Professional MBA
Entrepreneurship & Innovation

R&D Ambidexterity for Growing Organizations in the Context of Complex and Turbulent Environments

A Master's Thesis submitted for the degree of
"Master of Business Administration"

supervised by
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Vienna, 30th June 2018

Affidavit

I, Mario Flucher, hereby declare

1. that I am the sole author of the pages 20-45, 67-87, 99-101 of the present master's thesis, "R&D Ambidexterity for Growing Organizations in the Context of Complex and Turbulent Environments", 123 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that we have not prior to this date submitted this master's thesis as an examination paper in any form in Austria or abroad.

Vienna, 30th June 2018

Signature

I, Daniel Kollreider, hereby declare

1. that I am the sole author of the pages 5-19, 46-66, 88-93, 95-98, 102-104 of the present master's thesis, "R&D Ambidexterity for Growing Organizations in the Context of Complex and Turbulent Environments", 123 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
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Abstract

Managers today have to face the challenges of globalization. The constant demand for growth in the environment of global competition, with different economic conditions and even shorter product cycles, is the topic that causes concern today. In order to be economically successful in such a volatile global environment, the companies' management are concerned with the topic of organizational design in order to outperform the competition by the higher efficiency of their working methods.

This thesis shows which supporting methods, processes and structures exist for an ambidextrous R&D organization in a volatile and complex environment, by considering traditional as well as modern approaches. A timely design of R&D structure, process and culture which combines the most suitable methods and guidelines, was developed throughout the thesis. The structure and processes shall support the particular demands of Logicdata's environment and more specifically its R&D department. It is designed to meet the requirements of exploration and exploitation, strongly varying project categories and short-term strategical adjustments while also including support measures that promote cooperation and the right cultural mind-set in organizations.

The developed model has been tested and evaluated by the authors using three diversified use cases which they have experienced. The advantages and disadvantages of the existing, traditional structure and process were compared to the model developed in this thesis. The results show which advantages and limitations this model could have in their environment, compared to the existing model. In this way, the applicability and value of the model in helping to achieve the objectives of ambidextrous organizations, are also illustrated.

Keywords: R&D ambidexterity, growing organizations, flexibility, mass production, scalability, optimization, project organization, matrix organization, culture, strategy, structure, process.

Preface

This master thesis is an original, unpublished and joint work by the authors, Mario Flucher and Daniel Kollreider. Both authors have contributed to the intellectual development of the model presented in this master thesis to the same extent.

The problem which we deal with in this thesis arose in our professional environment; research and development in a medium sized company. With our developed model and the results, we not only want to bring our immediate environment to the next level, but also give interested decision-makers new approaches for better shaping existing structures, in accordance with the prevailing external influences and remain competitive on the global market in the long term.

We would like to thank the management of the WU Executive Academy and Vienna University of Technology for the organization of all Distinguished Guest Speaker Events, as well as all the discussions with our fellow students within the PMBA Entrepreneurship & Innovation 2016-2018. The knowledge we have gathered in this program is incorporated into our thesis.

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VOM	Versatile Organization Model
CTO	Chief Technology Officer
PLE	Product Lead Engineer
OU	Organizational Unit
LC	Local Coordination
OM	Organizational Management
SM	Strategic Management
R&D	Research and Development
IoT	Internet of Things

BIFMA	Business and Institutional Furniture Manufacturers Association
BU	Business Unit
CEO	Chief Executive Officer
B2B	Business to Business

1 Introduction [Daniel Kollreider, Mario Flucher]

In the 21st century, organizations have to face the challenges of increasing complexity, enhanced transparency, global interconnections, shorter time horizons, economic and environmental instability, as well as demands to have a more positive impact on the world (Robertson and Audio, n.d.).

Because of Logicdata's rapid growth and the constantly increasing demands triggered by the evolving market, the company has had to adapt its way of working several times. In the past, these changes have been initiated and implemented by the founder and a small, powerful, selected team, in an environment of trust and authority. But the continuing rapid growth has had its price. Today's organization is much bigger and more sluggish, authorities are distributed across several people, something which we could also observe in other organizations with similar growth behaviour. Changes cannot be performed as quickly as in the past and the consequences of changes are now much greater. There is a need for a paradigm shift, a new, timely adaptation method and a much more strategic and scientific approach.

Beside the well-known challenges for organizations, Logicdata was also facing additional challenges, triggered by issues such as the organisation's rapid growth, increasing production volumes, increasing quality standards, a big variety of project types and increasing competition from Asian competitors, to name just a few of them. To be successful in this environment, it is necessary to optimize the well-known area of tension between time, needed resources and quality (Holzbaur, 2007). Every state of the art organizational structure, like line-organization, project-organization or matrix-organization, has its advantages and disadvantages. Furthermore, different concepts of process organization struggle with the conflicting interests of predictability and flexibility.

The goal of this thesis is not to redesign the change management generally but to design an R&D-Organization which is able to cope with the rapidly changing and complex requirements of a turbulent global environment.

This situation raises the following research questions:

1. What are adequate product development methods and R&D structures for the different prevailing situations to be found in Logicdata's environment?
2. How can these methods be combined to form a new organizational model for Logicdata's R&D, to cope with the structural-, process- and cultural-challenges?

To answer the first research question, this master thesis deals not only with traditional, organizational structures and processes but also with new, more modern approaches. In addition, supporting aspects that are necessary for a functioning organization, are also considered in a theoretical part of this thesis. To answer the second, we will combine and summarize what we consider to be the best approaches to create a new model that is appropriate to Logicdata's challenges.

1.1 Ambidexterity in R&D Organizations

Organizational ambidexterity is defined as an organization's ability to deal efficiently with today's business requirements while, at the same time, adapting to changes in its environment. Sustainable R&D therefore requires a balance between exploitation and exploration (March, 1991). However, since exploration and exploitation deal with fundamentally different activities (Ahuja and Lampert, 2001) requiring different approaches, it is difficult for companies to be very well positioned in both areas and to work on the topics at the highest level. The ability to deal with both topics within an R&D setting at the same time, is called organizational ambidexterity (Duncan, 1976).

1.2 Course of investigation

Chapter 1 shows the changes in the environment of Logicdata and the challenges which the growing company faces. This chapter includes the two research questions, provides a structural overview of the thesis and explains the term ambidexterity.

Chapter 2 reviews existing approaches, structures and processes relating to organizational design and collaboration in projects. Traditional, consolidated methods, as well as modern, completely new and revolutionary approaches such as Holacracy, are considered in this chapter.

Chapter 3 covers the core of the thesis, by describing the model developed to meet the described challenges faced by Logicdata. The model uses all aspects that were explored in chapter 2 and seem appropriate from our point of view.

Chapter 4 evaluates the usability of the model by testing the VOM with real cases which Logicdata has had to face in past. The theoretical effects of these situations on Logicdata, as a VOM-led R&D organization, are described in detail.

Chapter 5 offers a summary of the contributions made by this thesis and a conclusion from the authors' point of view.

2 Theoretical Background

Jones (2013) described the organisation as *"[…] a tool people use to coordinate their actions to obtain something they desire or value […]"* March and Simon (1993) defined the organisation as a *"[…] system of coordinated action among individuals and groups whose preferences, information, interests of knowledge differ."* While there are several more definitions, they share common ground. An organisation is always a multiagent system with identifiable boundaries. A common goal is pursued whereby the agents' effort should contribute to the result (Puranam et al., 2014).

Puranam et al. (2014) pointed out that every organisation must solve four universal problems. The first two problems, *task division* and *task distribution,* are referred to as the problem of the "division of labour", while the second two problems, *reward provision* and *information provision,* can be assigned to "integration of effort". Task division refers to the problem of defining tasks and subtasks based on the corporate goals, while task allocation refers to the problem of assigning these tasks to the organisational system (agents). Distributing rewards (monetary and nonmonetary) to the agents to motivate them, is referred to as commission or rewards. Finally, provision of information means the distribution of the right information to the agents.

When we discuss traditional or new forms of organisation, we have to ask whether it is really new. A new form of organisation is one that solves one or more of the four problems in a different way than traditional organisations. In the following chapter we describe traditional and existing new, organisational concepts and structures together with their differences. We provide an insight into the relationship between strategy, structure and the environment because today's fast changing environment is the main reason why traditional organisations fail.

2.1 Organisational Change [Daniel Kollreider]

2.1.1 Strategy, structure and the environment

The *contingency theory* states that there is no one best way to manage an organization. Organizations have to continuously adapt to their internal and external environments, since they are constantly changing. That is the main reason why organizations change over time. The task for strategic managers is to analyze the environment, formulate a strategy and to implement it into structural forms.

Strategic management is basically understood as the development, planning and implementation of goals, more specifically, managing company resources in order to achieve these goals. Strategic management can be divided into three phases, *analysis*, *planning/formulation* and *implementation*. In the first *analysis* phase, the environment and the organization have to be considered. The environment is understood as the surrounding forces which influence the organization. They influence how a company operates and how it accesses limited resources (Jones, 2013, p. 81). The strategy *planning/formulation* phase defines and coordinates the company's vision, mission and goals. In the third and final phase, the *implementation* phase, specific actions and measures are planned and implemented. The first phase of the analysis is then initiated once again to review the effectiveness of the implemented strategy. Repeating this cycle (PDCA Plan-Do-Check-Act), over and over again, is the essence of strategic management.

A substantial aspect of strategic management is considering the interactions between environment, strategy and organization. Dynamics, turbulences and changes in the environment must be analyzed and the company's strategy adapted and adopted (Kavale, 2012). Once the strategy has been formulated, management’s task is to adapt the company’s organization and structure. Of course, the company’s structural capabilities must be taken into account in the development of strategy. Kavale, (2012) calls these two approaches "strategic alignment" and "matching".

Alfred D. Chandler defined *strategic alignment* using the paradigm "Structure follows Strategy" (Chandler, 1962). Chandler has stated in his published work, that the structure must be subordinated to the organization's strategy. He discovered that the structure should be adapted to the strategy and not vice versa. *Matching* was described as an alternative hypothesis by David Hall and Maurice Saias (Hall and Saias, 1980), with "Strategy follows Structure". Their hypothesis is that a given organizational structure influences the choice of strategy. The strategy is intended to support the distribution of tasks and the resulting competitive advantages. It has been shown that certain structures only permit certain strategies (Hall and Saias, 1980)

Kavale's theory of an interaction between alignment and matching is supported by Henry Mintzberg, who stated, "Structure follows Strategy ... as the left foot the right" (Mintzberg, 1990, pp. 153) He describes the interplay between strategy and structure. Since assessing strengths and weaknesses is an essential part of the strategic work and the organization’s structure is a key component in this, it follows that the structure must be an important factor in the strategy development, both in its limitations and in supporting the strategy (Mintzberg, 1990).

2.1.2 How have organizations changed so far

Organizations as we know them today, are a recent phenomenon in relation to the history of mankind. In the early days of man, when we were busy hunting and gathering as nomads, we can assume that complex forms of organization were unnecessary. Frederic (Laloux, 2014) (Laloux, 2015) describes the development of organizations by using six types of organization.

The very first forms of organization, the *archaic* (100,000-50,000 B.C.) and *magical* form (15,000 B.C.) did not demonstrate an organizational model. There were no hierarchies and no real division of labor at that time. A few hundred people had formed families or tribes.

The first real organization is called a *tribal impulsive organization*. This is characterized by the constant exercise of power by the leader. Fear is used as a means of ensuring the subordinates' obedience. Compared to today's organizations, the organization acts very quickly and reactively. Organized criminal units, such as the Mafia or street gangs, still have similar forms of organization. The first breakthroughs resulted from the division of labor and the authority of orders.

Traditional conformist organizations are characterized by highly formalized roles within hierarchical, pyramid-shaped structures. Instructions are given top-down. Exact processes are supposed to ensure a high degree of stability, which is valued highly in these organizations. Examples of these structures can nowadays be found in church organizations, the military or governments. Breakthroughs have been achieved through formal roles and processes. The formal roles enable stable and scalable hierarchies, whereby the processes should bring long-term perspectives.

Many companies today are structured using *modern, performance-oriented* forms of organization. They pursue the goals of being better than the competition and growing. Innovation plays an important role here. The principle of management by objectives is applied for the first time in this form. The "how" is no longer specified, only the expected result. It is for the employees to decide how it should be achieved. Multinational and national companies or modern schools, for example, have these structures. The essential elements of modern organizations are innovation, reliability and performance.

Many *postmodern pluralistic companies* are taking a new path. A strong focus is placed on empowerment and culture within the classical hierarchical structures. This is intended to motivate employees and thus lead to better results. A well-known example of this form of organisation is Southwest Airlines. The former CEO of Southwest Airlines Herbert D. Kelleher, using an unconventional management style, led the airline to become one of the most productive and successful airlines in the world. Empowerment, value-oriented culture and the consideration of the individual are characteristic of postmodern forms of organisation (Laloux, 2014).

What is the next step? Frederic Laloux has formulated the term *"Integral, evolutionary organization"*. He names three breakthroughs which lead to evolutionary organizations, self-management, wholeness and evolutionary meaning. Laloux assumes that evolutionary organizations function completely without hierarchies. They imitate the functions of complex adaptive structures as they occur in nature. This form of authority is supposed to be superior to conventional pyramidion structures.

In traditional organizations, people are encouraged to contribute with their professional self and leave other aspects out of the equation. Qualities such as determination, team spirit, rationality and strength are required while emotional, intuitive or spiritual qualities are both out of place and undesirable. Evolutionary organizations with their practices should enable the employee to contribute to the work environment as a whole. Evolutionary organizations are characterized by the fact that they are able to develop by themselves; in other words, they are alive. While they do not try to predict the future, the members of the organization are encouraged to listen, understand and steer the company in the right direction.

2.1.3 How organizations change

Not only have the forms of organizations changed in the course of history, but an individual organization also changes in the course of its life cycle. Larry E. Greiner has created one of the most well-known models for describing organizational changes (Greiner, 1998). He formulates five growth steps which are carried out in sequence (Figure 1).

Every growth step is triggered by a problem or crisis that needs to be solved. Companies which fail to overcome these crises will die, while others that have the ability to reinvent themselves and organize, will survive. Organizational adaptation which can be carried out with as little damage as possible, and as quickly and agilely as possible, leads to a competitive advantage.

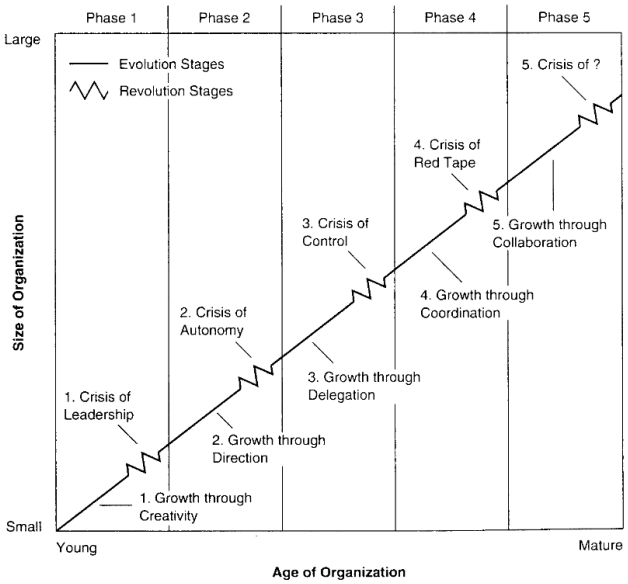

Figure 1:Greiner's model of growth

(Source: Greiner, 1998)

In the creativity phase, the company concentrates mainly on developing a product and a market. Founders are very often technicians who focus entirely on the company. Communication with the few employees is very simple and direct. As the company grows, bigger production demands more know-how and higher efficiency. The increasing number of employees makes communication more complex and it can no longer be done by the founder directly. Greiner calls this phenomenon the leadership crisis.

After some managers have been installed, the company can grow. A functional corporate structure, accounting systems, incentives, budgets and work instructions are adopted. Communication now becomes formalized and hierarchies are introduced. As the company grows larger and more complex, top managers lose touch with the product and processes and the crisis of control occurs. Lower level managers are better able to make decisions but lack the authority to do so. Decentralized structures are designed to ensure that decisions are made in the right places.

In the delegation phase, functional managers receive more responsibility. The top executives manage the company on the basis of reports and often deal with acquisitions while middle management is motivated by its increased authority and has a lot of influence. The control crisis is triggered by top management losing control of the highly decentralized organization. Although a return to centralized

structures usually fails, formal systems are often more successful for producing better coordination.

Decentralized units are combined into product groups (divisions) and considered separately as investment centers which are required to achieve independent results. Companywide programs to control and review the line managers and centralized data processing methods are initiated at the headquarters. Line managers become more and more independent and have to justify themselves to the headquarters on the basis of their results. There is a lack of confidence between line managers and headquarters. Greiner calls this the red tape crisis. Processes become more important than problem solving and innovation, and the organization is too large and complex to be managed using formal programs.

In the collaboration phase, rigid formal programs are replaced by personal collaboration. The focus returns to solving challenges. Formal systems are simplified and are more focused on personal skills. Teams are put together cross-functionally and assigned a task or mission. Greiner suspects the fifth crisis is the employees' psychological overload. The solution for this could lie in structures which allow the employee to recover and reflect at regular intervals.

2.2 Organisational Structure [Daniel Kollreider]

A structure is a formal system of task and authority relationships. It controls how people work together, coordinate their actions and mobilise resources to achieve goals. The organisation structure has an essential impact on the organisation's competitiveness, since it shapes the employees' behaviour and influences their motivation. As shown in the previous section, the organisation's structure is a response to the contingencies arising from environment and strategy.

2.2.1 Traditional organisational design

2.2.1.1 Functional structure

Functional structures are characterised by grouping people into separate functions or departments, which share commons skills or resources. Examples of these

functions could be R&D, sales and marketing, finance, IT, production and so on. The advantage of these structures is their high level of specialisation, because people with similar skills are grouped together. They learn from each other within their department and also supervise and control one another. They can do this in a very professional way because of their understanding and knowledge of the department. Usually, this specialisation increases productivity and it is essential in highly technical and specialised organisations. Typical for functional departments, is that the actors share a common subculture, common norm, values and even language. (Schein, 1996)

There are several disadvantages to these structures. When organisations grow and the product variety increases, it is difficult to provide a functional structure for such a complex variety of products or services. Jones (2013) describes five disadvantages of functional structures. **Communication problems** arise due to the increasingly distance to other functions and subcultural language. Actors have different perceptions of their function's responsibility and mutual adjustments become more difficult. **Measurement problems** arise, because it becomes difficult to measure each functional department's contribution to the overall success. Each function makes a contribution to each product so that measurement is complex. The problem of centralising functional authority across different locations, is referred to as the **location problem**. The challenge is to balance the need to centralise authority with the need to decentralise sufficiently to adjust to local needs. The **customer problem** refers to the fact that focusing on functions limits the specialisation of customer needs, because the functional divisions have to organise themselves so that they can meet every customer's demands. Finally, the **strategic problem** means that too much focus on solving the communication problem, reduces the focus on the corporate strategy as the organisation grows and becomes more complex.

2.2.1.2 Divisional structure

As organisations increase their variety of products, they may be located in several places around the world and to serve several customers or markets, they need to adapt the structure to these demands. When functional structures can no longer meet these requirements, divisional structures are introduced. *Divisional structures* group several functions according to different demands (product, market, geographic). They have to address the increasing variety by increasing vertical and horizontal differentiation and increasing integration between divisions (Jones, 2013).

The advantage of divisional function is the specialisation on different aspects (product, market or geographic). The disadvantage is that the specialisation on the other areas is lost and synergies are often not used. For example, specialised R&D which was gained in one product group may not be used in other product divisions, although there might be similarities. Divisional structures are usually very big and sluggish and are hardly able to adapt to new situations.

Divisional structures are grouped according their domain. *Product structures* group products into divisions. For example, a furniture producing company could setup divisions for the product groups beds, tables, chairs and so on. A product division structure centralises support functions like sales, R&D, etc. and decentralises the manufacturing of separate product lines into divisions. In a multi divisional structure, all support and other functions are separated in divisions. A product team structure is characterised by product teams which collect all the functions needed for a product. They are cross functional and sometimes temporary, existing for as long as the product is on the market.

In *geographic structures* the divisions are organised and structured according to the geographic location. The advantage is that these organisations can react to local demands, however, it is sometimes difficult to promote corporate norms and values across borders. In *market structures,* all skills and competences are grouped into divisions, in order to meet different segments' market needs.

2.2.1.3 Matrix structure

Typical for *matrix structures* is that people and resources are grouped in two ways simultaneously. Depending on the organisation, the matrix functions can be different. Groupings can be by functional domain, by product, by market or by geographic location.

