he operates within?

5.1.1 Main research question

Since the system aims in improvement of managerial decision making performance the question of the thesis could be stated as following - how should top decision makers synchronize internal and external information in designing organizational structure of low complexity and high flexibility?
Above question is in context of the framework of managerial decision augmentation i.e. what should the system collect data to allow decision makers in simplifying their organization in order to increase the flexibility.

5.1.2 Partial research question

Data flow is the very foundation of the system but since the amount is excessive for human mind's capacity appropriate filtering of the information must be applies. Hence the partial questions would be:

- What kind of information does a manager need in decision making?
- How information should be processed i.e. which analysis models are most valued among top decision makers?

5.1.3 Objectives of the research

This thesis aims to identify the current practice of managerial decision making: to what extent the managerial decision is based on mathematical tools, intuition, perception, or on their work experience and knowledge. Secondly, the organization must be understood hence the research strives to identify the characteristics of company structure, its silos and interfaces, and their inter-connection and find how these connections affect managerial decision making. To verify the crucial factors to be considered in deciding organizational structure within: customer, assets, employees, knowledge, competitors, technology, and stakeholders.
Above goals are together synthetized into a conceptualization of a system that would allow decision maker for deep insight into current situation within organization, simulate the potential opportunities, take fast and precise decisions, and effectively communicate them across the organization for swift implementation and detailed monitoring of the situation.

5.2 Deduction approach

This paper bases solely on literature review in order to develop a concept of managerial decision making augmentation system. All three propositions introduced will be verified against existing articles and books to empower them with credibility necessary to bring importance for this conceptual paper. This clearly top-down approach in necessary because the idea is unique and yet not developed. Having this it requires development of solid theory which could further be faced against the reality in order to be developed.

Such approach also allows bigger freedom in development of the idea, where while thoroughly reviewing existing literature the concept develops. This certainly means that while writing this thesis the concept has developed in non-linear manner, often changing the assumptions and priorities when new facets embrace.

5.3 Data collection procedure and time frame

The literature required for this concept development has been being collected throughout time of 3 months. It has been continuous process of finding interrelated papers and searching for new, independent ones. Procedures for finding the literature have been as following:

- Throughout google scholar by searching for key words, like “strategic decision making”, “organizational structure”, “ERP and strategy”, and so on
- Throughout review of references of already acquired books and articles, basing on the text of article and the connotations that were made to particular authors.
- Reviewing journals from the most recent issues (published between 2013 and 2015), e.g. *International Journal of Information Management, Journal of Strategy and Management, Strategic Management Journal, and so on.*

Firstly, when searching throughout google scholar or journal’s articles, the judgment was on the title of material i.e. whether it matches concept development’s needs. Further, basing on abstract or introduction, the more detailed analysis of the paper has been performed. Only books or articles that matched my requirements were saved onto drive only then to be reviewed.

5.4 Nature and source of data

The data is purely theoretical; books and articles. They cover needs of creation of the augmentation of decision making concept and all of these vary in context of age, source, and type of material itself. Most of the papers where developing new ideas basing on classic literature, but there were also few literature reviews or case studies.

5.5 Method of data analysis

As theory is collected for all three key aspects i.e. managerial decision making, organizational structure and knowledge management, and interrelation between these two the general concept is being synthetized on the foundation of existing knowledge in a novel way which enables development of new ideas on how to optimize all processes and enables high performance decision making. The concept of the system hence bases on the theory and synthesis of the knowledge collected from the literature review.

5.6 Reliability and validity

Here are few factors that will influence both reliability and validity. Firstly, because this thesis bases on work developed by multiple other authors, validity is based upon these previous papers and the actuality of the facts stated within. The biases originating from their cognition upon the subjects they worked on might additionally be magnified, or disturbed by authors' interpretation. To minimize this effect, multiple articles were reviewed on similar subjects to relate them and adjust the most objective statements.

Since this thesis is only conceptual paper it does not have any results given by interviews, or calculations. Hence the reliability and validity are limited to the choice of literature, literature itself, and authors' understanding and interpretation of that literature.

5.7 Delimitations and Limitations

This is a conceptual research only and it bases solely on reviewed literature. This is delimitation because its foundations depend on credibility of other researcher's works and the output is not yet proved empirically. Secondly, this conceptual thesis, for coherence purposes, considers only organizations with tangible production. This means that companies operating with services that potentially could also benefit from the developed concept are not verified in this thesis. Additionally, the developed framework will be assumed to be based on already well-established and functioning ERP infrastructure and systems – it does not consider difficulties with implementation, necessities of organizational modifications, and potential failures that may occur in over half of cases (Morton & Hu 2008). Neither it verifies how such extension could be implemented in technical meaning and also disregards potential failures of ERP systems implementation. This paper also simplifies the knowledge collection from across different departments regardless of type of knowledge and potential differences between the way it is collected and utilized. The last delimitation of presented framework is that it only will analyze the internal use of the conceptual system, i.e. it does not take market fluctuations, customer changes, competition analysis, and any other factor that is external to the organization. It does not take into account all other purposes the concept of managerial decision augmentation could be applied for.

Regarding limitations, this paper is based on limited number of literature due to time constraints. It also only bases on articles and websites available for free either on Google Scholar or repository of nelli.fi with student access from University of Vaasa. Additionally my limited knowledge and experience with ERP in practice may lead to discrepancies between the concept and the way existing systems work. It is highly theoretical concept which should be further developed and aligned by ERP and IT professionals. Limitation of my knowledge, especially tacit experience, considers also managerial decision making and techniques for effective management of the organization. Even with extensive literature review, the practical knowledge is necessary to face the theories found in papers and books.

6 PRESENTATION AND ANALYSIS OF DATA (I.E. COLLECTED INFORMATION FROM EXISTING LITERATURE)

6.1 Introduction to the concept

As mentioned in the introduction, the amount of data flowing through and within organization develops in extreme manner – according to Dragland 90% of world's digital data have been generated in previous two years (2013). Human brain, even thought has a great potential and speed of processing data and finding patterns, still requires support of technology in order to compromise explicit knowledge being reviewed with tacit understanding that processes and filters it. Autonomous systems still are probably even not close to be introduced and necessity of human decision maker is crucial for steering company throughout the vicious see of the market. The symbiosis of human tacit experience and technological ability to structurize, organize, and process unimaginable sizes of data can only develop a highly precise and hence successful decisions within short time frame.

This thesis is an introductory concept of a system that is aimed in augmentation of strategic decision making in organization. As suggested in *Proposition 3*, such system could be embedded into already existing ERP solutions, collect data from all within, systemize it, organize it, and process accordingly in order to display it in highly comprehensive way via interactive interface. Such data would be moderated and commented by mid-management for presentation of tacit knowledge of other professionals with various knowledge domains as per *Proposition 2*. Hence such concept development should include following elements: the end user – the strategic decision making team; the framework which is the development of idea how information would be collected, processed, stored, and shared; the interface that will present these data for the end user; and eventually understanding potential effect that such system could have on the organization.

This section generally is a synthesis of the above literature review with the idea that grew in author's mind.

6.2 The user

The end user of the system is certainly the strategic decision maker or, more preferably, an egalitarian group of decision makers (Proposition 1). Individuals included in such group should be senior managers with high managerial qualifications and their position in the organization can be described as the C-Level Management. However, even though they would be end users, basically any individual would have specific access to the system. In such way the input of knowledge in either explicit form of reports, documents, and the others or in tacit form of problem solutions, comments, and so on (refer to Figure *7*) could be captured and communicated to the top management for their needs. Each user of the system, however, would have different accesses in order to simplify the use and also to disable unauthorized individuals to access data which should be confidential. Knowledge database is being continuously developed what requires such input from all over the organization as per Chung and Besharati (2014):

> *(…) employees should be included in organizational decision making and this is consistent with the finding from the previous research (Al-Alawi, Al-Marzooqi, & Mohammed, 2007). The research shows that if the flow of information from top management to the bottom is easy, then knowledge sharing will occur more.* (2014)

Aside from above, treating all individuals at the company allows senior management for treatment of the organization holistically what Tyagi et al. (2015) have pointed as crucial for creation of competitive advantage.