An advantage of these types of structure is, that there are fewer barriers between cross functional teams and the problems which come with the sub culture problem are reduced. The dual function of the matrix structure gives a broader view of the product or service, for example, a technical perspective from R&D and a market view from Sales. The cross functionality also encourages mutual learning between disciplines. Compared to other traditional structures, the organisation is more flexible and able to adapt to change.

A problem of matrix structures is that the distribution of authority between the matrix's functions is not clear defined. Staff face the so-called "two boss problem" (Jones, 2013). This unclear and undefined situation results in a high level of employee stress. To overcome this problem, a very high level of coordination is needed to ensure a smooth process.

2.2.1.4 Network structure

A *network structure* is an innovation in organisational design. It is a cluster of different organisations which pursue a common goal. The collaboration is mainly organised contractually; in most cases one organisation takes the lead. The advantage of these, sometimes complex, structures is each participating company's high level of specialisation. In addition, the utilisation of high investment resources can be increased, and each company's investment can be reduced. These network structures are very flexible and able to adapt to changes very quickly.

The main disadvantage is that the coordination costs are very high. Contracts must be drawn up and maintained and communication between companies, some of which have different standards, norms and values, must work. Although the

participating companies are pursuing the same sub goal, they may still have separate corporate strategies which conflict with the common goal. In these cases, the partnership will not last.

2.2.2 New Forms of Organisation

2.2.2.1 Holacracy

Holacracy is a social technology, introduced by Brian Robertson, for governing and operating an organisation. In contrast to traditional organisations, it is defined by a set of core rules (see Table 1). The system should empower actors to make decisions according to their roles, instead of their titles or level in the organisation's hierarchy. Holacracy include four basic elements; a constitution which sets the rules of the game, the organisation structure and roles, the decision-making process and finally, the meeting process (Robertson, 2015).

Traditional Companies	**Holacracy**
Job descriptions: Each person has exactly one job. Job descriptions are imprecise, rarely updated, and often irrelevant.	**Roles:** Roles are defined around the work, not people, and are updated regularly. People fill several roles.
Delegated Authority: Managers delegate authority loosely. Ultimately, their decision always trumps others	**Distributed Authority:** Authority is truly distributed to teams and roles. Decisions are made locally.
Big Re-Orgs: The org. structure is rarely revisited, mandated from the top	**Rapid Iterations:** The org. structure is regularly updated via small iterations. Every team self-organizes
Office Politics: Implicit rules slow down change and favour people "in the know".	**Transparent Rules:** Everyone is bound by the same rules, CEO included. Rules are visible to all.

Table 1: Differentiation between traditional companies and Holacracy

("Holacracy – A complete system for self-organization," n.d.)

Holacracy tries to connect an organisation's explicit structure with an organic, natural form (HolacracyOne, 2005). Hierarchical structures are replaced by self-organised teams (circles) (see Figure 2). In most cases, operating units are referred to as *sub-circles* which act within a superior, *super-circle*. A circle is not a dedicated group of people, but a group of roles that must fulfil a task or pursue a goal. It has the autonomy to organize and coordinate itself Each circle has a double link with its sub-circle, represented by defined roles (lead-link and rep-link). The lead-link and the rep-link form the connections between the circle and sub-circle. They are members of both circles. While the lead link is responsible for the results of the inner circle, the rep-link represents its perspective to the higher circle (Robertson, 2015).

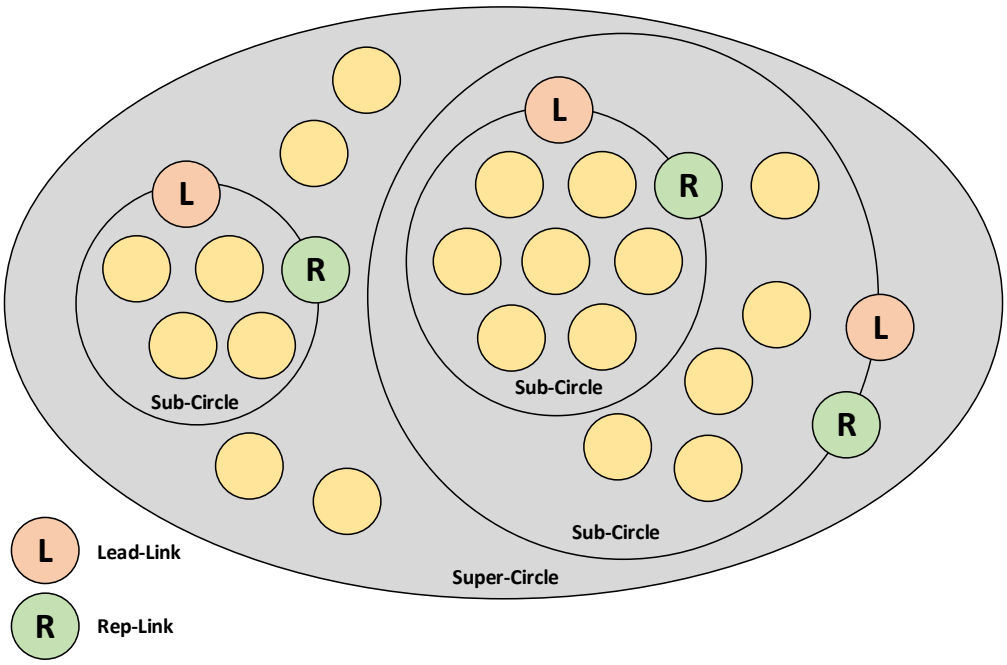

Figure 2: Holacracy circle structure

A basic element of Holacracy is the decision-making process. Decisions are neither top-down nor democratic; decision-making follows a process based on the principle of "inspect and adapt". Each member has the right to make a proposal and initiate the decision process. All relevant arguments are discussed during the process. The decision is taken if no important argument against the proposal remains. Proposals can only be "prevented" by objections based on facts and only concerns that would

harm the company or mean a regression, are considered relevant. The proposal can then be modified, or a new proposal can be agreed. The process allows for quick decision-making and promotes creativity, participation and identification with the agreement reached (Robertson, 2015).

In Holacracy, the governance process is separated from the operative process. (HolacracyOne, 2013). The aim of the governance meeting, held by every circle, is to optimise collaboration methods and the organisation itself. Governance meetings thus have a strategic character, while operative meetings deal with issues like cost, time, quality, resources and daily business activities.

Beside the core principles, Holacracy also contains several additional functions, aspects and rules for the organisation. There are, for example, "modules" for strategic planning, budget planning, project management, personnel development, team building, daily stand-ups etc. They are not necessarily needed when beginning with Holacracy but may gain importance during the organisation's development(Robertson, 2007)

2.2.2.2 Viable System Model

The *viable system model* (VSM) was developed and introduced by Stafford Beer in the book, *Brain of the Firm* (Beer, 1995). It is a reference model for the description, diagnosis and design of all types of organisations. The model is based on the laws of cybernetics, the science of controlling and regulating machines or systems. The core objective of the VSM is to structure social systems in such a way that they can cope adequately with the high complexity of environments and systems, and thus exist in the long term.

Stafford Beer was a pioneer in the application-oriented science of management cybernetics. He succeeded in modelling the functions of viable social systems by applying a scientific approach. In his viable system model, he describes the elements, functions, control relationships and interactions that are necessary for the viability and survival of systems. The viable system model consists of three basic

elements; the *environment*, the *operational units,* or process, and *management,* which is responsible for controlling. The model's structure is represented by five functions, called System-I to System-V.

For a better understanding of the model, three basic concepts and terms must be described, since they are particularly important in the context of the viable-system-model. They are (1) Ashby's law of variety, (2) the principle of recursion and the term (3) *viable system*.

One of the basic challenges for organisations, is dealing with the complexity resulting from the environment. Variety is a measure which describes complexity, it indicates how many states a system can compensate. ***Ashby's law of variety*** (Ashby, 1956) states that for a system that controls another system, the larger its variety of actions is, the more disturbances in the control process it can compensate for. In other words, the variety available to the controller (management) must be at least equal to or higher than, the variety of the situations it controls (Ashby, 1956). According to Ashby's law of variety, it is impossible for the management to capture and process in a meaningful way. all the information which comes from the operational units and the environment The VSM provides a method for dealing with this problem. The basic principle is to condense incoming information (reduce the variety) and to expand the outgoing variety. This can be done for example, by defining processes, tools or guidelines. This process is called variety engineering (Lambertz, 2016).

A core principle of the VSM is the concept of ***recursion***. It means that every viable system contains another viable system. Therefore, the model can be applied to every level of the organisation. This can be the organisation itself, a business unit, a functional department, a project or even an individual person. Therefore, it is very important to be clear about the level of recursion when designing or analysing a system. A ***viable system*** is a system which can sustain its own existence. Thus, the system should have some special characteristics. It should be able to grow, to

regenerate after any kind of damage and to react to changing situations. It must have the ability to reproduce itself and to mobilise resources (Lambertz, 2016).

In theory, ***System-I*** refers to value-adding units and is determined according to the company's purpose. For example, in a manufacturing company, the individual production steps could be mapped in this system. These could be, for example, the steps of cutting, painting and assembly (Lambertz, 2016) whereas in a retail company, it could be the various business units which have more or less independent responsibility for success and can act autonomously.

(Lambertz, 2016) describes the core function of ***System-II*** as the regulation and coordination of everyday tasks. It can be seen as a service function for System-I and System-III. System-II also has a reporting function in that it transmits System I's status to the operative management (System-III). These tasks are carried out in a self-organized manner. System II has no power in the VSM to give direct instructions to System I.

The main function of ***System III*** is operational management. It is concerned with the "inside and now" of the organisation and must ensure the efficiency of the operational units (Lambertz, 2016). The operational units (System-I) should be run in the interest of the whole organisation. The management is responsible for resource bargaining between the operational units. The typical functions of System-III are management accounting, budgeting and production control (Leonard, 2009).

System-IV is responsible for exploring the "outside and then" and providing the system with information about changes in the environment (Lambertz, 2016). To do this, a clear picture of the state of the operational business must be available so that alternative paths for the future can be offered. It is important to find a good balance between focusing on current value creation and concentrating on System IV and the expected future (Leonard, 2009).

To ensure that System-III and System-IV are in alignment, a set of boundaries, more specifically, norms, values and culture must be defined. This is the responsibility

of ***System-V***. It can be compared to the human being's conscience. These norms, rules and values should create a balance between the inside-outside and present-future. For example, they should decide about resource distribution, exploration and exploitation, and incremental or radical innovation. System-V represents the highest authority in the system.

2.2.2.3 Actor oriented scheme

Fjeldstad et al. (2012) explained the new forms of organisations using an actor-oriented scheme. He proposed the hypothesis that *"the ability of organisational actors to dynamically form collaborative relationships"* (Fjeldstad et al., 2012) is common to the new forms of organisations. In addition, the collaborative units must be able to manage common resources, pursue a common goal and solve the problem of freeriding.

The proposed actor-oriented scheme is based on three elements. The ***actors*** are people in the organisation who have the rights, skills and values for self-organization. The have access to ***commons***, where they share resources which are collectively owned by the actors. Finally, actors use ***protocols, processes and infrastructure*** to organise the collaboration between them (Fjeldstad et al., 2012)

2.3 Organisational Processes [Mario Flucher]

This section deals with the core processes of Logicdata's R&D. Core processes are those operationally important processes in the company, which are oriented to the company's purpose and designed to achieve the defined output and the benefit agreed with the customer. Core processes are therefore fundamental, value-adding, cross-functional activities. A core process is a direct, value-added process for the development of products or services, which results from the company's purpose and objectives. Depending on the prevailing hierarchy, correspondingly strict process specifications are necessary. The less the hierarchy prevails, i.e. a leading superior cannot intervene if there are deviations, the more precisely a process must be defined. Laloux has discussed this need for strong processes as a basis for self-management, in his publication (Laloux, 2014) to answer the question of what would arise in the absence of hierarchy.

2.3.1 Waterfall Model

This model takes its name from the frequently chosen graphic representation (Figure 3: Five-stage Waterfall Model) of project phases in the form of a cascade. There are clearly defined start and end points and expected results, which are generally defined by management and handed over to a business unit or project manager. The individual phases are structured so that they are determined in a certain sequence, building on each other. Waterfall models can be also used in huge projects, if the requirements and processes can be very well and relatively precisely planned in advance, but they do not perform well in changing environments, as they are inflexible and not designed for changes.

The basic model consists of 5 phases ("Das Wasserfallmodell," n.d.):

1. Analysis and concept
   In this phase, all requirements are captured and, if possible, all conceptual gaps which would lead to increased effort in the later course of the project, are closed.

2. Design

   Once the concept has been approved, the design phase begins. The aim of this phase is to obtain the customer’s approval for implementation in the development phase, on the basis of an "illustrative sample" (usually not functional).

3. Development

   The more undisturbed this phase is, the more efficiently the team can work on the implementation. The project managers’ task is to keep the team free from any interruptions, such as questions, requests for changes or personnel changes.

4. Test

   ‘Test’ is seen as a quality assurance phase. All the customer requirements should be reviewed during this phase. Experience has proven that technicians should not test their own work. In addition to the technical features, usability is also important here. Usability test cases are also derived from the requirements recorded during the concept phase.

5. Implementation & support

   Once the project has progressed to this stage, the project risk has already been reduced to a minimum. Implementation means integrating the finished product into the customer's system. From this point on, only support to ensure the customer’s trouble-free use is required.

Some advanced waterfall models specifically introduce junctions at neuralgic project positions to enable a stepwise upwards movement of the cascade. However, there is a large risk factor in this lack of flexibility. The urge to adhere exactly to the original plan means that errors in the implementation often only come to light at the end of the project. Correcting these errors at this late point, requires more

effort than would have been needed for an earlier revision (Riehle, n.d.). This risk is compensated by a high amount of planning effort to provide 100% certainty and confidence that the desired solution will be produced (Davis and Radford, 2014).

Since the customer only receives the result for validation at the end of the development phase, there is an increased risk that the customer's requirements have not been correctly implemented or misinterpreted or may even have changed during the course of the project. In waterfall models, these risks are often compensated for by even greater planning efforts at the beginning of the project, but this does not help in the case of changing customer requirements.

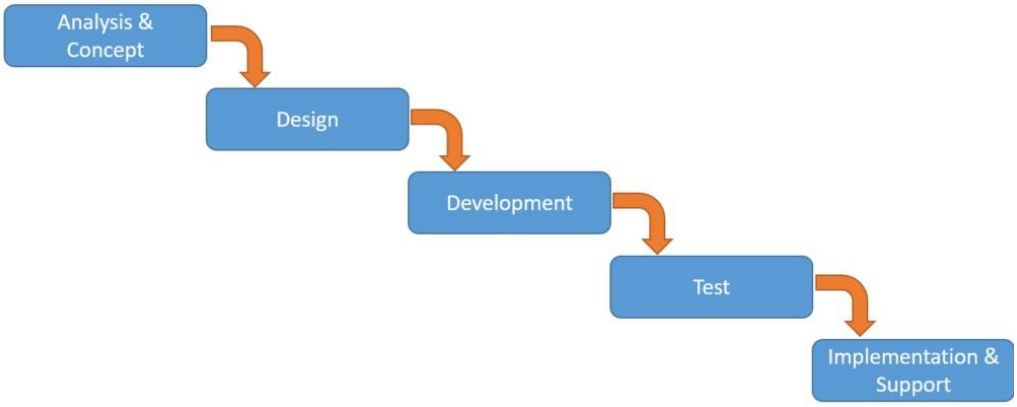

Figure 3: Five-stage Waterfall Model

Source: Own representation based on ("Das Wasserfallmodell," n.d.)

2.3.2 V-Model

The v-model is similar to the waterfall. V stands for verification and validation. Again, each phase must be completed before the next phase begins. Each development phase in this model has a corresponding testing phase. This means that the test cases are already set up during development and provide input for the next phase. Davis et al. considers the V-Model to be an enhancement of the Waterfall, due to the parallel activities which provide confidence earlier in a project that the desired solution will be achieved. At the same time, defects can be identified at each development phase (Davis and Radford, 2014).

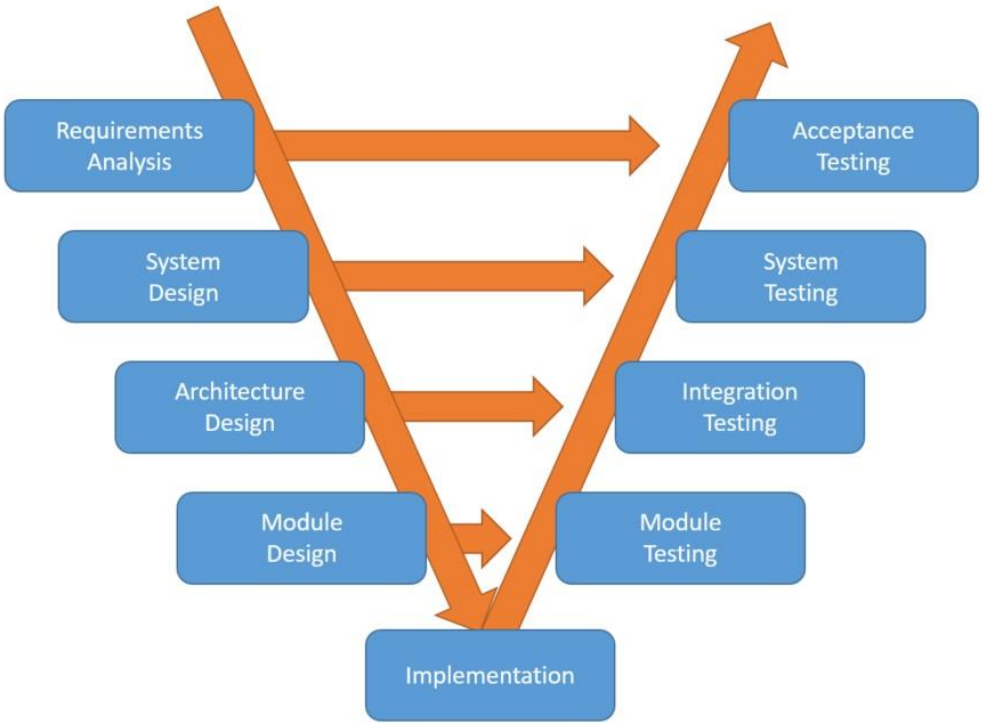

Figure 4: Layers of V-model

Source: Own representation based on (Davis and Radford, 2014)

2.3.3 Stage-Gate Model

The stage-gate-model was originally developed by Robert G. Cooper to significantly optimize extensive development processes for faster development and efficient resource allocation (Cooper, 2002). In this model, a project is divided into several individual sections and so-called gates. The individual sections are geared to the logic of the business segments and depend on the needs of the respective company's projects or industries. According to Cooper (Cooper Robert G., 2008), there are 4 to 6 sections (as shown in Figure 5), which, however, have been expanded in some companies, up to 10. The individual gates between the sections act as milestones, at which the project team checks certain predefined criteria to determine whether the project can be continued, so to speak, invest in the next round, or even be terminated. The evaluation, based on predefined criteria and

results, is usually made by superior managers, who control the means needed for the next section.

The advantage of this model lies in the fact that there is a strong demand for quality to meet the gate requirements and that it is impossible to omit a process step. In the stage-gate model, the individual sections are structured across divisions. Therefore, gates cannot be passed by individuals or groups, but only by the entire team including all departments. This also enables team members from different areas to work on activities in parallel and then jointly evaluate results at the defined gate in order to start the next section in good alignment. Thus, the process provides a course to facilitate the project and it improves the definition of the project manager's tasks and duties.

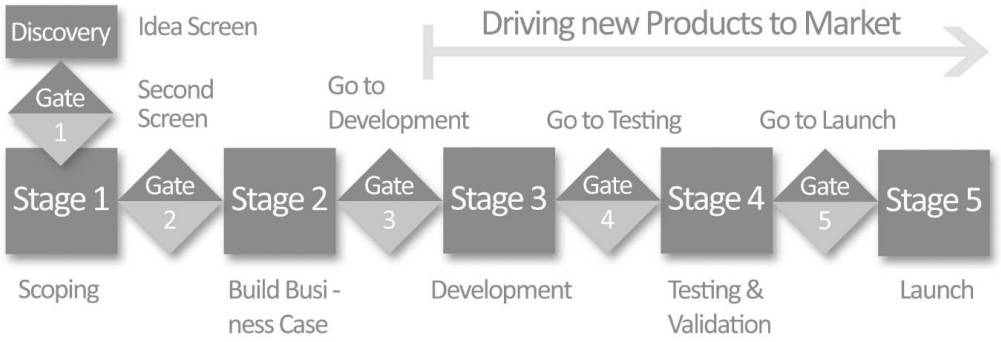

Figure 5: Typical 5 step Stage-Gate-Process

Source: (Pollhamer, 2011)

2.3.4 Agile methods

Development-intensive sectors such as mechanical engineering, the automotive industry, medical technology and electrical engineering, are the major economic pillars throughout Europe. But global competition is catching up: There is a high demand for innovation in shorter cycles, projects must be completed faster and cheaper but at the same time, with high quality. Agile management frameworks unlock untapped potential. Agile frameworks support the "sustainable development" approach. This means that, while we do not know the total project's

scope exactly, we can update our estimates at any time during the various development stages, provide the appropriate quality for intermediate prototypes so that we can enable customer involvement and be flexible enough to respond to new inputs. Project managers working with agile frameworks therefore primarily receive quality from R&D and not a predefined scope, therefore we speak of a value-oriented approach.