With having such access to transparently organized and processed data, top management would experience expansion of envision to alternate courses of action (Geletkanyez & Hambrick 1997) what allows them for development of more hypothesis in context of strategic decisions development, test them more efficiently by the system itself (forecasting and simulating), and hence by group take most appropriate decision (Proposition 1). Such a way of decision making would allow management to diagnose and dismiss omissions of details, biases, emotional influence, and hence it would diminish mistake commitment. With all explicit data displayed, end users will have possibility to focus on what they are meant to do – to synthetize data using their experience and noticing patterns. This means that intuition will be supported by the system itself what allows strategic thinkers working on one cognitive gear only – the planning gear. As already mentioned planning gear is much less effortful and additionally no switching of cognitive gears occurs. The decision makers in such situations should have their efficiency in decision making increased enormously.

Incorporation of all employees increases communication flow (Proposition 1), not only allowing for knowledge creation and share but also in reverse manner – it allows for very accurate and straightforward feedback. This will have great impact on learning as it occurs in a big extent by feedback (e.g. Hayashi 2001). Such learning would occur on all levels of the corporation across all organizational functions (refer to Figure *9*). This feedback has also other function – socialization of knowledge across different domains; individual that has expert intuition of one particular domain will not be much effective in performing intuitive decision making in domains that he is not related to. Additionally, as the job mobility is increasing individuals might not be able to form broad, complex, and detailed domain relevant schemes, but since such domains could be included in the system they only could focus on heuristic intuition which is domain-independent. This, however could only be possible with introduction of a system with its own cognition – what actually already appears in the horizon with example of IBM's Watson Explorer mentioned in the introduction.

Kaplan and Norton (2000: 5) pointed that value cannot be assessed from individual intangible asset, but they create a value as set of assets in holistic manner created by strategy. Hence all of these intangible assets, including tacit knowledge, must be stored in a way that will be accessible for appropriate personnel within the organization. Such repository should be updated continuously in order to remain valuable for current circumstances and because of vast number of data passing through such update should possibly be automated for explicit data, while tacit knowledge as an input of individuals should be transparent the data moderation from someone authorized. Authorization should differ for individuals on different levels in the organization as their function vary significantly.

> *Organizations that wish to facilitate effective intuiting need to concentrate on promoting ongoing and deliberate practice in kind learning environments. They may also encourage managers to be mindful of their environments in order to facilitate implicit learning.* (Dane & Pratt 2007, 49)

6.3 Framework

Framework is general core of the system: how the data could be collected, what the sources of data would be, how the knowledge would be organized, processed, and filtered. This requires highly complex infrastructure, but since the suggestion is to build it into existing informational system like for example

enterprise resources system like SAP this matter could be skipped and only theoretical flow of data could be represented. The idea is that the system will not be fixed; it would evolve over time, adjusting itself for current circumstances of the organization and the environment it operates within – autopoeic system (Proposition 3) which enables the adaption for emerging circumstances and develop the strategy over the time (Proposition 1).

Figure *13* shows the graphical representation of layout of the system in organization. This is very generic and basic flowchart that could be applicable for most manufacturing enterprises. The core of the system is knowledge database strictly connected to the System of Managerial Decision Augmentation. The functions of organization are here divided into departments of the organization with own management and employees. Each individual within department represented by a ball with 'I' letter inside communicate with other individual inside of his department. This communication may regard to work processes, to performance, feedback regarding recent changes, and any other subject that could be discussed on the shop floor. For simplification and keeping the diagram clear, no communication within departments have been drawn. Firstly, because the most important communication, from the system point of view, is the communication within specific domain, speaking in other words – professional of marketing will cover more subjects and draw better conclusions when discussing with a professional from his domain (marketing) rather than any different (Proposition 2). Secondly, communication between departments might be useful, from perspective of the system, but will draw rather general conclusions, which anyway might be externalized into the system. Included in the individuals in the graph are managers. Again, it has been performed for simplification of the picture, but even though managers will have bigger accesses into the system, their role is generally similar to other professionals working under him.