Traditional designs are based on a plan & control approach. The scope and the necessary effort are determined in advance. Escalations are mainly compensated by time or effort and the scope is kept constant during the entire project duration. New insights gained during the project are not fed back into an updated planning (see also Figure 6: Agile vs. Traditional designs).

In order to be successful with agile methods, a new approach for the business processes networked with the agile framework, such as strategy finding, is also required and cultural issues also play a major role. Tate highlights the importance of developer collaboration and technical excellence along with the project management side of agile practices.(Tate, 2006)

Agile methods are not only a collection of rituals, but a cultural and technical philosophy. (Tate, 2006; "Webpage Atlassian.com," 2018)

Coplien et al underlines the importance of three basic principles in any agile approach: Trust, communication, self-organization. Management usually takes care that these values gain importance in the company, but in agile methods, the process itself ensures supportive conditions (Coplien and Bjørnvig, 2010).

Agile methods have their origins in software development, which evolved during the 1990s due to challenges such as cost pressure, time pressure and high complexity. Today, agile methods such as Lean, Scrum, Kanban, extreme programming, Design Thinking or feature driven development, are already among the most widespread methods used in software development. But these methods also have their advantages in non-IT areas, as the study *Status Quo Agile 2014*

(Komus, 2015) shows: 27% of those surveyed stated that agile methods were used, and 86% rely on Scrum. In addition, the study also states that Lean is very well known for the high punctuality and efficiency which it enables. Therefore, Scrum and Lean as agile processes, will be examined in more detail in the next chapters.(Komus, 2015)(Komus, 2015)

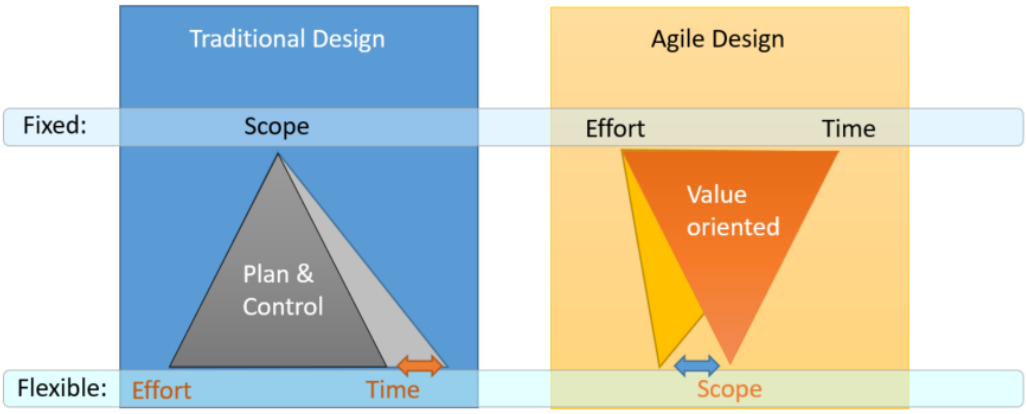

Figure 6: Agile vs. Traditional designs

Source: Own representation based on ("Agile Project Management. Respond to changes quickly.," n.d.)

2.3.4.1 Scrum

Scrum is an empirical, incremental and iterative framework for innovative projects that cannot be fully planned. Initially Scrum was introduced as a method for pure software development in *Wicked Problems, Righteous Solutions* (DeGrace and Stahl, 1990), later an article entitled *The New New Product Development Game* (Takeuchi and Nonaka, 1986) is to be found, describing the application of Scrum in a production environment.

Scrum as a framework, is a collection of working techniques, structures, roles and methods for project management, ideally used in an environment with high complexity, volatility and therefore, high uncertainty. Such a project starts with only a formulated vision (basic assumptions defined by a visionary) which is

assigned to the Scrum unit in the form of a project. Like "Lean", Scrum methodology focuses on the continuous further development of the employees involved, the production processes, the tools and methods. The basic assumptions remain the same throughout the entire process, the aim being to achieve the highest quality with the lowest possible effort while involving customers in the process. In Scrum, it is generally assumed that the development processes are too complex for every detail of the whole project to be planned in advance, or the hours estimated for every task to be done by every project member. Therefore, the Scrum unit is small team (usually 3-9 people) which, together with the product owner, organizes a fixed time frame for the completion of the next self-chosen task packages. Scrum focuses on improving the team performance and not individuals'. Cross-functionality, autonomy and transcendence ensures that the team commits to their self-chosen task packages (in Scrum, also called backlog-items) and delivers the functions on time and in good quality (Sutherland, 2014).

The Scrum process is very strictly defined, and compliance with it is the prerequisite for a successful result, namely high quality for the required tasks. Key principles of Scrum are doing one thing at a time, facilitating small improvements, measuring output and removing impediments to achieve the flow (Sutherland, 2014). Scrum is often also associated with values. The core values are recorded in the *Agile Manifesto* (Beck et al., 2001):

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

2.3.4.1.1 Roles and responsibilities

3 important roles are defined in the Scrum process.

Product Owner (PO)	Scrum Master (SM)	Team (3-9 P)
I decide what to do & why	**I focus on how to work better**	**We do the work / development**
➢ Responsible for the product vision and delivering value	➢ Coach the team on Scrum	➢ Have the skills to deliver the product
➢ Manage the product backlog	➢ Work with stakeholders to remove impediments and improve velocity	➢ Decide how to achieve each increment

Table 2: Roles in Scrum

Source: (Sutherland, 2014)

The *product owner* is responsible for setting the team's common goal. It is his responsibility to take care of the budget and to define priorities for all backlog items. These are important preparatory aspects for the team when choosing the set of backlog elements for the next sprint.

Effort assessments for backlog items are carried out by the whole *Scrum - team* before implementation starts. Sprint planning is used to choose those backlog items with highest priority for implementation in the next time box (the sprint) – normally between 2 and 3 weeks - during which the team is totally self-organized to achieve their planned quota of backlog-items. It is exactly this self-organized approach in the Scrum process, which ensures the commitment of every Scrum team member. In Scrum, we always discuss self-organized teams, which also means that we assume that the team uses the members' individual strengths to adapt dynamically and quickly to the changing, complex tasks which arise.

The entire process, with all tasks and roles, is monitored by the *Scrum master*. This role's tasks also include creating the necessary transparency and maintaining the continuous improvement process. The Scrum master must always ensure that the team can be productive and deliver high quality, that the working conditions are right and that the team is happy in what it does.

2.3.4.1.2 Product backlog

The product backlog contains the product to be developed's functional and non-functional requirements. It contains all the functionalities, including technical dependencies, that the customer requires. Before each sprint, the product backlog elements are re-evaluated and prioritized; existing elements can be removed, and new ones added. Highly prioritized features are estimated by the developers and transferred to the sprint backlog.

2.3.4.1.3 Sprint backlog

Sprint backlog elements normally require no more than 2 working days, to maintain clarity and separate complex tasks into small portions. Because the team members know their own capabilities and total capacity per sprint best, they self-organize how many backlog items they can deal with. Work effort is not represented in hours but in "story points". Story points (SP) are an abstract unit for a backlog item's corresponding level of complexity and effort. With this universal unit, it is now possible to jointly estimate the effort requirement of backlog items independently of individual performance differences in implementation.

2.3.4.1.4 Sprint

Each increment is a time box, normally of 30 calendar days, which is called a sprint. Within each sprint, the team develops an increment of potentially shippable functionality, which is then presented to the client side. This early prototype is used to get extensive feedback from Product Management about the implemented functionalities and those that are still on the implementation list. Management and other interested stakeholders are also invited to this sprint review. Based on the

newly gained knowledge and the feedback they received, the Scrum team plans the next sprint.

2.3.4.1.5 Daily meeting

Every morning at the same time, there is an exchange meeting of about 15 minutes. The content is exactly predefined:

- Have you finished what you had in mind for yesterday?
- What tasks do you have until tomorrow?
- Is there anything that is blocking you?

To show the team's current status, completed tasks and features are displayed in a burndown graph.

2.3.4.1.6 Review and Retrospective

After each sprint, a formal review of the results is carried out together with the direct customer (product management, sales, management, but also other teams and the product stakeholder). For this purpose, the current prototype is demonstrated, and its technical characteristics are analysed together. The customer can therefore see from the prototype whether or not it meets his expectations. At this point in time, change requests can easily be submitted to the team and documented in the product backlog.

To keep the process of continuous improvement alive, a retrospective is carried out after a sprint. Findings about what went well and what could be improved, are recorded and assigned to the respective area of responsibility. It is the Scrum master's task to integrate these findings into the organization or product, backlog.

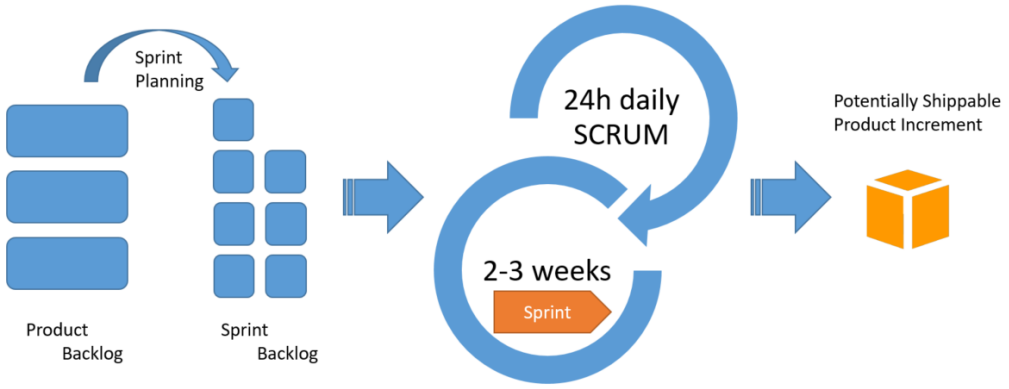

Figure 7: The Scrum Process

Source: Own representation based on (Sutherland, 2014)

2.3.4.2 Lean product development

Lean, as a methodology for improving a process, has gained popularity with the Japanese auto industry. Toyota in particular, was a company with a "minimalist corporate culture" which ensured outstanding long-term success. Lean is not only about minimalism but about value enhancement. All activities that do not increase value for the end customer, are irrelevant in Lean, and defined as "waste" (jap. "Muda"); we should try to reduce or eliminate it. Lean is not only a process, most important is the Lean secret: an "all hands on deck" mentality that permeates every employee, every manager, every supplier, and every partner. The Lean process increases efficiency, effectiveness and the quality of processes while reducing operating costs. While agile (2.3.4 Agile methods) emphasizes customer involvement, Lean extends this so that everybody in sight is a stakeholder and for example, can contribute to designing the architecture (Coplien and Bjørnvig, 2010).

Jeff Sutherland, inventor of Scrum, states that both Scrum and Lean are based on observations from complex adaptive systems (Sutherland, 2008). While the Scrum principle is based on rapid decisions, Lean is based on rapid development after a

decision has been reached (Liker, 2004). Another difference is that Scrum insists that there are no recognized specialists in a team while the contrary is true for Lean.

2.3.4.2.1 The Lean secret

Lean focuses strongly on an architecture that has been diligently worked out, jointly with all stakeholders, right from the start. This architecture is the basis for a fast implementation without the necessity of reworking due to functions being forgotten or misunderstandings, which would result in increased, unforeseen costs. The secret of Lean lies in teamwork, iteration, and up-front planning with the cooperation of all stakeholders: "Everybody, all together, from early on" (Coplien and Bjørnvig, 2010).

Principles of Lean:

- Specify value in the customer's eyes
- Identify the value stream and eliminate waste, ensure the flow of the process
- Understand all aspects of the customers' demands in the right time frame, by providing prototypes
- Involve and empower employees
- Continuously improve

All these principles are supported by the Build - Measure - Learn Cycle (Figure 8) which Ries describes as the core of the Lean start-up model (Ries, 2017).

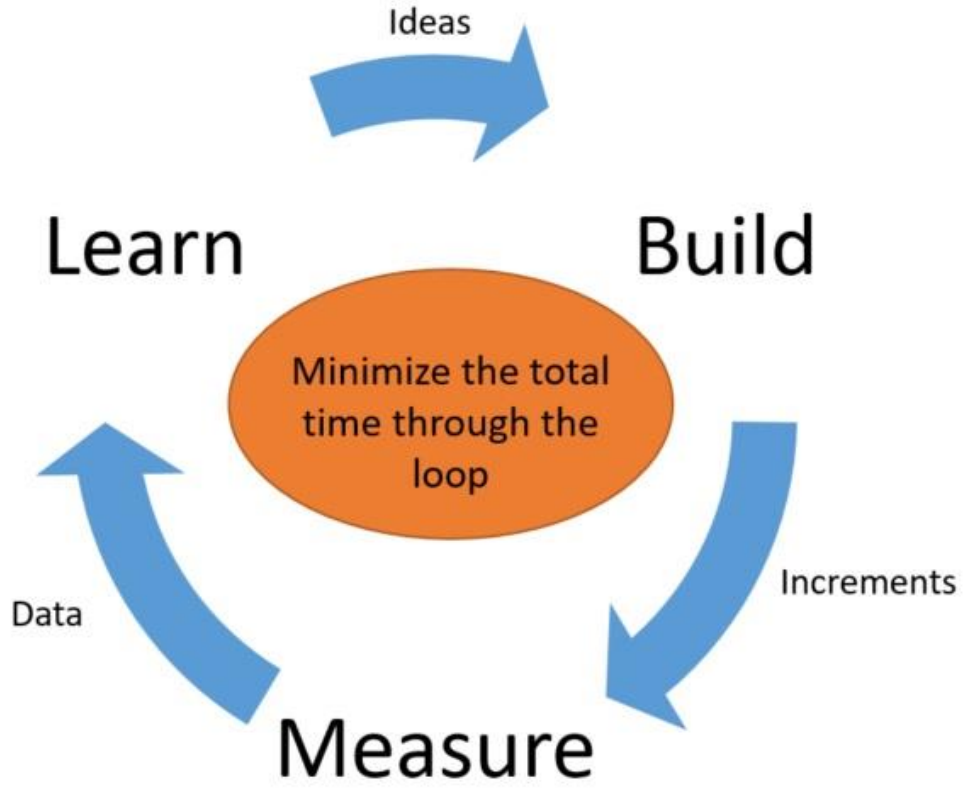

Figure 8: Build - Measure - Learn Cycle in Lean

Source: Own representation based on (Ries, 2017)

2.3.4.3 Conclusion Agile vs. Lean

Regis Medina believes Lean and agile are two separate approaches for different aims or objectives. Agile is a process for organizing a team, building the right product with the minimum overhead in an unclear environment. He links it with the keyword “BUILDING”. Lean is, in his mind, the practice of developing the right skills and engaging people to deliver more value with less waste and is therefore linked with “LEARNING” (Medina, 2013). Both methodologies differ from traditional processes in their careful, qualitative execution and focus on continuous learning. Traditional approaches are often focused on overcoming a milestone or a result of the team’s concentrated efforts and often therefore suffer a loss of quality. Coplien et al blames this "Throw it over the wall" attitude for the fact that waterfall

developments already have a very bad reputation today (Coplien and Bjørnvig, 2010).

Both describe themselves as agile methods and can therefore be applied in situations with similar environmental conditions. However, in Table 3: Comparing Lean with agile, Medina sets out some subtleties which differ considerably.

Lean	Agile
Thinking and doing	Doing
Inspect-plan-do	Do-inspect-adapt
Feed-forward and feedback	Feedback (react to change)
High throughput	Low latency
Planning and responding	Reacting
Focus on Process	Focus on People
Embrace standards	Inspect and adapt
Bring decisions forward (Decision Structure Matrices)	Defer decisions (to the last possible moment)

Table 3: Comparing Lean with agile

There are so many other different processes for developing and cooperating in projects. In general, we can choose the process that best supports us in what we still want to learn (Medina, 2013).

2.4 Organisational Culture [Mario Flucher]

The organizational culture describes the prevailing values in an organization and determines the collective organizational, as well as individual, behaviour of employees. At the same time, the culture not only influences the cooperation of employees inside an organization, but also how decisions are made and how the

environment, i.e. suppliers and customers, is dealt with. Edgar Schein defines organizational culture as "a pattern of basic assumptions - invented, discovered, or developed by a given group as it learns to cope with its problems of external adaption and internal integration - that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems (Schein, 1992). This paradigm is also passed on to all new employees in the sense of the prevailing, common, organisational culture and thus defines the overall cultural appearance and behaviour patterns which have an external effect. Culture is important in organizations because it describes how value can be created through people to achieve a greater competitive advantage with a culture better than that of the competition.

Schein's model is based on 3 levels of cultural phenomena, which, in his opinion, prevail in organizations (Figure 9: Schein's 3 Layers of Culture):

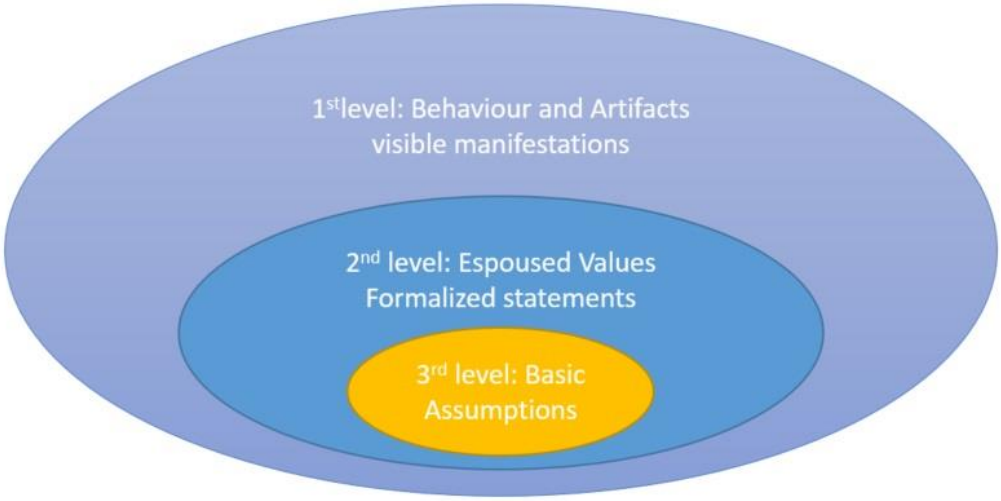

Figure 9: Schein's 3 Layers of Culture

Source: Own representation based on (Schein, 1992)

On the 1st level, the surface, we find humans' visible behaviours. Language, clothing, rituals and good manners are examples of this level. Good forms, such as

for dealing with suppliers and external partner companies, can be specified and trained at this level by means of an internal organisational charter, and compliance monitoring can be performed more easily than on other levels.

On the second level, we talk about ideologies, feelings for the right thing. These are attitudes that an employee should have but which are no longer easily transportable via a code of conduct and certainly cannot be trained on demand. Honesty, friendliness, infatuation with technology, striving for perfection are qualities that have been lived and developed over the years, for example, already in childhood or through the private environment. It is possible to change this, but it takes time and willingness to change.

Level 3, the lowest level, are basic, anchored assumptions which are not questioned or discussed. They are so deeply rooted that they are not consciously perceived and taken for granted by the members of the organization. Characteristics, relationships to nature and other people, can hardly be changed by organizational guidelines; change takes time and work over several generations.

If culture seems so important, then the question also arises, whether and how it can be changed? Edgar Schein (Schein, 1992) takes the approach that precisely at the point when the prevailing culture no longer seems appropriate, it can be adapted to the corresponding environmental conditions. At the same time, Schein's work demonstrates a concept for implementing cultural changes and points to one serious stumbling block: "change creates learning anxiety", which he describes as the fear of leaving the familiar environment and changing into something new and unknown. This concerns the individual fear of losing power, giving up personal identity and perhaps even putting group membership at risk. Schein (Schein, 1996) also differentiates between 3 management cultures; the operator culture, engineering culture and executive culture. The greater the learning anxiety, the stronger the resistance and the defensiveness will be.

If, from a management point of view, an adaptation of the culture is required, it is necessary to keep the learning anxiety as low as possible. As a supporting measure

for achieving this, the employee must be assigned the feeling of “psychological safety”. To create a “sense of urgency” (Kotter, 2008) recommends conveying the reasons for the necessary cultural changes in the form of the company’s vision. The underlying problem necessitating change must be defined clearly. The involvement of employees in the development of the measures prevents the formation of isolated groups. Getting feedback and bringing positive role models into the system, is a further method which supports the group in this learning process.

In Kotter’s statement: “*[..] If volatility continues to increase, as most people now predict, the standard organization of the 20th century will likely become a dinosaur."* (Kotter, 2008), he described his recognition that companies in today's global environment are constantly undergoing cultural redesign and adaptation. This also highlights the necessity of dealing with the topics of *motivation, individual empowerment* and *feedback, teamwork and cooperation*.

2.4.1 Motivation

The origin of a certain basis motivation is the simple fact that people must earn their livings. The outdated carrot and stick thinking was a very famous approach for bringing employees to a higher motivation level because it was so easy to apply. Rewarding a properly executed activity will get you more of these and on the other hand, punishing a mistake should result in less of them. This concept’s weak point is that you always have to keep an eye on your employees and their activities. Such behaviour generates mistrust.

A new approach to motivation is to create an environment of trust, so that the organisation’s members are ready to actively participate in the ongoing adaptation to rapidly changing environmental conditions (Laloux, 2014). Malik also describes trust not only as the robust basis of a good leadership culture, but also as the basis for a social interaction in which the conflicts that inevitably arise when people cooperate, can be solved or become bearable (Malik, 2007). On the one hand, having conflicts is a positive sign, because it is a sign of participation and interest in what has happened and that we are not in harmony with ourselves. Laloux

reaffirms the need to address conflicts to bring tensions within the company to the surface. Only by bringing a deep-rooted conflict and the associated feelings and unfulfilled needs, to the surface is it possible to work together on a solution. Fear and distrust prevents many companies from discussing and clarifying differences of opinion (Laloux, 2014).

2.4.1.1 Pyramid of human needs

The basic question that concerns us in a motivation concept for employees in organizations is the sequence of individuals' needs. If we know what really drives people and what they want to achieve, then we can create the framework in an organization so that employees can work in a purposeful, motivated and concentrated manner on the topics that help the company to move forward. A very well-known theory of motivation was devised by Abraham Maslow, a founder of the humanistic movement in psychology. His theory published in the paper *A Theory of Human Motivation* in 1943 states that unsatisfied needs from the lower levels are always of more importance than those from higher levels. The lower levels are defined by basic physical requirements, while higher levels become more psychologically and socially oriented. This is an important principle to address the right motivation concept to employees. If managers want their employees to be creative and innovative, aspects which can be found on the top of the pyramid, we need to ensure that all their needs from lower levels e.g. their need for food, health, safety and respect are sufficiently fulfilled. An organization cannot always directly influence these needs, but it can ensure a friendly environment in which the employees' basic needs can be fulfilled quickly and easily through their own efforts.

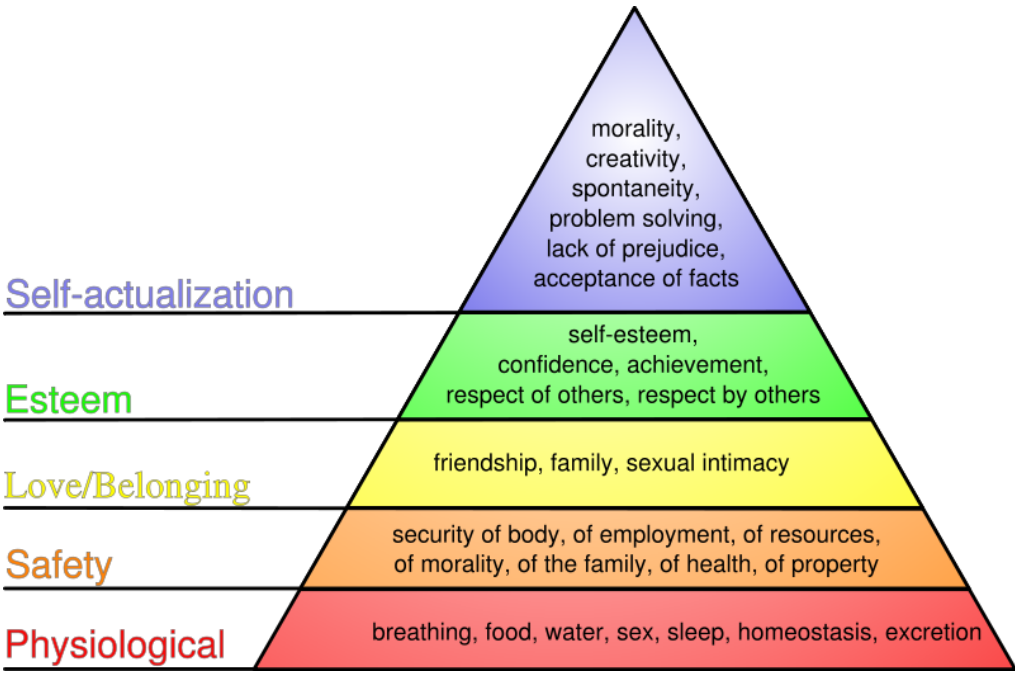

Figure 10: Maslow pyramid of needs

Source: (Finkelstein, 2006)

Based on the levels shown in *Figure 10: Maslow pyramid of needs,* we can find cross references to several motivational principles in companies:

Physiological level: An organization should offer lunch for employees, so that they do not need to spend the whole morning thinking about where to eat and how to get there. A power napping room could give some employees the chance to get over the "soup coma" and gather strength for the afternoon. A 10 minutes power nap is better than 4 hours unproductive and error-prone working time. The environmental conditions in offices like temperature, humidity, noise, dust and draughts, are serious topics not only for people's health but also because they define the proper conditions for efficient and highly concentrated work.

Safety: If employees are informed about the current financial status and ongoing activities, they feel more security in their employment, which satisfies this need. With adequate wages, families can afford to live and also a little luxury. Because

mankind is getting older and older, we pay more attention to our health. Ergonomic work places as well as small health supporting programs, fit into this section. Even small investments can keep employees' health at a high level in the long term

Love/Belonging: With a flexible working time concept, employees can arrange their work and their family. Health care for relatives can be arranged much more easily with flexible working time. In summer time, people want to enjoy daylight while in winter they are probably willing to work longer. We should take care of employees who have families at home when we design workshops with obligatory overnight stays.

Esteem: Receiving respect is a cultural topic. We, as a company, should treat everyone with proper respect but we should also give employees the opportunity to further develop themselves and give them the sense that they are valued and contributing to the organization. Praise and recognition based on individual and team achievements will fulfil the needs in the esteem section.

Self-actualization: This is the peak of Maslow's pyramid which he explained as: *"It may be loosely described as the full use and exploitation of talents, capabilities, potentialities, etc. Such people seem to be fulfilling themselves and to be doing the best that they are capable of doing... They are people who have developed or are developing to the full stature of which they capable."* If we have enabled employees to reach this level of their needs, we have them at the right place to be creative and innovative from a highly self-motivated position.

Meanwhile there are already further studies which while only partly supporting Maslow's theory also expand on it. In a study in 2011 (Tay and Diener, 2011), researchers from the University of Illinois discovered that while the fulfilment of the needs was strongly correlated with happiness, self-actualization and social needs were important even when many of the most basic needs were still unfulfilled. Another team of psychologists (Kenrick et al., 2010) extended Maslow's 5 levels to include basic biological drives instead of self-actualization: Parenting, mate retention, mate acquisition together with Maslow's status/esteem, affiliation and

self-protection and immediate physiological needs. Summing up, we have to understand that fulfilment of human needs can be powerful motivators but does not always follow the hierarchical structure defined by Maslow.

2.4.1.2 The 'flow channel'

The happiness researcher Mihály Csíkszentmihályi is known as the creator of the flow theory. Figure 11: Achieving mastery with the right mix of challenge and skills, illustrates the "flow channel", which is a mental state in which a person is deeply concentrated and completely absorbed in an activity. In this narrow band, activities are carried out in a kind of trance. This state is dominated by the feeling of control instead of fear and boredom, since the skills and demands of the activity are in harmony with each other.

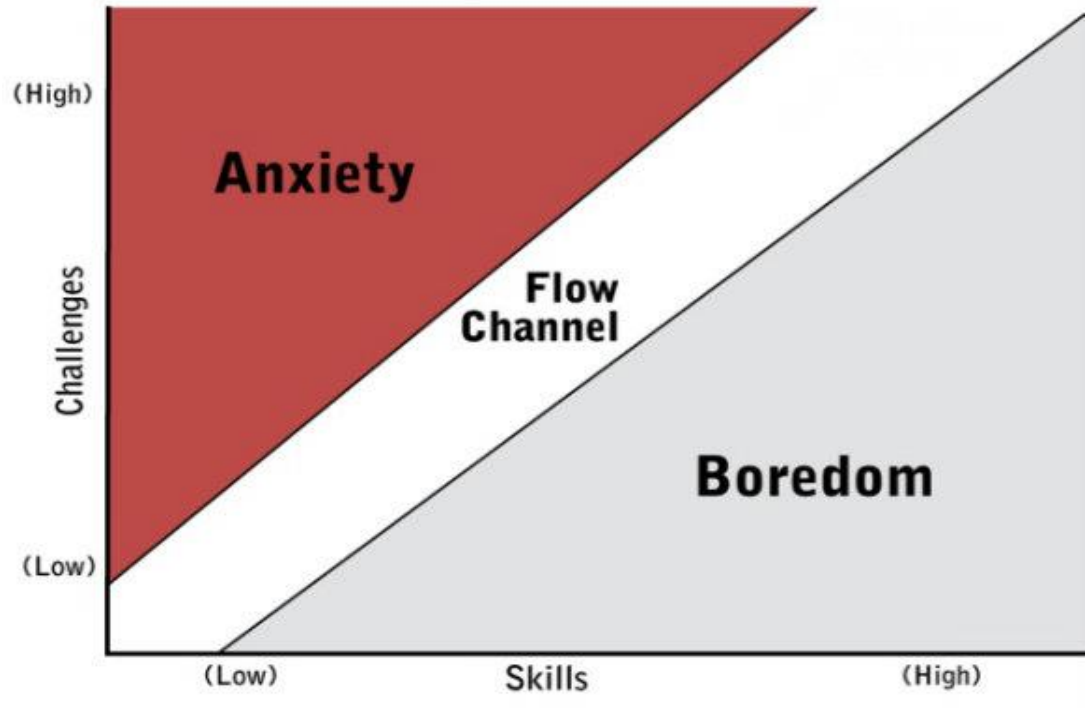

Figure 11: Achieving mastery with the right mix of challenge and skills

Source: (Csikszentmihalyi, 2009)

2.4.1.3 Storytelling

Another powerful motivational method is storytelling. A story itself is a very powerful tool. A good story depends not only on the content, but also on the person telling the story and what experiences are shared. Often it is stories about fears, touching or even funny stories that are shared. When telling a story, the teller opens up and often shares intimate experiences with colleagues, which in turn creates trust. It can be used to inspire employees, giving them a good/positive reason to go to their office every morning. Sometimes, however, a good story initiates hope and courage to do the things that you set out to do, because the teller has shown that it is possible.

2.4.2 Empowerment and Feedback

In today's very ephemeral times, being able to make quick decisions is a decisive factor for success. There are a lot of things that kill speed in organizations but one is outstanding, "Debates in committees where no person has the D (the right to decide)" (Zook and Allen, 2016). Malik (Malik, 2007) has a very interesting perspective of a corporation's most important asset, human beings. While computers and machines continue to do their job once they have been set up, humans need to be continually educated and trained to improve, but never will reach a level of total perfection. Because employees are humans and individuals, we also have to be developed individually and not all in the same way. To do so, we need someone to evaluate us and give external feedback, to work out our weaknesses and strengths. Ideally, feedback should come from all sides (often called 360° feedback), from direct superiors but also from subordinates and colleagues. And the basis for an open discussion culture is once again, the previously mentioned, trust.

To quote Jos de Blok from Buurtzorg at this point: "To be honest with ourselves and others, we need to feel safe. Only then we can use the strength of every colleague and prevent people from doing something that they really cannot or do not want to do."

Large-scale development programs with a standardized scope, are of little help here. It is much more important to focus on the various individual, ideal learning paths. The best way to learn in a professional environment is by doing.

Laloux, in his publication (Laloux, 2014), describes feedback not only as a snapshot, but also in combination with the necessary foresight, a way of recognizing an employee's potential. Coupled with knowledge of their strengths and abilities, they can be empowered to take on challenging tasks and thus learn new things, sometimes even by using the trial and error approach.

Empowerment coupled with the right mind-set, produces the decision-making speed demanded in today's world. The mind-set we are talking about is described as "promoting visionary thinking" in Niven and Lamonte's publication (Niven and Lamonte, 2016). It is a growth-oriented mind-set in which learning opportunities and improvements are derived from errors. This approach is also supported by Zook and Allen (Zook and Allen, 2016), in this case, however, it is more a matter of weighing the risks and opportunities against each other and then consciously accepting them to reach a decision, just as the company's founder has done before.

2.4.3 Teamwork and cooperation

An organization is the sum of the strengths of all its members and not a one man show. Objectives and Key Results (OKR), as a method, is the means to achieve effective teamwork for the performance of increasingly challenging tasks in cross functional teams and global organizations.

2.4.3.1 Objectives and Key Results

OKR is a planning and control approach which was invented by Intel co-founder Andy Grove, and introduced as a leadership model to Google, as well as Twitter and LinkedIn, just to name a few well-known examples. As Peter Drucker discovered in his book *The Practice of Management*, some employees have the company's overall vision in their heads, but others are focused exclusively on doing their daily work. Drucker stated the importance of individual goals for every single

worker, from top management down (Drucker, 1986). Of course, every single contribution counts but if we have a strong alignment with the overall goals, we can easily change the strategy and we see the inevitable effects on the individual sub goals. This networking of goals allows maximum flexibility despite a hierarchical goal structure. According to Niven and Lamonte's definition, "OKR is a critical thinking framework and ongoing discipline that seeks to ensure employees work together, focusing their efforts to make measurable contributions that drive the company forward" (Niven and Lamonte, 2016). Therefore, we are not talking about small intermediate steps with little significance, but about valuable contributions to the big picture. Malik also speaks of "few goals, but great ones - those that matter, that mean something when they are achieved" (Malik, 2007).

While the objective gives us a basic overview "What we want to do", the key results tells us "How will we know if we have met our objective", thus making it quantitative (Niven and Lamonte, 2016).

2.4.3.2 Meetings

The gathering of people enables exchanges on a personal level and a consensus to be found when working together. Personal meetings are still preferred compared to the opportunities provided by current technology, such as telephone, video and internet conferences. Considering that in many companies up to 80% of their meetings are inefficient and unproductive (Malik, 2007), the need for designing them better arises automatically.

A meeting is more than just an exchange of information. According Laloux, it can be about the fear of being exposed, it's often about just being heard, getting help to solve challenging issues or simply balancing out interpersonal tensions. Sometimes it is enough to bring emotions to the table, to have a common basic understanding of the facts and the possible background, so that we can then concentrate together on the solution (Laloux, 2014).

The *number of meetings* depends on the size of the working groups and the complexity of the tasks, but also the team's composition in terms of the respective competencies. The usefulness of a meeting should always be questioned by every participant. Therefore, an agenda to be sent out in advance, with a clearly defined goal for the joint meeting, is obligatory. But what happens if the agenda shows that coming together at least in the current situation, is not helpful? To quote Malik, who has already described this situation very precisely, "Do not do the meeting!" (Malik, 2007).

It follows automatically, that regular meetings (most popular weekly or biweekly meetings) have very little right to exist, if they are not simply to be described as a placeholder in the outlook calendar. A regular meeting is usually used for ad-hoc topics and therefore has a very poorly prepared agenda. To conclude, serial meetings should simply to be avoided and a meeting organised only due to current necessity (Laloux, 2014).

3 Versatile Organisation Model

This chapter describes an organizational model (VOM, Versatile Organisation Model) which is specifically designed to meet the needs of Logicdata's development department. First, the company’s environment is discussed followed by the development department’s environment within the company. From this, the special requirements on the organizational model, the processes and the procedures which are described in this chapter, can be derived.

The versatile organisation model is based on the new forms of organisation described in chapter 2.2.2, which seem more suitable for the ambidextrous challenges (exploration and exploitation) and the variety of tasks. Elements of the Viable System Model, Holacracy and the actor-oriented scheme were combined and extended to form a new approach to an organizational structure tailored to Logicdata's requirements.

The process and process design approaches described here are based on elements of agile methods such as Scrum and Lean, but elements of the classical methods, Waterfall and V-Model, are also combined in a superordinate stage-gate approach, as described in chapter 2.2. Finally, this chapter highlights cultural aspects of organizational development (discussed in chapter 0) which are, in our point of view, essential in an environment where information is exchanged with everyone and willingness to go the extra mile is required to gain the edge over the competition.

3.1 The environmental conditions [Daniel Kollreider]

The interrelation between environment, strategy and structure has already been described in detail in chapter 2.1.1. In the following, Logicdata’s environment and especially the development department’s environment and integration into the company will be analysed.

The strategy and structure are derived from the company's vision, mission and environment. The R&D strategy and structure are embedded in the company’s

environment and must support the corporate strategy. Jones, (2013) divides the corporate environment into a *general* and a *specific environment* (see Figure 12).

3.1.1 Logicdata's environment

The **general environment** includes all the forces that influence the specific environment and thus all organisations located in the general environment. Competitors are often located in the same general environment as Logicdata, so they face the same challenges and opportunities.

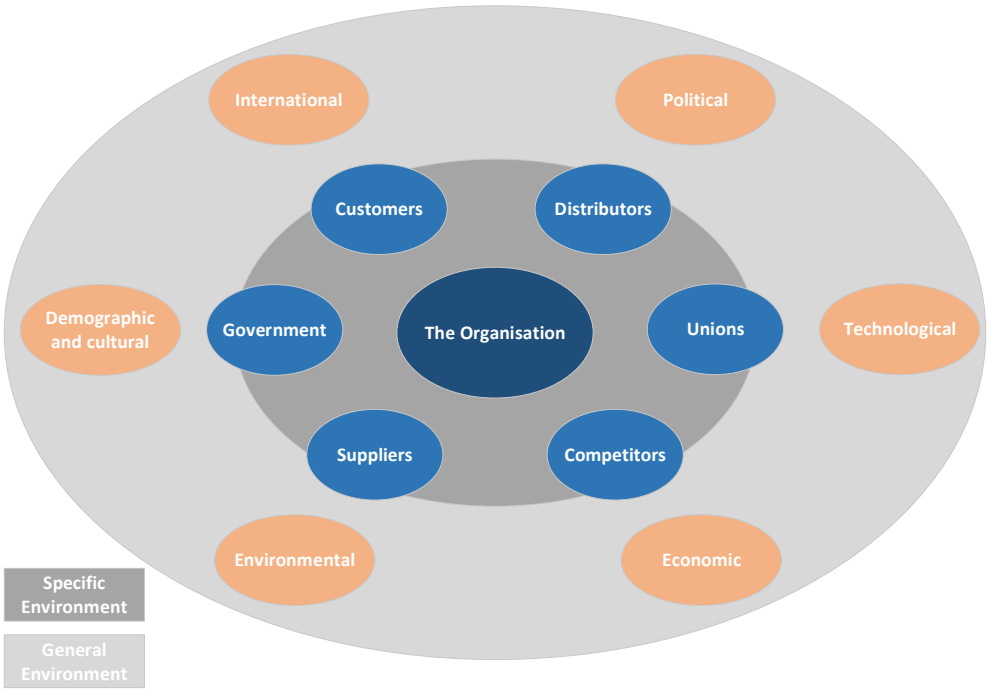

Figure 12: The organizational environment

(Source: Own representation based on Jones, 2013)

Demographic and cultural forces have a significant impact on Logicdata. New and modern approaches to organizational design and the way people work together, have also changed the way office space is used. Recently, the trend towards shared-space, home office and ergonomic workstations has emerged. The more flexible work locations bring infrastructure savings, but also places new demands on office equipment and thus on Logicdata's products. In addition, different cultures in

different countries are characterised by various quality and design requirements. The difference between Europe and North America is noticeable here. Products must either meet the requirements of both or be designed individually to meet local needs.

Political, ethical and environmental forces influence the labour market, which is controlled by targeted political programmes and education policy. Technology-oriented companies like Logicdata are highly dependent on a qualified workforce and are therefore influenced by political situations. The environmental trend towards resource-saving products and services also influences product design, packaging and the logistic concept. Culture-specific differences in the understanding of Corporate Social Responsibility (CSR) policy can vary greatly on ethical and environmental policy issues. As a globally operating company, Logicdata must take account of these differences in its strategy.