Customer and suppliers, represented as yellow sub-process boxes, will also have input to the knowledge database, but not directly. Firstly, because knowledge stored within company should be protected from external insight for the reason that knowledge within company is one of biggest factors elevating company to be competitive. Secondly, for the standardization – communication between customers and the company should be freer, spontaneous, and it such is in order to maintain good relations with the customer. Any standardization on such communication might make customer feel bounded and hence less interested in cooperation. Nevertheless, their feedback and any information gathered while cooperating – sales history, preferences of products, and so on – would be input by marketing or sales department. All the communication between departments would continue to flow freely, what might not

be visible on the diagram, however the learning factor will mostly be gathered from the knowledge database.

Once the information developed through socialization of individuals is externalized to the system – so the tacit information is transformed into explicit, which will be stored within the Knowledge Database – it will be transformed, standardized, and grouped accordingly by the System of Managerial Decision Making System and eventually displayed in comprehensive way to the senior management. There the information will be processed as described in chapter 6.2; the information will be internalized, again socialized within top managers, combined to form the strategy, and communicated throughout the system. Communication of new decisions or goals would be direct to all involved individuals, so the information will be accessible only for these who have appropriate accesses. This way skip cascading of the information throughout the managerial levels and enforces collaboration. This simplifies not only communication but overall information flow within organization. This enables higher flexibility that would allow faster changes and maintain them in almost real time manner. Such system could easily be integrated with lean philosophies for avoiding non-value adding processes and decreasing overall complexity of the system, and eventually using the system for decrease of the organization's complexity. Enterprise's Complexity Degree (ECD) as a factor of complexity of the company could be included into the interface. Possible actions could be simulated in order to forecast influence of corresponding actions onto projected ECD (this anyway could be applied in any other indicator). ECD is defined as relations between structural elements, variety of these relations, and certainly number of the elements in the organization. Such measurement of organizational structure complexity enables comparison of different structure designs what leads to development of so called Control Adequacy. Additionally, such way of managing standardized information, will allow consulting companies to share their knowledge by selling it in packages (as per Wagner et al. 2014).

Inside of the Knowledge Database would be solutions already developed by researchers (e.g. Figure *7*) (*Proposition 3a*). The system would feed on information stored by the database and processed in order to calculate KPI's develop forecasting, prepare statistical data using already existing software, and filter the data so that only most important data would be displayed for the decision making team. Nevertheless the end users will have influence on what they would decide to see (this will be elaborated in the next sub-chapter). The framework will be elastic and its key driver would be a corporate value in order to support decision maker with the choices. It also works other way - the values/vision and general strategies emerge

over the time, hence the tool also could help shaping these as a result of longitudinal decision making (Proposition 2).