Technological forces primarily define the products themselves, but also place high demands on the organization itself, which must constantly expand, question and adapt its core competencies. Megatrends like the Internet of Things (IoT), lead to completely new business models for Logicdata but also require new product development methods. Industry 4.0 could provide Logicdata with an attractive opportunity for local production in Austria. Again, the organisation has to adapt to the new circumstances.

Economic forces such as interest rates, unemployment rates, exchange rates or wage levels, are constantly changing and pose a high risk to organizations which are unable to adapt. Especially globally organized companies, like Logicdata, must not ignore these forces. If it can use them properly, it can lead to a competitive advantage. A flexible, globally organized company which can react quickly to changes, has a lot of scope for optimizing costs (e.g. by relocating production, by using globally organized product development, by managing the risk of changing exchange rates, etc.) and minimizing risks.

The **specific environment** includes the forces, due to stakeholders, which have a direct influence on the company's resources. These are customers, distributors, unions, government, suppliers and competitors which affect the organization in a certain way.

C**ustomers** probably have the biggest impact on the company. The variety in Logicdata's customer portfolio is rather large. Customers differ greatly in size, processes, procedures and structures and their requirements in terms of price, products, services and quality, also vary greatly and are strongly influenced by country and cultural factors. Because customers are integrated into the value chain to different degrees, Logicdata has to use different business models for different customers.

Distributors have not played a decisive role in the previous (B2B) business model. With the expansion of Logicdata’s business area and the product range from components (drive technology, mechatronic package) to finished goods (adjustable bed), this has changed., Distributors will have a significant influence on Logicdata's organization through future new products or services.

Unions: Through the union of several furniture manufacturers and suppliers to form the Business and Institutional Furniture Manufacturers Association (BIFMA), a standard was created which significantly influences the US market. Like the European standards associations, these unions can be used to actively and strategically influence standards for the benefit of the members. Governments control companies in a similar way, through rules and regulations that are partly concerned with product safety but also regulate the import and export of goods.

In addition to customers, **competitors** also have a decisive influence on the company’s design and organization. Logicdata is exposed to increasing price pressure from Asian manufacturers at the same time as increasing innovation pressure from European and American competitors. High productivity, economy of scale and optimal use of global markets combined with a high degree of innovation, requires companies to be ambidextrous in the sense of agility and effectiveness. In

addition, more and more competitors are emerging in the form of customers and suppliers who are countering the maturing market with strategies such as vertical forward and backward integration (Jones and Hill, 2013, p. 317)

Many **suppliers** in a global environment represent a challenge for the organization. Suppliers affect most areas of the company, for example, purchasing, R&D, quality management, finance and others. New technologies and a wide range of products increase the complexity of supplier management. In addition, the problem of strongly varying purchase quantities resulting from the different customer structures, must be solved.

All these influencing factors are constantly changing and, in some cases, cannot be foreseen. The organization and corporate strategy face the challenge of constantly adapting to these uncertainties. Rigid strategies and organisations are no longer sufficient for these demands.

3.1.2 The R&D environment

Having analysed the company and its environment, the following chapter describes the R&D department's integration into the company. Basic structures like functional, divisional or matrix structures were described in chapter 2.1.3. In this chapter, the R&D department's integration into the company is described independently of the department's structure. The interfaces differ depending on Logicdata's R&D department's area of responsibility, which can be divided into three categories: *product development*, *innovation management* and *support activities*.

Product development: The main task and primary purpose, of the development department is the development of new products and services. The interfaces to the company can be derived from the decisions required during product development. Krishnan and Ulrich, (2001) have compiled a wide range of literature on product development and its decisions. They define product development as the transformation of a market opportunity into a product available for sale. Krishnan

and Ulrich (2001) distinguished five phases; *concept development*, *supply-chain design*, *product design*, *production ramp-up* and *product launch*. Although Logicdata uses a different logic for the phases of product development, Kirshnan and Ulrich's phases are used in the following section to describe the R&D department's interfaces.

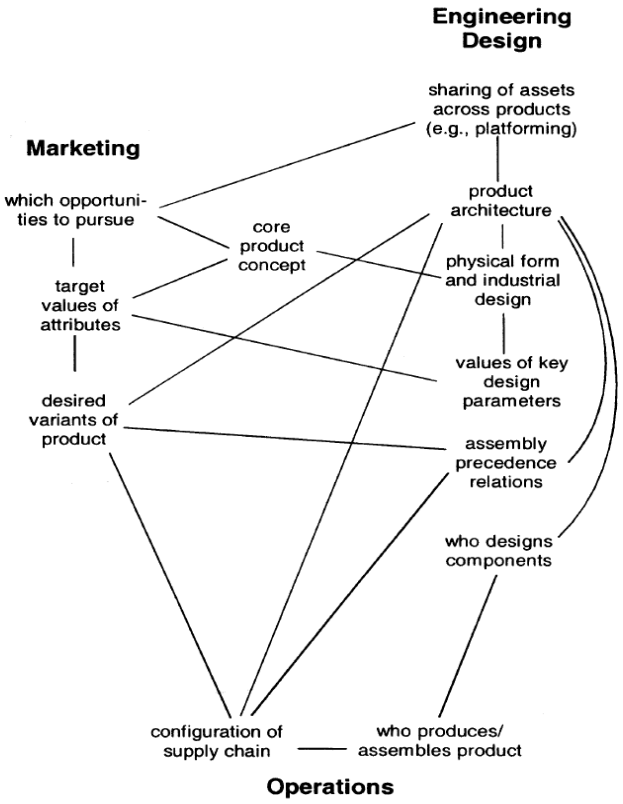

Figure 13: Clustering of product development decisions

(Source: Krishnan and Ulrich, 2001)

Figure 13 shows the network of marketing, operations and engineering/design and assigns tasks and the responsibilities of these areas. At Logicdata, these areas are split up into several functional departments which are summarized in Table 4. The distribution of tasks/decisions to several areas and functional departments, leads to many interfaces between them.

In the *concept development* phase, the product characteristics are specified, the product architecture is defined, and the core product concept is developed. The R&D department cooperates with Product Management to define product variants and the target values of product attributes.

During the design of the *supply-chain*, the R&D department, together with the purchasing and production engineering departments, defines technical requirements for contract manufacturers and suppliers. The R&D requirements are derived from

the product or component specification. Internal coordination between R&D, Quality Management, Strategic Purchasing and Production Engineering is necessary.

In the *product design* phase, ongoing coordination between all the departments and external partners is necessary. Product, requirement or production changes must be communicated quickly to all responsible departments. The product design phase overlaps with the *production ramp-up* phase. In the production ramp-up, the R&D

Area	Functional Department
Marketing	• Product Management • Business Unit Management • Sales
Operations	• Production Engineering • Quality Management • Strategic Purchasing • Production Management • IT Management
Engineering/Design	• Mechanic Development • Software Development • Electronic Hardware Development • Research • Test and Verification • Project Management

Table 4: Structure of functional departments at Logicdata

is only involved in a supportive manner. The R&D departments is also responsible for supporting sales and production engineering during the *product-launch* phase.

The interfaces, information channels, coordination and decisions during product development, are mainly of an operational nature. Therefore, the intervals are sometimes very short, in special cases a day, because decisions must be made as quickly as possible although the reconciliation and reporting intervals are usually weekly or monthly.

Innovation management: Numerous options are available for anchoring innovation management or corporate foresight, in the organization. Gruber and Venter, (2006) analysed several large companies in their study and found that this task is very often directly related to R&D and senior management. At Logicdata, the responsibility for innovation is assigned to the Chief Technology Officer (CTO) and thus to the R&D department. Since innovation management is distributed over several roles in the organisation and has a strong connection to the corporate strategy, coordination of all these stakeholders, including R&D, is needed.

The development of the long-term corporate strategy is the responsibility of the Chief Executive Officer (CEO) and the company owners, in alignment with the CTO. The medium-term business unit (BU) strategy and thus the business unit innovation strategy, is synchronized with the CTO by the respective business unit manager. The functional strategies (e.g. R&D strategy) are derived from the corporate and business unit strategies. The interfaces are predominantly of a strategic nature, with longer intervals. While business unit strategies are reviewed once a quarter, the corporate strategy is revised annually.

Support activities: These are largely unscheduled activities that can arise at any time during day-to-day business. If quality problems occur, the development department is sometimes involved in analysing the root causes and defining short and long-term corrective actions. Production engineering and R&D are closely linked if product-related problems occur in the production line. Direct and fast access to the respective knowledge carriers in the development department is crucial for these interfaces. Solving these problems has the highest priority in most cases because the ability to deliver or high complaint costs, are at stake. In a similar way, R&D support can be requested by the sales department for responding to customer inquiries which also requires a fast and uncomplicated completion.

The development department’s numerous and versatile interfaces into the company, different categories of responsibility and the different cooperation characteristics (from fast support in case of problems, up to long-term strategy development), place

high demands on the R&D organisation and require different skills from the people involved. The optimal fulfilment of these requirements is decisively influenced by the organisation's structure and is therefore an essential objective for the design of the R&D organisation.

3.2 Structure Design [Daniel Kollreider]

This section describes the structure and architecture of the new approach for Logicdata's R&D organization, the Versatile Organization Model (VOM). The core elements' functions and responsibilities and the model's important roles are covered below. The core elements are the ***operational units***, ***local coordination***, the ***operational management*** and the ***strategic management***. The connections and similarities to alternative approaches in organizational design are shown for each element.

Figure 14: VOM shows the VOM's entire structure and its environment, which is clustered into *strategic*, *support*, *operational* and the *R&D environment,* according to the R&D's responsibilities categories (see section 3.1.2). Furthermore, each element's inputs and outputs are illustrated

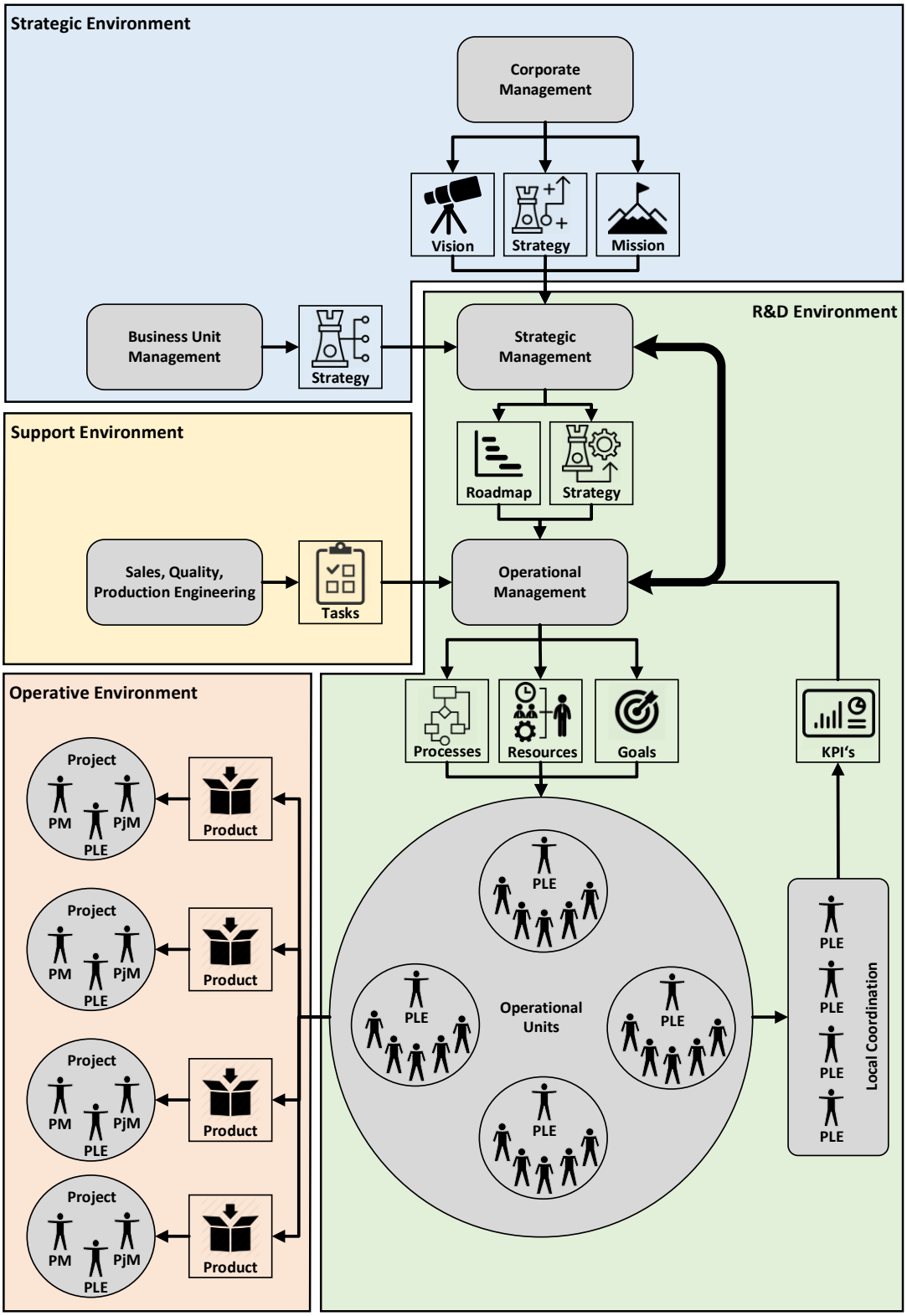

Figure 14: VOM

3.2.1 Operational Units (OU)

The core elements of each organization, the operational units (OU), define the purpose of the overall system and are responsible for value creation. Stafford Beer, (2002) described this using the acronym POSIWID (The purpose of a system is what it does). The development department's purpose and tasks have already been described in section 3.1.2, as product development, innovation and support activities.

In viable system model (VSM) theory, the operational units correspond to System-I. However, these units are inflexible and only change as a result of changes in the organization. Robertson, (2015) describes operational units as *circles*. Unlike the VSM, they have a certain dynamic character and are not rigidly formed. Fjeldstad et. al. describes the operating units as *"[…] actors who have the capabilities and values to self-organize;*" (Fjeldstad et al., 2012)

The design of these units is decisively influenced by the characteristics of the tasks to be performed. The more dynamically the tasks changes and the more the tasks and organization are influenced by uncertainties from the environment, the more agilely and flexibly the organization must be able to adapt. Because of Logicdata's dynamic environment, the tasks vary greatly, and their duration can range from a few hours (for support activities) to several years (in bigger product development projects). As a result, the effort involved also varies considerably and lies between a few hours and several man-years. Due to the tasks' origins (short-term support activities versus long-term strategic goals), the activities are more or less plannable. But the most important factor is that different tasks require different skills and differently qualified employees. This has to be considered in forming the operational units.

For these reasons, the R&D department's purpose and thus that of the operating units, cannot be defined rigidly (POSIWID). To employ the VOM, the operational units are formed cross-functionally via the R&D functions (mechanics, electronics, software and test), depending on the requirements of the respective task. They can

be assembled quickly, flexibly and variably because all necessary precautions and mechanisms are already in place and defined. These mechanisms will be described in section 3.2.3. The OUs exist for a limited period of time, as long as required by the taskand are equipped with resources and competencies according to the nature of the task.

3.2.1.1 Product lead Engineer

The *Product Lead Engineer* (PLE) is responsible for the local management of the operating unit. The role represents the OU's interests to the operative management and vice versa, the strategic interests of the management to its group. In Holacracy thinking, this role has similarities to the *lead link* and the *rep link*. The lead link has the task of aligning the sub circles with the broader context's purpose, strategy and requirements while the rep link represents the sub circles' interests in the super circle. The role conveys the frontline feedback into the broader context (Robertson, 2015). Since the PLE specifically represents the OU's interests and the area of responsibility is limited to the technical management, in contrast to the Holacracy concept, the distribution of authority does not seem necessary. Other authorities are described in the following sections. The rep-link and lead-link's combined responsibilities are not limited to operational activities. Therefore, a separation of power makes sense.

The PLE's main task is the technical management of the group. The role is responsible for the implementation and results of the tasks and objectives assigned to its group. All technical decisions and responsibilities during a product development are borne by the PLE. Its tasks include advance planning of the resources required and planning the necessary competencies. This gives it the opportunity and obligation to identify and elevate irrecoverable deviations to the superior management. The PLE is responsible for defining the tasks and objectives for its group members and thus for also conducting the technical feedback. In this way the role takes over a part of the responsibility for leadership and the development of the employees' professional skills of.

The *technical experts* are know-how carriers with special expertise in a specific field and thus perform an important function. Experts can either be part of the operating unit for particularly technically demanding tasks or act as consultants to several groups without being currently assigned to one group. They are not authorized to give instructions and can be called in by the PLE as an independent consultant for support. The flexible formation of operational units in the VOM enables an extremely agile use of resources, such as technical experts. A major advantage of this role is that the employee can fully focus on his professional development and on the implementation of his specialist subject's know-how. In order to make optimum use of and promote the strengths of the individual employees, this model can be divided into a coordinative, leading role (PLE) and a specialist role (technical expert).

3.2.1.2 Competences in R&D

The employment of people in line with their strengths is a central responsibility of management. Special attention was given to this aspect during the development of the VOM model. The efficient development of innovative and safe products requires a multitude of capabilities which one individual cannot fulfil on his own. Leonard-Barton, (1992) has divided the skills into four dimensions (Figure 15)

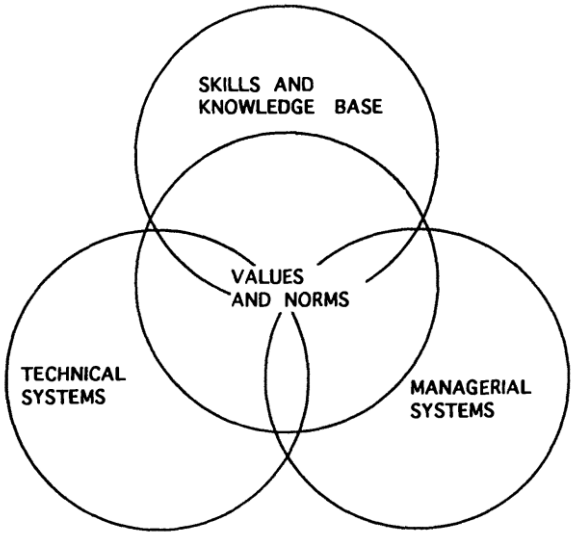

Figure 15: Four dimensions of capabilities

(Source: Leonard-Barton, 1992)

The first dimension is the personal *knowledge base and skills*, which in most cases are described as core competencies. This involves technical and scientific, company-specific know-how which is usually acquired through education. The second dimension, the *technical system*, is accumulated over years and structures the employees' tacit knowledge. It can also be described as a wealth of experience. The third dimension is knowledge, skills and experience, represented by *management system*. It is the ability to turn resources into results. The fourth dimension are the cultural and social skills, *values and norm*, that must be available as a prerequisite for cooperation. These are the most difficult skills to learn.

All these skills are necessary for Logicdata's development department's many different tasks. However, different skillsets are required depending on the nature of the task and the phase of development. For example, knowledge and technical systems are more necessary in the concept phases while in the ramp-up phase, it is the management skills that coordinate the various departments involved. It is an art for the PLE and operational management to correctly assess and distribute the competences.

3.2.2 Local Coordination (LC)

The *local coordination* system essentially fulfils two main tasks. The first is to provide status information to the operative management and the second task is the

short-term, fast stabilization of deviations. In the VOM, the local coordination system is represented by the group of product lead engineers.

System-II is the counterpart of the local coordination system in the VSM. (Lambertz, 2016) describes the core functions as the regulation and coordination of the everyday tasks. In Simons' *Framework for controlling business strategy* (Simons, 1994), the diagnostic system shows similarities to the local coordination system. He describes it as a formal feedback system which has the task of monitoring the operational results and reacting to deviations with corrective actions. Managers use diagnostic systems to check goals, key figures, strategy fulfilment, etc. and to detect and react to deviations early on (Simons, 1995).

3.2.2.1 Status reporting

According to *Ashbey's law of variety* (Ashby, 1956), it is impossible for the operational management to capture all the information from operational systems and process it in a meaningful way (see chapter 2.2.2.2) . To make reporting effective, the information must be condensed for the information recipient; the essential information must be extracted and prepared in an understandable form. The variety of information must be reduced so that it can be processed by the operative management. An effective reporting system is one of the prerequisites of this model.

Category	Information for the operational management
resources	• Do the operating units have and will have sufficient resources to fulfil their current tasks? • How are resources used (innovation, product development, support activities)?
competences	• Do the units have the right competencies? • Are the right competencies available in R&D department, currently and in the future?
performance	• Do the operational goals achieve the strategic goals? • Do the operational units meet the project goals? • Can the support activities be fulfilled? • What is the efficiency and performance of the units?