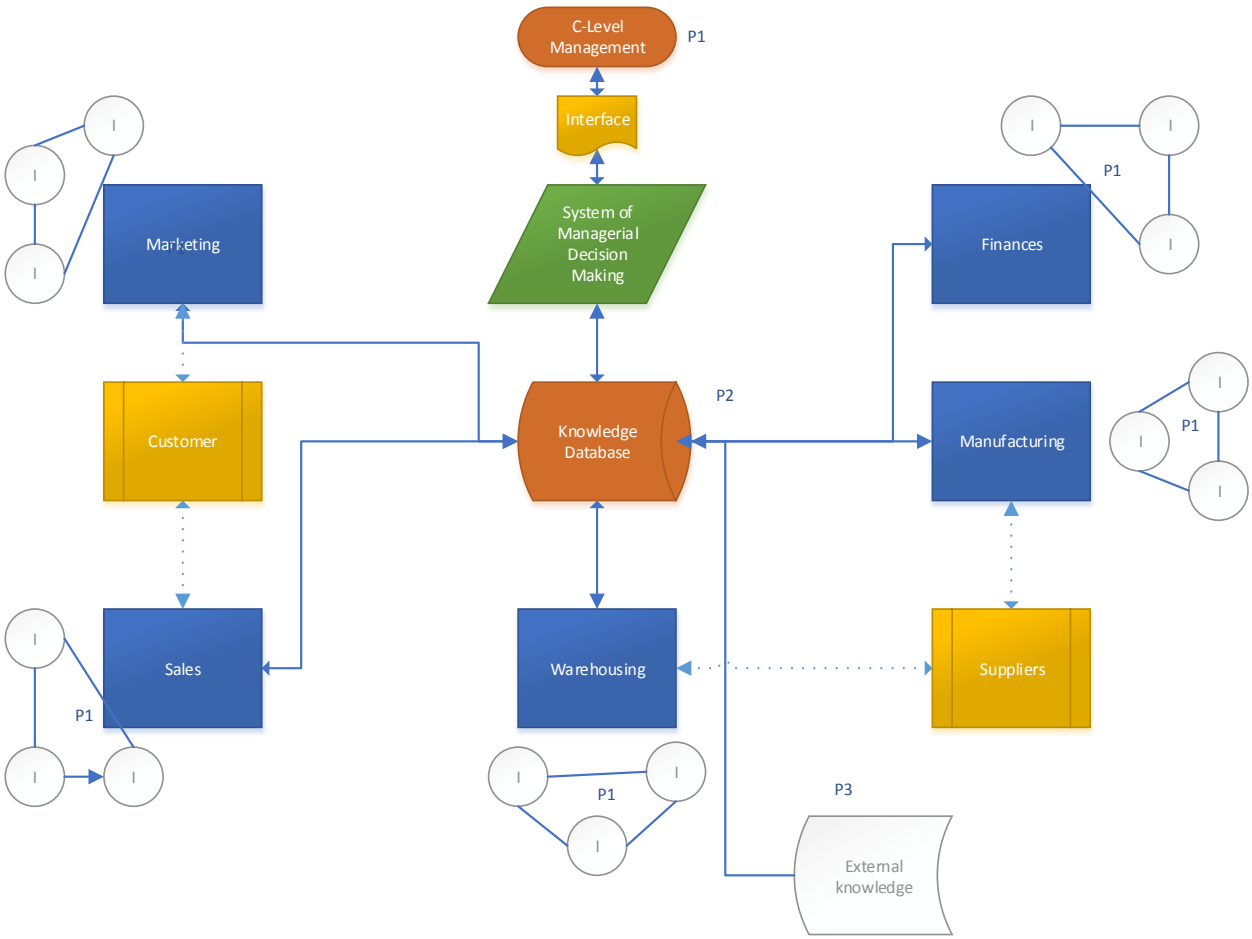

Figure 13 Basic, theoretical framework for system of augmentation of managerial decision making (with propositions localized)

6.4 Interface of the system

Interface is what user will directly work on and hence it is essential for it to be transparent, clear, not complicated, yet powerful, allowing the user to perform all tasks he should throughout the system. As already mentioned before, the accesses will vary depending on the user's location on the corporate

matrix: his managerial level, and position within department. Accesses could be based on Active Directory where users are being added to particular security groups granting them particular rights for specific actions, locations, and so on (Allen & Hunter 2006).

Nevertheless within the contemporary literature, interesting concepts have been introduced, like for example 2.5D environment which is the fine balance between beneficial use of 3D in data visualization and simplicity and intuitiveness of 2D environment which has led several researchers to recommend the use of hybrid – the 2.5D interfaces (Baumgartner, Ebert, Deller & Agne 2007; Wiza, Walczak & Cellery 2004). Such environments can provide users with the cognitive/spatial advantages of 3D whilst retaining the refined interactions of 2D (Baumgartner et al., 2007), therefore reducing the chance of users becoming 'lost' in the system. Interface must base on some already existing to be familiar for the users, but should emphasize the newest concepts like for example 2.5D environment of SIZL system. IT solutions are important, but adding cognition to system itself could enable user to access all tacit information that would be externalized into it; e.g. IBM Watson Explorer with its great capabilities could in future be used for realization of such system, which would primarily be based on SAP solutions and 2.5D interfaces. Also as intuition works on recognizing patterns, the interface should be developed in accordance to the way intuition is performed. Bergman, Beyth-Marom, Nachmias, Gradovitch and Whittaker (2008) revealed that individuals prefer navigation throughout the interface over searching when locating files. These two ways of locating files anyway should coexist in a successful interface.

Interface could possibly look like map developed by Feurer & Chaharbaghi (1994) visible in Figure *10*. It just is a sample one of many views that decision maker could possibly see. The suggestion is to have it adjustable, with input from the user in order to simulate and forecast whereas system would use highly sophisticated statistical methods. The display could reveal necessary KPI's and comments from lower management that would also work as hubs for remarks from individuals under them. Below, as another example, visible also developed by Feurer and Chaharbaghi (1994) a graphical way of positioning the competition in relation to the organization:

	Key technology /skills								Overall competitive position	Competitive position of the organization	Directly related technology and skills	Indirectly related technology and skills
	1	2	3	4	5	6	⋯	*n*				
Organization										Strong		
Competitor 1												
Competitor 2										Medium		
Competitor 3												
...										Weak		
Competitor *n*												

Figure 14 Technology and skills matrix (Feurer and Chaharbaghi 1994)

6.5 Effect on the organization

System of Managerial Decision Making Augmentation would increase performance of the organization on many levels. The framework will provide mutual language and standardize the knowledge within organization, making it more accessible, shareable, and reachable. Externalization of information performed by the system would enable external advisers to assist with decision making; individuals not originally being included into the subject will have more unambiguous point of view and hence will be able to give suggestions that have been omitted by the others. Larsen (via Hayashi 2001, 65) has said that "Whenever I have this uneasy feeling about a decision we're about to make, for example, about a new product or a major organizational change, I will often ask other trusted advisers who may not have been in the original discussion."

Increased communication level, better knowledge creation and management, all channeled for more efficient decision making could only influence organization in positive way, but this is still long way from this concept to implementation and further empirical research how does it influence and to what extent.

7 RESULT AND DISCUSSION

7.1 Introduction

This thesis develops concept of managerial decision making augmentation, an idea of a single point of decision making with highly applied holistic viewpoint within the organization. It engages each and every asset, individual, and process at the enterprise by collecting information, both explicit and tacit, in accordance to SECI (Socialization, Externalization, Combination, and Internalization) modes. The concept hereby developed is only theoretical idea of a system that could further be developed but it would require extensive research of professionals from several expertise domains like ERP systems, knowledge management, interface design, active directory, and many others. This should be just a basis for development of more technical insight onto the system – by the definition, concept is even prior to the introduction. Thus, this paper opens number of doors for vast lands of research that could be further executed.

For clarification of few aspects of the concept, three Propositions have been introduced with one sub Proposition. These have been evaluated in analysis of data and supported by the development of the concept itself. Augmentation of strategic decision making, theoretically, would have tremendous influence on the efficiency of strategic thinker's work, firstly because data presented in comprehensive way would enable manager to review all crucial information revealing most updated situation and secondly because he would need to work only on one so called *cognitive gear*. Enhanced decision making in other aspects the system would influence within operation of organization should affect overall performance on a great scale.