Table 5: Measures and Key Performance Indicators

To operational management to make decisions, all information must be condensed into the three main categories. Table 5 summarizes some of the most important key performance indicators and the information that must be made available to operational management. However, it should be pointed out that it is sometimes difficult to define measures which objectively and reproducibly reflect the real situation in the operational units. For example, there are many different approaches to R&D performance measurement which are not described in detail here.

3.2.2.2 Short term stabilisation

The second important local coordination task is the short-term identification and stabilization of problems and deviations. A possible course of action would be, for example, moving resources between operating units or a deviation from agreed processes within certain boundaries. It is essential that deviations are recognized quickly and that the PLE's have not only the decisive abilities but also the competences to be able to intervene. The group works autonomously, self-organized and makes the necessary decisions within boundaries which must be set in advance.

The group’s scope of action and decision-making powers must be defined in advance. They are specified by operational management. Simons, (1994) calls this control instrument the *boundary system*. He describes it as a formal system that sets explicit limits and rules to be followed. The main advantages of this local coordination system lie in the speed and agility of decision making and also in the quality of the decisions, as these are made at the point where the most information (highest variety) is available.

3.2.3 Operational Management (OM)

Some dependencies and connections to the operative management became apparent in the description of the local coordination (cf. section 3.2.2) and the operative units (cf. section 3.2.1). In fact, the operational management plays a central role in VOM. Its core task is to optimize the operational units’ efficiency and effectiveness and to distribute the tasks by providing resources, rules and processes. The operational management forms the temporary units and is responsible deploying employees according to their strengths.

A similarity to the boundary system, as described by Simons, (1994), can be seen in the specification of rules and procedures. Boundaries are often set in the form of processes and rules of conduct, such as release regulations. The limits are influenced by the analysis of the risks to be avoided. McCarthy and Gordon, (2011) establish a link between the R&D organization’s efficiency and reliability goals, the boundary system and product development of an exploitive nature. This is consistent with the VSM approach, in which the operational management (System III) is concerned with the “inside and now” of the organisation and has to ensure the efficiency of the operational units (Lambertz, 2016).

3.2.3.1 The operational control loop.

The importance of Ashby's law of variety and the resulting need for condensing of information, was discussed in section 3.2.2. Operational management can be seen as a controller (Figure 16). The controlled system or system to be controlled, are the operational units. While target values are specified by strategic management or

the environment, the feedback of the actual status is carried out by the local coordination system. The operational management has the task of processing all aggregated information from the local coordination unit, inputs from strategic management (R&D strategy, product roadmap), support requests from quality management, sales and production engineering, and passing on control variables to the operational units.

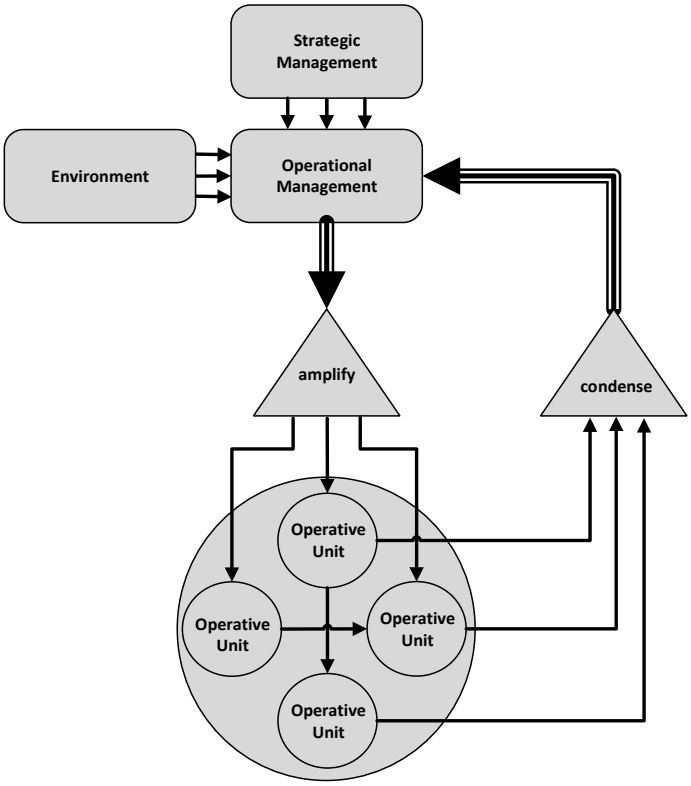

Figure 16: Operational Control loop

Contrary to the principle of condensing information, the control variables must be amplified. The operative management is unable to give detailed instructions to the operative units, because the variety available to it is too small to take valid decisions. Amplifying, or multiplying, control variables are those that are generally valid for all operational units and that determine how tasks are to be processed.

3.2.3.2 Processes, tools and methods

For example, the development and optimization of processes, procedures and methods that set certain standards in working methods, are opportunities for intervention with a multiplying effect. They are valid for all operating units and therefore have an amplifying character. Within defined limits, the PLEs should be

able to adapt the processes to their specific task, so that they can also take corrective action in the event of deviations (cf. section 3.2.2). The specification of guidelines and standards (construction guidelines, layout guidelines, coding guidelines, guidelines for working time recording, etc.) or the definition of the tool to be used (CAD software, PDM systems, time recording systems, etc.), are also reinforcing actions.

3.2.3.3 Task allocation

The free and flexible formation of the OUs is a central element and characteristic of the VOM. This is the model's particular strength, but also poses a great challenge for the management. As a first step, the operational management must identify the superordinate synergies in the product development activities and tasks so that they can be grouped accordingly. Another decisive factor is the challenges faced by the team in assessing the tasks correctly and deriving the right competencies from them. This provides the basis for the correct formation of the working group (OUs). Of course, it is also important to know the employees' competences and special characters. The OUs' composition must take into account the social structure, the compatibility of the employees and the cultural aspects. For this reason, personnel management and leadership is another very important operational management task.

The same procedure can be applied to drawing up the strategic goals from the given R&D strategy. The first step again lies in the analysis of the task, in this case the R&D strategy, and the formulation of the objectives. This is followed by the definition of the necessary competences and its allocation to the respective responsible persons. The distribution of short-term, barely plannable support tasks from the environment, can hardly be strategically planned. Here, not only how and where resources are available for these tasks is crucial, but also which skills and previous knowledge must be available for an efficient implementation.

3.2.3.4 Resource management

Resource management, especially in an R&D department, primarily involves making human resources available. Of course, other resources including IT infrastructure, development tools, prototype tools, must also be considered. The operational management's task is to correctly estimate and budget resource requirements. The local coordination provides information on the current resource utilization and the advance planning of resources for the current activities while the strategic management provides information on the product roadmap, the R&D strategy and the requirements for reserving resources for support activities. These inputs must be used to plan the need for equipment and employees, but primarily, also the correct distribution of competencies (see section 3.2.1.2) for the future. Recruiting and on boarding of new employees, is the responsibility of the operational management together with the company's HR-Department.

3.2.3.5 Leadership and coaching

The VOM is based on the basic principles of self-responsibility and decentralised decisions. This also means that responsibility is spread over several areas or persons, therefore leadership and development of these employees is crucial to the success of the model. It is operational management's task to train and coach the employees in their roles and responsibilities accordingly. Special attention is paid to the product lead engineers, as they have a dual role to play; the technical control of the task and the functional management of the employees.

3.2.4 Strategic Management (SM)

While the operational control loop, with its elements *operational units*, *local coordination*, and *operational management*, deals with the "inside and now", *strategic management* has a different focus. It is responsible for medium and long-term planning and forms the main interfaces with the strategic environment. Strategic management's main task is the formulation of the R&D strategy and, together with the business units, the development of the product roadmap and thus also innovation planning.

Strategic management has its counterpart in the VSM, the system IV. It is responsible for exploring the "outside and then" and providing the system with information about changes in the environment (Lambertz, 2016). McCarthy and Gordon, (2011) describe a combination of the company's growth and innovation goals, with the interactive system (Simons, 1994) and thus with its exploration projects. In this way, they establish the interactive system’s connection with future planning and innovation.

3.2.4.1 The strategic control loop

Analogous to the operative control loop (cf. Section 3.2.3.1), there is a strategic control loop (Figure 17) which naturally pursues different goals in terms of content and time horizon. In this case, the target values are specified by the R&D environment, or more specifically, the corporate management and the business unit management. Additional inputs, such as new technology trends, information from competitors and customers, innovations in regulations, norms or standards and much more, need to be considered as additional information in the strategic work. Operative management is the system to be controlled. The control loop is closed by the operative management making status reports to the strategic management. As already described, the strategic management must be informed about the status of, and exchange information very closely with, the operational management. This is

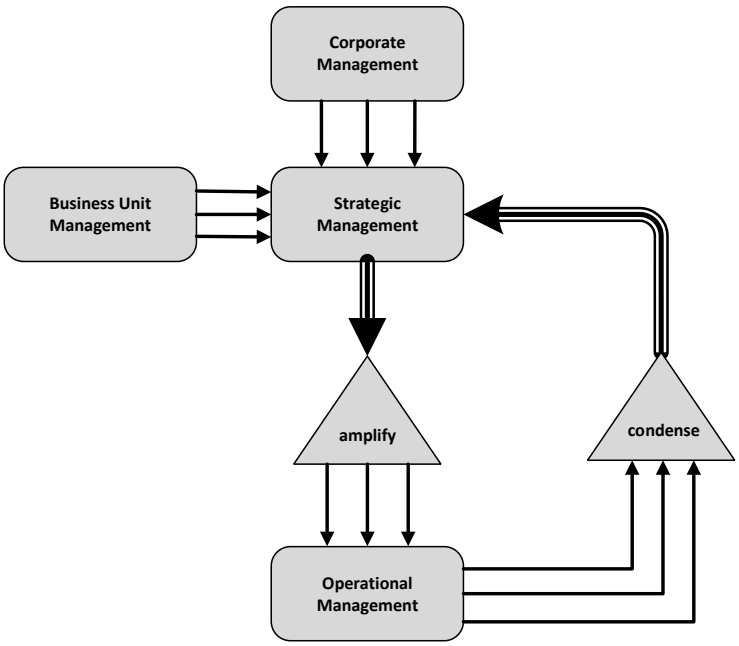

Figure 17: Strategic Control Loop

controlled by setting the R&D strategy and the product roadmap. Targets are also set by strategic management for certain strategically important key performance indicators. These include, for example, the extent to which support activities should be carried out for other departments. These are adopted directly by the operative management and administered independently. Limit values can also be set on the extent to which the operational management can independently set objectives. This could be, for example, internal innovation goals, carrying out research work or optimizing the organizational structure itself.

3.3 Process Design [Mario Flucher]

3.3.1 The need for an evolutionary operational organization

In the last hundred years, mankind has focused on improving management in every area where it has been applied. A process of doing and learning, trial and error so to speak, has brought management to its “perfection” – at least from point of view of some successful managers. These days, management is automatically connected to hierarchical structures in which the top level of the hierarchy has most power. These top-level managers have the birthright to make decisions in their business environment. They are the handful of people steering companies based on their individual, collected interpretation of market, customer demands and internal company processes. On the other hand, the lowest level is nearly powerless. Their actions ranging from investing money, to their tools they need to work, making decisions and also in bringing up new ideas, are limited.

In an organization which uses hierarchy for control and coordination, managers have the authority to resolve conflicts at lower levels because they have a broader view of the organization and its environment (March et al., 1993).

The limitation of this model is that senior management must filter and evaluate all the available information both in and outside the company from external partners, derive technical as well as strategic measures and allocate resources based on this

information. Especially in large companies, these tasks mean an overall overload for top-level management (Fjeldstad et al., 2012)

Though autochthonous hierarchical management is still part of the curriculum, we had to consider whether it is still a suitable approach for our R&D department to achieve its goals and be economically successful. We live in a digital age in which information can be spread all over the world within a fraction of a second. Product innovation is an inherent part of our company, but market demands are changing at very short intervals and business opportunities exist only for a very short time. With this excess of information, an overloaded hierarchy is pre-programmed (Galbraith, 1974). It is crucial to make the right decisions in order to take advantage of opportunities and overcome challenges, but they should be based on a solid basis of knowledge of events and backgrounds.

The following sections show how our model deals with the situations described in our ambidextrous R&D environment at Logicdata, while remaining flexible and competitive in terms of quality, speed and resource allocation. Another point discussed here is the formation of teams and their cooperation, as well as the respective responsibilities as a basis for making good decisions without using outdated hierarchical approaches.

3.3.2 The basis to solving Authority and Control

Laloux's approach to evolutionary management in his publication (Laloux, 2014), set the direction for our hypothesis of the Versatile Organization Model, namely: "Employees are doing the right thing, just trust them!". To make the hypothesis possible, VOM needs clear role descriptions which are necessary for employees to know for what they are responsible and accountable.

VOM is not a network of autonomous, self-organizing people like those in Buurtzorg (Laloux, 2014). In principle, we can also compare VOM with the processes in a human body, as was done in a lot of other evolutionary management literature. Some functions in a company are also found in the conscious mind, like

giving strategic direction, planning tasks, analysing facts and data. Fast decisions and also reactions to short-term changes in environmental circumstances are made by the subconscious mind and the consciousness only becomes aware of them after a time lag. In our model, strategic R&D management takes over the role of the conscious mind, by giving a strategy and direction based on feedback from operational R&D management as well as environmental and corporate strategy. Although these two types of management represent different people and different roles, they do not insert hierarchies into the model.

The term authority is replaced in VOM by trust. We trust that our colleagues are contributing their experience to their roles, being prudent and getting the best out of the given circumstances and we let them make decisions, even though we know mistakes may happen. Everyone is aware of his or her own abilities and those of their colleagues or is made aware of them through feedback and the assessment of one's professional experience level. This means that we can trust that everyone has exactly the right sized task and also has the appropriate experience and training. If an employee is makes a decision within his area of responsibility, there is no need for further approval from another person, who may not at the front-line and hasn't yet dealt with the issue.

Control has been exchanged for feedback and review, to support new strategic orientation and changed priorities on clearly predefined key-performance-indicators but not technical instructions. We are carrying out reviews and feedback regularly at scheduled intervals (but aligned with our goal system, see section 0) and not simply when it happens to fit into the frame. With this temporal rhythm and the awareness that reviews and metrics, are an integral part of our work which does not slow us down but instead supports us, we are no longer talking about control but rather about support.

Strategy and targets define the direction we need to take together as a whole team. A strong, well thought-out R&D strategy conveys where we, as a team, want to go but on the other hand, it also gives us a purpose and explains why we do things.

3.3.2.1 How to make sustainable decisions and give commitment

Front-line obsession was introduced in the *Founder's Mentality* (Zook and Allen, 2016). Its key message is that you can only make good decisions if you have an intellectual curiosity about every detail of how the business works and build up a clear and complete overview which can only be formed at the ground level and not only in top management. In order to make quick but also sustainable decisions in the different project phases we see it as important that the PLEs are acting directly at the developer's workplace or during a review with other stakeholders, acting on the front line so to speak. PLEs also must build robust relationships with product management, design, quality assurance and operations, because sustainable development means staying connected to all facets of the project. And exactly this is asking to also be connected with the customer and production.

With this concentrated project overview, the group of PLEs are the people who can make the best R&D related decisions in a project. Individual PLEs are allowed to reallocate resources in their specialist area, in order to focus more attention on short-term challenges in a project. The backlog in the other project can then be cleared out at a later point in time, if necessary. If there are cross-departmental challenges, the PLEs will first seek a solution internally without involving operational management, as long as it is possible to avoid deviations from the targets. If this is no longer possible and it is no longer possible to achieve the project goals, options and effects must be prepared and project targets, i.e. priorities, decided, together with operational management and project management.

Because operational management has the entire resources of the whole R&D at its disposal, adjustments to strategy and goals, as well as changes in resource allocation to projects can be brought into R&D without any great effort through our group of PLEs. This allows the maximum efficiency and effectiveness without being influenced by departmental thinking.

3.3.2.2 Estimations and commitment

If we want to determine our current situation based on KPIs, we also need to estimate the costs of implementing requirements and to re-evaluate the value of the activities already achieved. Estimates are generally difficult, especially if a team must retain the estimated efforts. To get this commitment from the whole team, estimation meetings are to be carried out, as in Scrum (Sutherland, 2014), by the whole team and not handed down from above. Technical decisions that make a decisive difference to the next project steps are made directly by the group of PLEs, which also ensures that they can and want, to follow the path they have chosen together.

3.3.2.3 The dispensable employee

Successful teams approach their project with a clear "we" attitude. Every member of the team supports the others to ensure the project's successful completion. On the one hand, reviews serve as quality assurance measures, but on the other hand, reviews are also used to familiarize the entire team with the prototype across functions. Team members have different competencies and train each other, so that no-one can become a bottleneck to the delivery of the work. By doing this, there is no individual who has the critical path or knowledge anchored in an individual which would make that person indispensable. The operational management must ensure that knowledge is spread across the entire team and the entire company.

3.3.3 Phases of R&D projects in an ambidextrous environment

As already described, the R&D at Logicdata operates in a very dynamic environment. This dynamism and uncertainty in handling projects, requires a more agile method of cooperation, especially for innovative projects, where the prevailing uncertainty, due to the introduction of new products, the development of new markets and the use of new technologies, makes the meaningful planning of activities no longer possible.

But Logicdata's R&D is not only concerned with innovative development (exploration), where the focus is on novel, emerging and pioneering technologies but also with exploitation or maintenance, based on mature, familiar and propinquitous technologies (Ahuja and Lampert, 2001). Since these types of tasks are much more predictable, the goal is clearly defined and, with the prevailing development experience, the path to achieving the goal can be easily estimated, therefore the use of agile methods would result in unnecessary overhead.

Depending on the level of uncertainty of the projects in our R&D, different approaches to the project management method are necessary. Jones describes (Jones, 2013) uncertainty as a function of complexity, dynamism and the richness of the environment (see also Figure 18: Three Factors Causing Uncertainty). To understand these prevailing factors in projects better, an adapted Ansoff Matrix will be used to categorize projects and activities (Ansoff, 1986).

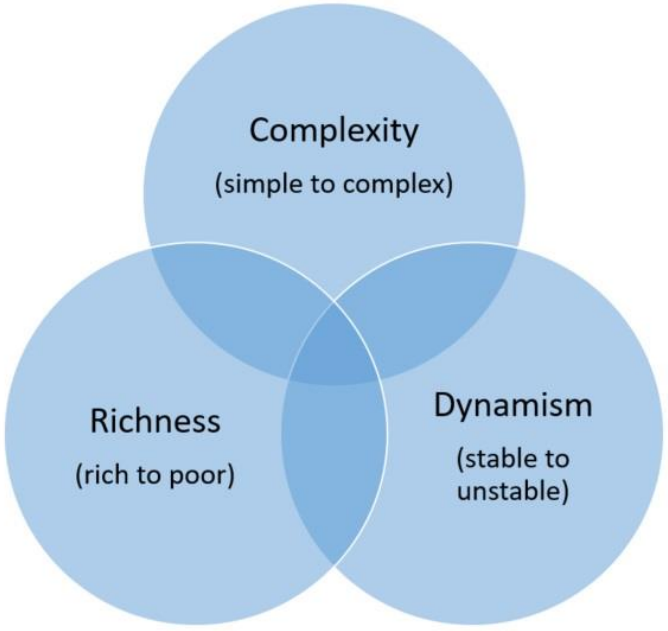

Figure 18: Three Factors Causing Uncertainty

Source: Own representation based on (Jones, 2013)

The Ansoff matrix, also called product-market matrix, describes the four product-oriented growth strategies:

- market penetration
- market development
- product development
- diversification.

For our overview of products and markets with very short life-cycles, as well as the necessity of clustering of new ideas and modifications, we have used the extension of the original version of the Ansoff Matrix according to Philip Kotler (Kotler, 1999), with sub reference to Madique & Zirger (M. A. Maidique and B. J. Zirger, 1984) (see Figure 19: Ansoff Matrix for Project clustering).

Figure 19: Ansoff Matrix for Project clustering

Source: Own representation based on (Ansoff, 1986)

The categorization of a product development with the help of our Ansoff Matrix, defines the uncertainty level that we have to deal with in both directions, product and market wise. Depending on the categorization, we can also derive the level/types of R&D tasks to be performed, e.g. if we see our project on the bottom left side, the current products and current markets are well known to the company and the product specification is clear and comprehensive, resulting in a very predictable project progress. With this categorization, we are focussing on production topics or design-ins, for current markets but not the development of new products or new markets. In contrast, we have diversification, which needs completely new products and unknown requirements in new markets and therefore adds a lot of uncertainty to the project.