7.2 Managerial implication

For now, this concept is too theoretical to be implied by managers. This is still a subject for theoretical researchers to be undertaken and probably long time might pass before the system could be implemented in first testing environment. Managers, however could in further research share their professional opinion and shape the development of the system. Potential, sample question for managers:

- Do you find corporate values important (scale) and how aligned you find your values against corporate values?
- Do you find time for reviewing literature regarding management?
    - If so, how valuable (1-10) and applicable (1-10) you find them?
    - If you find them highly valuable and applicable how often would you implement them (1-10)
- Do you consider a system of enhancing your managerial decisions worth using?
- To what extend you support your decision making with technology? (1-10)
- Do you incorporate intuition when performing your decision making?
- What is the size of team you feel yourself most comfortable to work with? (1 meaning for preference of working individually)
- Did you incorporate any ERP solutions within your company? If not are you planning to do so? When?

7.3 Future research possibilities

This concept further on should be opposed with empirical research including interviews and statistical analysis. It is crucial to collect data from managerial environment in order to adjust theory with reality. With such developed, the framework should be settled logically i.e. development of algorithms and creation of scheme for development of IT system. Finally, technical approach on integration with existing infrastructure/systems like SAP and final implementation plan should be founded.

Besides, this conceptual paper only focuses on manufacturing SME's. Since hereby developed system potentially could be implemented in any organization regardless of its industry, size, and type (including nonprofit organizations like universities, hospitals, or governmental institutions) this concept could be faced against these different environments in order to develop fully operational system integrated in particular enterprise/organization. Also it is important to take into account facets influencing success of implementation of ERP systems and structural contingency related to it. Development of infrastructure, analysis what should be included, how could user amend the views, and on what basis he could navigate through it. Adding cognition to the system would be a very advanced step in development of the system. Development the system internally i.e. how would it process data technically.

The system, unlike existing ERP solutions, is intended to adjust to the organization over time in order to verify most important values within individuals and create communication connections. Such evolution is anticipated to be continuous what makes the system autopoietic. This requires understanding of organizational sociology, knowledge management morphogenetic changes, and psychological aspects of managerial decision making

This concept should be validated by the potential end users – managers. The questions related to the system, its importance, already existing similar solutions, and application within manager's organization will be asked in order to have confirmation whether or not the framework of managerial decision augmentation is indeed needed, to what extent, and what industries seem to be the most appropriate. Hence the interviews will be held with managers from across different industries in order to have more broad view. The country of companies will be Finland. The country is known for its interest for newest technology, solutions, and optimization of processes thus companies are keenly implementing new ideas and systems. As a developed and mature market, Finland is an area where possibility of managers being interested in augmentation of their decision making related to optimization of their enterprises seems to be higher than elsewhere.

The interviews will be flexible, with few questions prepared prior, but with expectation of free comments from interviewees. In such way we will not omit any potentially important remarks and this will create a valuable base for data analysis and development of most realistic and least biased conclusions.

Because, as already mentioned in theoretical part, the framework is suggested to be a part of already existing infrastructure and systems it is of high importance for us to know the opinion of decision makers. Firstly we need to know what solutions they currently use, if they actually have any of ERP systems, and whether extension of processing the dataflow and mixing the tacit data with explicit in order to display it in a comprehensive way for the strategic thinker is what they would like to use.

8 CONCLUSION

This thesis has developed a concept of a system for augmentation of managerial decision. It based on classic and most contemporary literature; the literature review is a big extend of this thesis as it was necessary for creation of the concept and to add credibility and reliability. The herein developed concept is hence highly theoretical composition of most contemporary needs that strategic thinkers would require for ever more dynamic and competitive market with vast ambiguous opportunities.

The literature review itself is a broad insight on contemporary topics in domain of managerial decision making, knowledge creation and management, organizational structure development, and flexibility of organizations. All these topics even though disconnected have been merged successfully for the needs of the concept and reviewing the theory in this thesis should set up reader's mind into the concept of the system.

Even though the concept itself does not represent any technical ideas nor real case implementation it still is a starting point of a very broad and extensive research on the topic of managerial decision making augmentation that yet have not been found till date in any literature. This makes this thesis unique as the topic covered is a drop in the ocean of void niche that has been found.

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