In addition to the uncertainty level, we can also show the type of activities that are necessary and which we should prioritise, in the respective areas of our Ansoff Matrix (Figure 20: Type of Activities in the Ansoff Matrix). Again, in the bottom left, the focus of the project is more in the direction of production and therefore R&D only performs supporting activities. Activities in the top right area of the Ansoff Matrix comprise ideation, research, concept, development, validation and production.

Market assessment and preparing the project's technical and market-related advantages, are included in the phase called ***ideation***. In this phase, we deal with finding ideas. A comprehensive development team is not necessary. Product management will be most active here and generate new ideas together with one dedicated PLE, as support. A process for coming up with new ideas (e.g. considerations in *Closed or open innovation* (Felin and Zenger, 2014)) is helpful but not the focus of this work. If more support is needed, the PLE can have direct access to the R&D resort in consultation with his/her colleagues.

Detailed market research and the determination of customer needs, definition of the product (properties, requirements, and characteristics) and target market, positioning, reassessment of attractiveness, financial analysis and the idea's

feasibility, are covered in the ***research*** phase. Either a small dedicated research team works on the research question or one/some PLE(s) have already been assigned to it by the operational management.

A ***concept*** phase comprises all the tasks needed to prepare for implementing the development plan, for example, testing to ensure compliance, continuous feedback from customers, financial analysis improvement, market introduction and production planning and resolving patent related questions. This phase begins with the results from the research phase, which is more of a product vision than a concrete outcome to be achieved. The result of this phase is a product prototype, tested in the laboratory to prove the concept and ensure that all uncertainties have been transformed into known risks. To achieve these objectives, a small autonomously-working team of PLEs, with some developers, is necessary. There is no need for any form of project management or special process at this time. In some situations, it may be necessary to define a maximum duration for the concept phase. Of course, uncertainty must be eliminated in any case, but the degree of open risk to be handled in the next phase can be determined during the concept phase.

The ***development*** phase is concerned with the actual product development process. Directly connected to it is ***validation,*** which deals with customer acceptance, product tests, market acceptance tests and revised business and financial analyses. All the assigned R&D resources, together with the PLE(s), are involved in the project during this phase. We think it is important, to achieve the necessary level of accountability, that the initial team that worked on the concept phase, can continue to work on the same project and implement the concept in the way they planned. To have short feedback rounds with R&D's surrounding environment, we ask to use the Scrum framework for this phase. Again, PLEs have the task of networking and connecting all the teams together with each other and also ensuring that the right tasks are worked on. The closer the project is to reaching the validation phase, the more accurate the estimates will be in each sprint and the more accurate the further planning will be. If a project starts at the latest, immediately before the validation phase, it is possible to use a conventional V-model or Waterfall project

sequence. Short feedback loops are no longer necessary at this stage; at this point in time the project uncertainties are no longer present, and risks are very low.

The final phase, the ***production***, involves implementing the plans for roll-out and market launch, as well as life-cycle management. The majority of the R&D team, except the PLEs, has already been withdrawn from this project, however they are still available for production-related topics and will successfully complete the project in R&D with lessons learned and smaller wrap up tasks.

Validation Production	Research Concept Development Validation Production	Ideation Research Concept Development Validation Production
Validation Production	Concept Development Validation Production	Research Concept Development Validation Production
Production	Concept Development Validation Production	Research Concept Development Validation Production

Figure 20: Type of Activities in the Ansoff Matrix

With the help of the project categorization, based on the Ansoff Matrix, links can now be created to the stage-gate model, developed by Robert G. Cooper (Cooper,

2002). The stage gate process (Figure 21: Stage-Gate Model in Product Development) separates the entire product development process into several individual sections/phases, and so-called gates. The advantage of this model is that we are now able to enter a new project into any of these sections depending on the Ansoff Matrix's categorization of a project and follow a standardized sequence of development with predefined rules and roles.

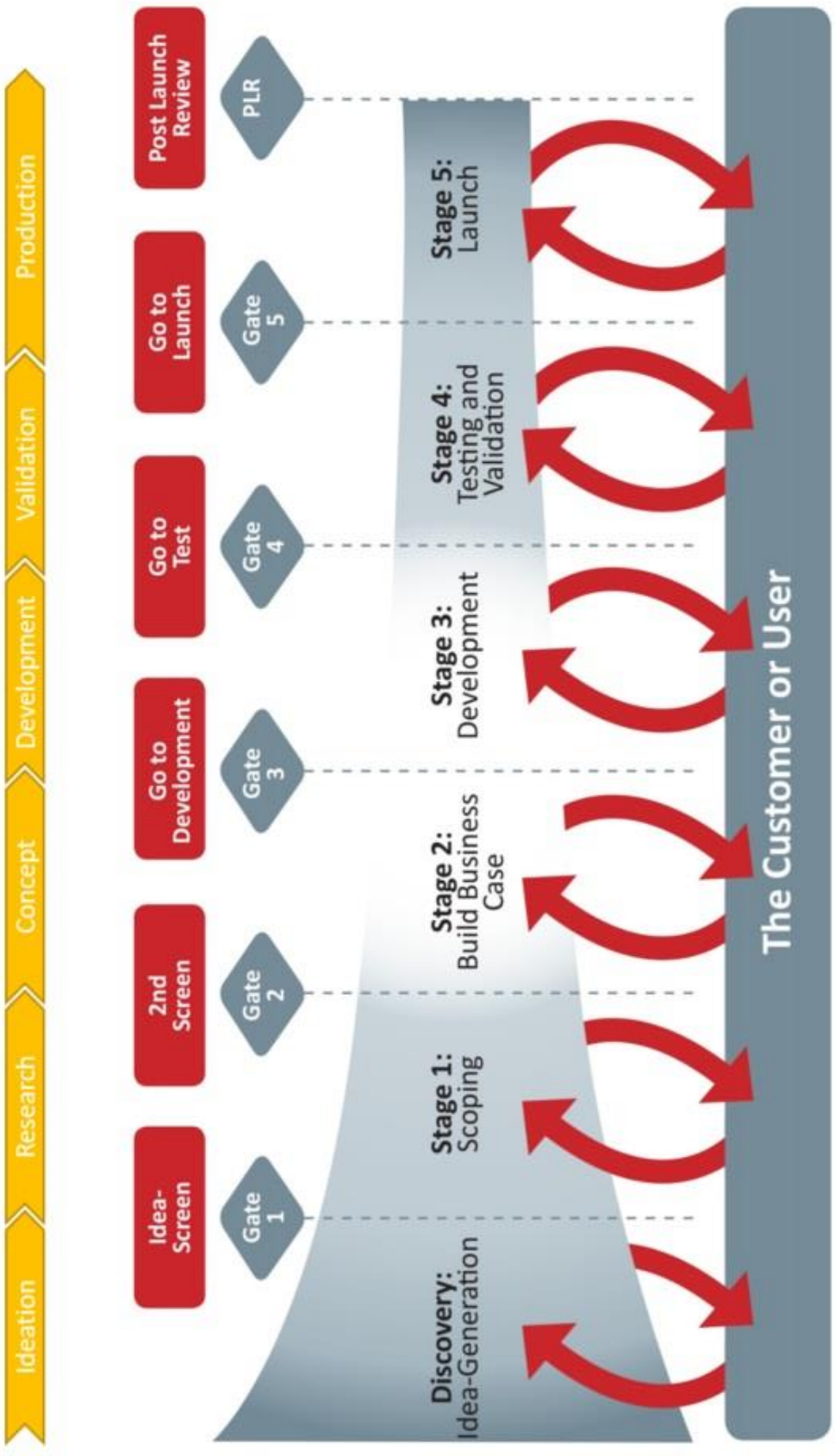

Figure 21: Stage-Gate Model in Product Development

Source: Own representation based on (Cooper Robert G., 2008)

3.3.4 Support from IT tools

When a lot of people have to work together on complex topics, support from digital tools is needed for retaining an overview of massive data and showing interconnections between people so that patterns can be recognised and procedures complied with. To answer the challenge of *information provision* from (Puranam et al., 2014), the requirements for such a tool are multi-faceted:

- Collaborative
- Transparent
- Integrated

A collaborative tool brings people and groups together to work on common topics. Ideally, project or backlog planning in Scrum and effort logging for single tasks, are done in the same tool with the same database in the background, which is accessible from any computer. Therefore, we use a modified, web-based, collaboration tool called JIRA from Atlassian.

The project manager has to specify milestones (e.g. “prototypes for trade fair” or “ramp-up”) and the next steps to be achieved in the tool and the PLEs assign all the tasks to their colleagues, for which they also have to record their accrued hours. If the tasks in the projects are linked to the higher-level milestones, this results in a current plan and overview of the project, with precise, hourly records of activities and spent effort. These expense data, combined with the time stamps from the effort records, serve as the basis for further key metrics calculations, such as current total expense recorded across all areas or open versus closed tasks, and also enables the setting of priorities for the next steps to be implemented.

Especially in complex projects, lasting for many years, all the data needs to be visible to every project employee and also management, to provide a good overview of already achieved, but also, open issues and related resources. With one click, all open issues should be visible and will make an up-to-date, transparent overview available to the PLEs and management.

As we have multiple projects running at the same time, we need an integrated solution. A single interface should be able to present the information from various projects. A dashboard able to filter and condense the flood of information, can be used to show several projects at once, or just individual tasks. Each of our projects needs a dashboard which is accessible to everyone.

A tool which is to be used by an entire R&D team and the whole company, also needs a set of rules. Rules and guidelines about the way project management uses the tool and sets their milestones, how to record working time, what form of comment is needed and not to be forgotten, what information is needed for individual tasks. If we want to derive key metrics and control projects with this data, we also need to maintain data such as recorded effort, start dates and due dates of tasks, regardless of whether they are team or individual tasks.

Comprehensive metrics support the control process, but only those that do not burden the team are helpful. If no measures can be derived from key metrics deviations to improve the situation, then these key metrics must be discarded to avoid wasting effort on pointless metrics, but in our opinion, the basic metrics defined in the Scrum process are mandatory.

3.4 The Supporting Culture [Mario Flucher]

Even the most sophisticated model is doomed to failure if it does not receive the necessary employee support. Employees must be motivated, motivated to perform activities and be willing to think outside the box. This chapter describes how to achieve the right cultural environment so that employees go the extra mile in support of the “Versatile Organization Model”.

3.4.1 Our motivation model

In theory, we can divide motivation into two basic types:

- Intrinsic motivation
- Extrinsic motivation

In VOM, both types are of interest to ensure motivation in our R&D department. The most important to understand, is that motivation should continue possible at the desired level, without taking new measures. How long motivation actually lasts depends, in the end, on the way a person is motivated. Because extrinsic motivation is based on external factors and drivers, like salary increases or bonus payments, this type of motivation has a financial limitation to its application. While bonus payments can be linked to goal achievements and be used in some way to make the goal more appealing, a salary increase is in our point of view, a very poor, long-term motivation factor. Once the employee has received the increase, they will get the new salary, according to their contract, every month regardless of subsequent target achievements. A salary reduction is not allowed in some countries (e.g. Austria) and if skills and salary no longer match and collectively agreed wage increases come into force, overpayment could be a consequence.

Today, in our extremely complex society, it is important to cooperate with team colleagues to keep up with the competition. The old-fashioned carrot and stick method is outdated. People are more educated; they have already understood how the system is structured and have therefore worked out how to manipulate the system in the short-term and benefit from rigid, key figure-supported monitoring and rewarding systems. We want our employees to volunteer for projects and tasks; enjoyment-based, intrinsic motivation (Pink, 2010) guarantees that employees are working in the so-called “flow channel” (see also 3.4.4.2 Achieving mastery and autonomy).

3.4.2 Career model

Extrinsic factors can also be found on the emotional level, where social contacts, power and acknowledgement play an important role. A lot of our employees today, and definitely in the years to come, strive for career advancement opportunities in order to be able to live out their power, have a say and determine what others do. The main problem here is that a company has a limited number of positions with personnel responsibility. Furthermore, if one has a very young team leader, one may

see no future prospects and career opportunities and falls into a motivational hole. In order to avoid these situations, we implement a professional career model which enables everyone to develop further, independently of the size of the company and available team leader capacity. This career model can also be linked to salary development and technical responsibility or specialization. Such a career model needs to be supported by targeted training and, to rule out injustice, should include certain predefined criteria for an employee's advancement to the next level. Depending on the level, it is also possible to allocate a certain number of hours, which the respective employee can use freely in projects to distribute his work package among other employees. This is not a representation of hierarchy but of the experience that the employee has gained and is feeding back to the company.

But it is not the case that once you have earned a level, you can rest on your laurels. On the contrary, to maintain the level, it is necessary to meet predefined goals at the correspondingly challenging level. Operational management is responsible for balanced and fair evaluation within the career model.

In addition, from a certain level onwards, there should be the opportunity of spending some days each month on a freely selectable activity which is, in employee's view, worth working on. This can not only be research or process changes, but also improving contacts or questioning existing solutions. The only requirement is that the results are presented to the whole team, to enable common learning.

Another way to present personal success is a 10 minute, individual but company-wide, voluntary presentation of achievements. This allows a feeling of pride to be developed. Employees experience a feeling of elation and enjoy the recognition when they receive applause from the entire company, including the management.

3.4.3 Just get A-players

Intrinsic motivation is in our view, more powerful than the extrinsic model, since it is sustainable. If people are intrinsically motivated, their efforts are not influenced

by external factors but by their own inner drive. These employees are interested in working on exciting and challenging tasks. Factors such as money or admiration (extrinsic), do not play a key role. Assuming that all of our employees are well-meaning people and that we can trust them, we can also assume that they will do the right things (Laloux, 2014). The only thing we need to ensure, is that we only hire precisely these benevolent people.

A very diligent hiring and on-boarding process must be in place to support the VOM. The profile of requirements and the tasks that the employees will be assigned to in their desired position, must be clearly defined so that the right people are attracted and selected during the hiring process. To attract the right employees, putting on a mask and showing the applicant an exaggeratedly perfect working environment is inappropriate because it will not match reality later. In such a situation, one can assume that the applicant will also start to adopt and display non-existent qualities and experiences.

Job interviews should take place in a culture of open discussion in which facts and figures on the one hand, and cultural differences on the other hand, are on the agenda. In order to find out how well a new employee fits into the existing team/company, it makes sense for the direct team colleagues to participate in the job interview and in deciding whether they will be able to work with the applicant later on (Laloux, 2014). This ensures team spirit, because employees, team leaders and applicants would later have to live with the consequences of employing the wrong person.

When we have the right people (let’s call them A-players) on board, an on-boarding process will ensure that new employees are accepted by the group, introduced and emotionally linked to the dominant company culture so that they can bring in their valuable contribution. A basic introduction to the history of the company is mandatory and will answer the question “Where do we come from?” But the actual on-boarding process cannot be completed in a 2-hour meeting with the management.

Laloux (Laloux, 2014) describes a new evolutionary process for on-boarding divided into three areas: *Self-management, Striving for wholeness and Listening to the evolutionary purpose.* In our model, these 3 areas are also addressed in the on-boarding process:

Self-management: in this part, an employee is taught how self-management works and which tools support it. It is no longer about command and control but about solving problems using one's own initiative.

Striving for wholeness: We have a summary of our basic rules and values. These are summarized under the heading "Charter" and explained to new employees so that they demonstrate a uniform, company-wide behaviour in various situations, such as conflicts, but also in dealing with customers and suppliers.

Listening to the evolutionary purpose: The role of this part is to synchronize the organization's purpose with that of the employee. It is important that the management, which determines the purpose of the organization, also participates in the on-boarding procedure.

3.4.4 Drive to learn, to create, and to improve the world

Daniel H. Pink showed that when we have our "A-players" on board, we need to allow them to unfold their potential with the help of the right environmental conditions. Three key words, which Pink has developed in more detail in his publication (Pink, 2010), are essential in VOM: *Mastery, Autonomy and Purpose*.

3.4.4.1 Purpose

To start with, every employee needs to understand his individual contribution to the big picture. Both the temporal effect (long, medium, short-term) and the content (strategic, operational component), are important. A company's management is responsible for elaborating an overview of the company's corporate strategy. R&D management, on the other hand, also develops an R&D strategy that supports corporate strategy but only focuses on R&D topics. Using targets to lead a team,

was described as a management task by Peter Drucker (Drucker, 1986). To receive the employees' full commitment, they must formulate their own goals in VOM. Of course, we are referring to SMART (= Specific, Measurable, Achievable, Relevant, Time-bound) goals, which contribute to achieving the overall strategic plans. Employees together with their team leaders, can make their contribution to the corporate goals through individual goals. With a transparent system in place, everyone understands his small contribution to the big picture, which communicates purpose to our employees so that they will give commitment in return.

3.4.4.2 Achieving mastery and autonomy

One non-modifiable factor to be found in many companies, is the fact that there are complex and challenging tasks but on the other hand, also non-challenging, boring tasks. How can a team leader or PLE find the right challenge for an employee's existing skill set which allows them to work in a flow channel? But exactly this broad spectrum of tasks' complexity and difficulty enables us to take advantage of a big opportunity. By allowing our A-players, because we assume that these people have the basic prerequisites for this approach, to voluntarily choose the project or strategic goal to which they want to contribute, we can ensure that they are taking the right job to match their interests and level of experience. To let them know their level of experience, we have an extensive feedback program and career model in place. Thus, we have a very broad range of experience and people's skills in corporations' R&D, so that we can be certain that every task will find party of interest and finally be assigned, without additional intervention from the PLEs.

3.4.5 Continuous learning and the fun factor

We know that people are eager to learn new things and increase their skill sets. On the other hand, the company also wants to increase the employee's overall maturity level and company skills. If we align both and set up an academy program in which employees can teach each other, we would create a win-win situation. To underline the company's aspiration to support continuous learning, some courses should be

treated as working time – especially if the experience gained directly supports their daily work and the achievement of goals.

The fundamental basis of every innovation is the idea itself. To allow our employees to be creative, we like the concept of the maker-space ("Webpage Makerspace Germany," 2018). An area within the company equipped with a machinery park (e.g. 3D-printers, milling machine, soldering stations, laser cutter …) should give employees room to unfold their creativity. If they have had an idea, they can try it out in this maker space, specify it in detail and add the idea to the idea-pool, where it can probably evolve into the next trailblazing innovation to which they will probably voluntarily contribute later on.

Fun is a very important key factor but should not be exaggerated, because it could then lead to performance loss. The fun factor can be maintained by team events (teambuilding outside the company) but also sport events with professional support sponsored by the company (soccer, jogging and volleyball), after the working day. Work can be much easier if you know your colleges on a personal level. The social rituals described will promote communication but also boost cooperation between the employees and the different teams.

Especially when things have really gone well, they should also be celebrated. It is not only a matter of sharing experiences about what went well with colleagues, but especially to have played a part in it together. Laloux also highlights the importance of collaborative learning and feedback in his book (Laloux, 2014). Announce what went well, what you learnt, what can be done differently next time and what are concrete measures for improvement. Celebrating good things and share the story behind them, is a ceremonial rite to build common bonds between members in a global organization (Jones, 2013).

3.4.6 OKR concept with IT support

Section 2 highlighted the challenge “division of labour” (Puranam et al., 2014). It is clear to us that objectives are needed to give both direction and purpose. The global R&D management has to set the course in alignment with the corporate strategy. Team leaders together with their team, define contributions for each individual via key results. Ideally, results are not imposed but defined together with the respective team leader or senior developer, according to the employee’s experience and training. This approach allows for maximum buy-in and can also ensure that the task is correspondingly challenging.

The flexibility behind OKR is most important for the Versatile Organization Model. Goals are set quarterly not only to adapt to new external events, opportunities which have recently arisen, market changes, but also to internal changes e.g. shortage of personnel resources. In addition, we perform goal reviews biweekly and let the findings flow into the next iteration of goals.

Many challenges require cooperation between different teams with completely different departmental knowledge. Maximum transparency and networking are required for these individual teams to make the right contribution to achieving the common goal. Every single person must have the opportunity to see his colleagues’ goals simply. If such a digital network is adequate and available, it is also possible to provide potential inputs or feedback to other goals. We support cooperation and commitment with a correspondingly high degree of transparency and also enable the maximum adaptability and thus also the efficient implementation of our current strategy.

As can be seen in Figure 22: OKR system overview, the transparent system ensures a constant flow of information back from the key result status, not only to every employee but also to the R&D management, so that appropriate adjustments to the strategy can be made if necessary.

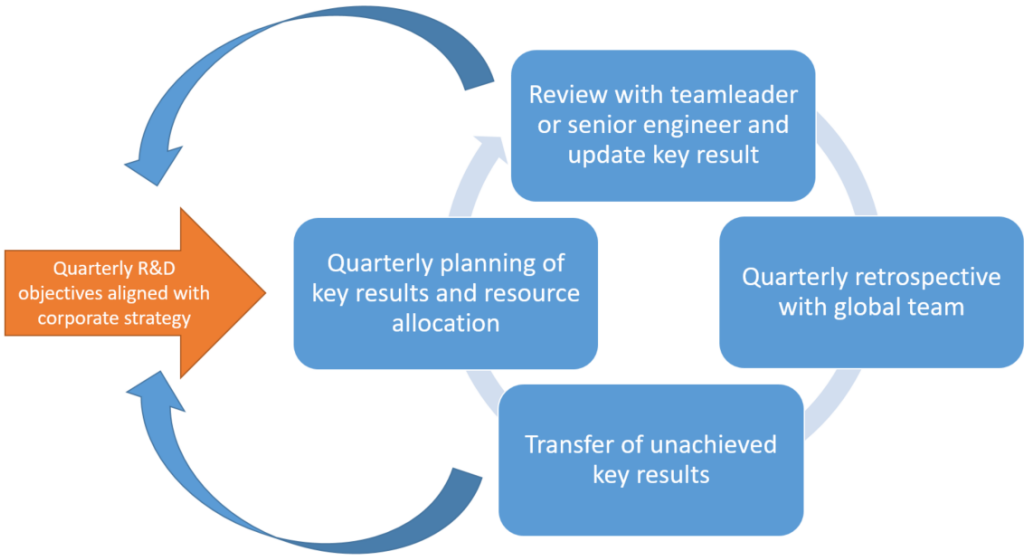

Figure 22: OKR system overview

Source: Own representation based on (Niven and Lamonte, 2016)

3.5 Solving the Design Challenges [Daniel Kollreider]

3.5.1 The right extent of differentiation

As organizations grow and the number of people working in the organisation increases, it becomes more difficult to define who is responsible for what and who reports to whom. The challenge is how to design *differentiation*, which is understood as the process by which an organisation allocates people and resources to organisational tasks, and how the task and authority relationship is established (Jones, 2013). By simply increasing the vertical and horizontal differentiation and the division of labour, the complexity of the organisation increases to the same extend.

Because of the increasing vertical differentiation, the chain of command becomes longer and therefore slower and more prone to failure. Due to the concept of distributed but concentrated, authority in the VOM model, the main structure stays

unchanged, while the organisation grows. There is no need to increase any vertical or horizontal differentiation. Growing means working on more tasks, with more people, in a larger number of OUs. The chain of command and the concept of authority remain unchanged, it is simply more of what already exists. Every employee knows his own responsibilities and those of others exactly, even if the organisation is growing. As a result, the R&D structure is still able to adapt to changing environments and to cope with different types of tasks.

An expansion of the horizontal differentiation in usually means more specialisation. For some companies this is a reasonable path, because they profit from the specialisation however this structure can be particularly advantageous for organizations with low dynamics in the environment but with a high degree of specialization. Logicdata benefits from an agile and cross-functional R&D department which can respond to changing conditions. The requirement for specialization is solved in the VOM by introducing the role of the technical expert, who operates flexibly as needs arise in the OUs. This means that this resource can be used very efficiently.

3.5.2 Balancing differentiation and integration

The challenge in balancing differentiation and integration is to get people to communicate and coordinate across their subunits. Introducing differentiation together with rigid processes and detailed role descriptions, promotes the formation of subcultures and builds barriers between people and functions. People view their role in the organisation strictly from their subunit's perspective (Jones, 2013). The problem is that people in subcultures have their own specific norms, values and languages, which makes efficient communication very difficult (Schein, 1996). This is amplified by the fact that specialisation again creates its own language, which makes it difficult to learn from one another.

Integration is the process of coordination of tasks, functions divisions to collaborate efficiently. Gareth R. Jones summarised and described several integration mechanisms(Jones, 2013, p. 122). The range is from very simple mechanisms like

hierarchy, to more complex processes such as the introduction of an integration department. All these methods must be applied carefully, so as not to limit the organisation's efficiency through overly complex integration mechanisms.

The VOM has implicitly implemented some of these methods. The cross functional operating units have a *team* characteristic, with a very flat hierarchic structure. All R&D functions, electronics, mechanics, software and testing, work together with a common goal of developing a product or solving a problem. The PLE has responsibility for coordination.

Local coordination is a mechanism for coordinating the operational units through a dedicated team of PLE's. In this sense, it can be seen as an *integrating department* or a *integrating role,* with the aim of the short-term coordination of the OUs.

The operational management is a group of managers which meet face to face, in *direct contact,* to coordinate the operational units' activities. They assign tasks and objectives and ensure that all the OUs are following the same strategy. Furthermore, the OM defines the target values for performance and ensures that every OU can achieve the performance requirement. Resources are managed across the board, so that all R&D tasks can be optimally fulfilled.

Strategic management is responsible for developing the R&D strategy and the product roadmap. The R&D managers are given the responsibility of coordinating with the business unit managers and the managing directors, to develop their departments' strategic direction. In this sense, the SM can be considered a liaison role.

3.5.3 Balancing centralization and decentralization

Balancing centralization and decentralization means distributing authority in the organisation. Authority is power that is delegated formally and which gives a person the right to hold other people accountable for their actions and the power to take decisions about the use of the organisation's resources (Jones, 2013, p. 125). It is accompanied by an equal responsibility for one's own actions. Distributing

authority means deciding who should decide what. In general, this can be centralised, meaning that all decisions are taken top down in the hierarchy or decentralised, at several points in the organisation. In organisations with highly centralised authority, people tend to pass the buck to their superiors, instead of accepting the responsibility or risk. As a result, the decision-making process is slow, and decisions are made by people who may not have the best information for doing so. In contrast. in highly decentralised organisations, it could be difficult to keep the organisation focused on its goals and strategy. Decisions take place at several points in the organisation and are sometimes not aligned with each other.

The basic concept of the VOM is to distribute authority in such a way that decisions are made by people who are best able to evaluate the situation because they have the most and most accurate information at the time the decision is made. Some of them are centralized in the strategic and operational management while others are decentralised in the operative units and the local coordination.

All aspects with a long-term and strategic character, such as strategic planning, product roadmap development and product portfolio management, are the responsibility of the SM and thus, is also has the decision-making power. The strategic setting of target values, such as the research rate or the allocation of exploration and exploitation, gives the OM and the OU’s the opportunity to make their own decisions in their areas. The OM is responsible for the usage of human and all other resources; it has full access to the R&D budget and R&D resources. Furthermore, the OM take all personnel decisions, such as hiring, redundancies and salaries. Within the limits of the specified research rate, the OM can decide to execute research projects which they think are necessary for the future innovation product.

All technical decisions are in the hands of the PLEs. They define the development strategy, although the development process is specified by the OM. In the VOM, this process is a framework that assists the PLE in planning the strategy. The PLEs have the authority to interpret the process and to adapt it to their project or task. A

budget is transferred to the PLE, to which he has full access during the project runtime.

In this sense, responsibilities, competencies and decisions are distributed via the VOM. All decisions are taken by people with the highest degree of knowledge and information. The concept is very simple, so that it is very easy for employees to understand the decision-making process. The responsibilities are transparent, so that everybody knows the extent to which he/she can take decisions and risks.

3.5.4 Balancing standardization and mutual adjustments

When people in an organisation pay too much attention to rules, when people no longer support other people or departments or when the organisation is unable to react to changes or requests, there is probably an imbalance between standardization and mutual adjustment (Jones, 2013, p. 129).

Standardization means following a specified model which is defined by a set of rules and norms, where rules are formal written statements and norms are standards of behaviour, often unwritten. Norms and values are often related to a group of people or a subculture (Schein, 1996). Standardization make people's actions routine and predictable. This reduces the risk of making mistakes but on the other hand, it can also slow down the process in uncertain situations.

Mutual adjustment is the process through which people use their best judgment to evaluate every new situation and take decisions detached from any processes or standards. This increases an organisation's ability to react to changes and navigate in unknown waters. Mutual adjustments promote creativity and are to some degree, indispensable in an innovative environment. The downside is the higher risk, because decisions are taken afresh each time, without any guidance. This increases the susceptibility to errors. The process of mutual adjustment can be inefficient in an environment which is very predictable and stable.

The VOM uses several tools to balance specialisation and mutual adjustment. The operational management's responsibility is to formulate rules and norms, and to

provide standards and tools. The main tool/standard is the process development framework (process). It provides a guideline for product development but also allows for adjustment and adaption. The PLEs have the freedom to decide whether to execute items in the framework or not. Items have no set chronological order, so that the development strategy can be defined for every project separately.

The VOM allows different types of collaboration for different tasks. All the tasks are categorised according a three-times-three Ansoff categorisation (cf. section 3.3.3) and the development phases are designed based on this. The stage-gate model (Cooper, 2002) gives guidance for defining the development phases. The PLE can choose the type of collaboration, depending on the uncertainty of the task and the development phase. In the ideation phase, nearly everything in unpredictable. It is impossible to standardize this process and doing so would slow down and restrict the solution finding. In the research and concept phases, some reporting and controlling are necessary, but the creativity should not be limited too much. Agile tools like Scrum, are perfectly suited to deal with this situation. In the final development and validation phase, the team should know the precise result expected. A standardized and risk reducing project management method (waterfall methods), provides safety and speed of development.

4 Verification

In order to test our model, we have taken real events with an interaction with R&D, which have happened in our environment in the past. These real cases and their effects on R&D and the whole organization, are known to the authors and can therefore be assessed. In order to evaluate the same scenarios in a VOM environment, the authors put themselves into an R&D department based on the approaches described in chapter 3.

Three different use cases are dealt with in this chapter, to prove the model's suitability for use:

1. *Environmental Change*

   In order to put the company on another foothold, the owners decided to set up a new business unit. In this new unit, the company's existing core competencies and experience are to be used with the aim of quickly attaining market leadership. A large-scale development project has been started based on the assumption that we have to deal with similar customers and same technologies.

   This use case should show how changing influences on the R&D environment would affect the model.

2. *R&D China expansion to develop customized handsets*

   There is an upcoming trend towards individualization spreading in the market. Despite the increased expenditure on development, production and storage of customer-specific products, demand in this area is increasing and an R&D adjustment to meet the ongoing pressure of reducing time to market, is requested.

   This use case should show how the model enables high volume production-oriented development. at the same time as dealing with flexible and customized development for low quantities.

1. *Extension of core competencies through IoT*

   A new megatrend, IoT, is also reaching the market in which Logicdata is active. As the market leader, customers expect concrete products to be also offered in this field. Since R&D has not yet been active in this area, the competencies for such development activities must first be built up.

   This use case should show how the model deals with expansions and growth.

4.1 Use Case I: Technological competence leveraging in the bed market [Daniel Kollreider]

4.1.1 Forces for change

Strategy: Over the years, Logicdata has continued to expand its core competence in mechatronic product development. The company has concentrated on the market for adjustable office furniture and has become the world market leader in the field of system technology. In order to fulfil its growth strategy, the management has decided to open up new markets by de-linking its core competences from existing products and re-linking them to new products (Danneels, 2007).

Environment: To reuse as much of the existing technology, suppliers, partners and know-how, as possible, a project was initiated to develop the market for adjustable home furniture. The supplier's existing business model was abandoned and Logicdata has developed into an OEM. This has significantly changed the specific business environment (see section 3.1). Not only the distribution channels but also competitors, customers and unions have changed.

Structure/Process: To catch up with the new competitors as quickly as possible, a very large, cost-intensive product development project was started. The project was integrated into the R&D department's existing structures and processes, although the task was significantly different from what was known at that time. The product and market requirements were largely unknown and new technologies were

introduced. This caused a high degree of uncertainty in the project and many changes of direction.

4.1.2 Impacts on the R&D organisation:

Structure: The implementation of product development in the short time available, required a very large Logicdata development team, with up to 60 project members. All functional teams within the R&D departments were involved in the project. In Logicdata's current, traditional functional structure, the tasks and the employees were rigidly assigned to the functional team (see section 2.2.1.1). The frequently changing project scope required a very high degree of coordination across many team boundaries. A lot of important information was lost and the core task of information provision (see Section 2) could no longer be ensured. Development efficiency was significantly reduced.

The frequently changing tasks would have required different competencies in the individual phases of development. The changes in product and market requirements move rapidly from creative conception phases to design phases with high demand for design experience and phases of verification which require manual and testing experience. The rigid team structures partially prevented an agile assignment of competencies to tasks and thus limited the structure's flexibility.

Process: Logicdata currently uses waterfall planning methods which are very well suited to the planning of processes with little uncertainty. However, the characteristics of this project were clearly different. The market and technological uncertainties were very high (cf. Section 3.3.3) and the planning methods were unsuitable. The project planning, with milestones and activities planned in advance and shown in Gant diagrams, provided an illusion of certainty that did not actually exist due to the frequent necessary adjustments. The frequent postponements of milestones and appointments have led to dissatisfaction, especially in management.

The rigid and detailed development processes increase the safety and quality of the products but at the same time, also increase the effort needed for changes in the

project. Approvals and decisions are regulated by the hierarchical, functional structure and take a long time due to the extent of knowledge available to the decision-makers. Fast adjustments were therefore hardly possible.

Culture: The frequent adjustments to target dates have led to management uncertainty. As this project was of strategic importance, the management felt the pressure to intervene in the project. The operational interference gave the project staff the impression of mistrust and led to demotivation. Existing decision-making structures were partly ignored or temporarily changed, resulting in decisions being delayed or not taken at all. The, sometimes, chaotic conditions had led to uncertainty among the employees.

All in all, many changes of direction, many partly incomprehensible top-down decisions and the project's lack of success, as well as that of individual persons, have led to demotivation and distrust in the organisation and management.

4.1.3 VOM Approach:

Structure: The VOM offers the possibility of forming teams (operational units OU's) very fast and agilely and equipping them with the necessary competencies (cf. Section 3.2.1). They can thus be precisely adapted to the respective task and challenge. Since the OUs are formed cross-functionally and not in rigid functional teams, the common task is in the foreground. The interface losses that can occur with team-related task distribution, are thus avoided. The information provision within the OUs is fast and transparent.

Frequent and short-term changes can be compensated by the mechanism of the local coordination system (see section 3.2.2). Product lead engineers can decide for themselves whether resources should be transferred between the OUs at short notice. This also ensures that the right competencies are used to solve the tasks. Thanks to local coordination's standardized reporting function, the operational management is sufficiently and transparently informed about the status and can make decisions.

Process: By categorizing the project according to the methods described in chapter 3.3.3 and the resulting product development phases, it is possible to avoid a too fast classification of the project in rigid planning methods such as waterfall. In this case, the market and technology situations were very unclear. The operative organization methods described in chapter 3.3 offer the opportunity to carry out fast development iteration during early and uncertain product development phases with very little or no planning effort.

Agile methods such as Scrum, promote short intervals of product (prototype) manufacture and a regular product strategy validation in market studies. This avoids long, unreviewed development phases and significantly reduces the risk of not developing in line with market requirements. The exact planning of the next steps and the rough planning of activities in the distant future provides a much more realistic picture of the situation and does not pretend to be absolutely accurate. Rescheduling is much easier and less time-consuming. The accuracy of the planning is greater and therefore generates less concern and interference on the part of management, who in turn can focus their efforts on the project's strategic planning.

Culture: Through the operational units' flexible design and the agile design of processes and methods, the focus can be on the actual task of product development and success in the form of results, will be achieved more quickly. This increases employee motivation and in turn increases the team's performance.

The clear communication methods, the opportunities for direct decision-making, the dissolution of team-related interests and the concentration on the task, result in fewer conflicts and frictional losses in the organisation. The situation's transparency and management's restraint from operational decisions conveys mutual trust.

4.2 Use Case II: R&D China expansion to develop customized handsets [Mario Flucher]

4.2.1 Forces for change

Environment: Due to the growing pressure from new competitors in the furniture industry, Logicdata's customers face the challenge of differentiating themselves from their competitors. Many follow the trend towards individualization, products which are specially adapted to customer needs. This is sometimes done at very short notice with a maximum of six months market intervals. This strategy places certain demands on suppliers, including Logicdata. Logicdata as a company had to solve this new challenge due to the changed environment.

Strategy: To ensure competitiveness, Logicdata has focused strategically on high volume products over time to keep product costs low through economies of scale. The structure, processes, strategy and corporate culture were geared to this. Meeting the market demand for rapid product development, tailored to customer requirements in smaller quantities, meant a strategy adaptation for the company.

Structure/Processes: Due to the rigid company structures and the rigid processes, focused on quality assurance and risk minimization for high-volume products, the company, but above all the development department, was unable to meet this customer requirement. The short time-to-market intervals could not be met. For this reason, a separate, geographically separated, organizational unit, with its own processes and procedures was created in China. This unit specifically handled the customization projects.

4.2.2 Impact on the R&D Organisation

Structure: The establishment of a separate organizational unit in china required more effort than originally planned, especially in the start-up phase. Because new employees had to be hired and new processes had to be defined and trained, this new OU was occupied with itself for some months before engaging effectively in customer projects.

The OU with its new local team leader was able to become active in China after a very challenging start-up phase but then a new problem arose, the matrix organization. With a local team leader to ensure cultural understanding and the blurred functional responsibility held by the headquarters, an ignorance of responsibilities arose which led to misunderstandings and therefore blocked the progress of projects. To communicate the OU's purpose, it was necessary to include them in the strategy development process or to let them have their own strategy developed, which in turn meant coordination effort and friction losses, due to different approaches.

Process: Daily reconciliations about "Logicdata common" approaches, required a higher communication effort between the existing OU in Austria and the new OU in China. The new processes that were set up and trained in China had to be coordinated with the long-standing and deeply rooted processes in the headquarters first. The resulting matrix organization placed particularly high demands on process design, as the ultimate product responsibility was not clearly regulated.

The necessary cooperation between the separate OUs could thus be defined, on paper at least. However, the two OUs' different degree of maturity was not taken into account. The process of knowledge transfer was poorly organised and, if it took place at all, was very costly and driven forward with little motivation.

Culture: The prevailing fundamental differences between Asian and European culture are well known. Unfortunately, the management was wrong in assuming that different OUs in different countries would have little interaction with each other and cultural differences would therefore have little influence. Precisely these differences led to wrong decisions being made, mutual mistrust built up and led to an even greater separation of the China OU. This separately-managed OU lost any sense of being a part of the R&D and thus also its connection to the rest of the company.

4.2.3 VOM approach

Structure: In the VOM approach, the corporate strategy's adaptation to the new environmental conditions would be used as input in order to set new goals for the entire OU. The objectives developed in R&D serve as guidelines and provide direction for the task's implementation within the existing structure (cf. Figure 14: VOM). Since no structural adjustments would be necessary, the integration effort from employees in another country would be very low. The employees would find their purpose within the OU automatically in the strategic elaboration. Since this must be coordinated with the entire OU before it is communicated to the employees, it ensures that the existing structure and all employees, will support the comprehensive strategy. As described in chapter 3.2, there is still the great advantage that fluctuations in capacity utilization within the OU can be easily and quickly compensated by the PLEs and operational management.

Process: With the classification of projects in a superordinate stage-gate process, it is possible to start at different phases of the process depending on the uncertainties. Since the topic of individualization can be very diverse, it is particularly important to seek close cooperation with the customer. The basis for a targeted development is coordination using prototypes which is ensured by the Scrum process. Individualisation which only involves small deviations from an existing product can be processed in a slim V-model or Waterfall process, supported by existing knowledge in the OU. Both tasks are covered in VOM and the interfaces are regulated clearly. This clarity in the superordinate process defines responsibilities and at the same time, allows simple tasks to be completed quickly and decisions to be made without detours.

Culture: The prevailing structures and processes in VOM make it possible to implement new requirements from the environment or the market inside the OU with hardly any changes being necessary. The great advantage of this situation is that the existing employees can focus on successfully integrating the new employees in China, training the processes and providing the necessary technical

support, especially during the start-up phase. Common goals and KPIs support the team's expansion and enable an effective method of working, despite different cultural backgrounds.

4.3 Use Case III: Extension of core competencies by IoT [Daniel Kollreider]

4.3.1 Forces for change

Environment: In most cases, a change in the environment also triggers a change in the company, as in this case. Very often synergies result from different trends, which then culminate in completely new products or solutions. People's ways of working have always changed and we are again confronted with a big change (Laloux, 2014, p. 35). Modern IT technologies have made the workplace less important. Work is characterized by frequent changes of location and home office has increased in importance. Companies have recognized these trends and are trying to deal with the changes in the best possible way. New technologies, such as IoT, and the resulting opportunities for predictive data analytics, support companies in this. IoT supported office furniture is also gaining in importance and offers new opportunities for innovative companies, such as Logicdata.

Strategy: The company management decided to follow the IoT trend and to expand the product range. Although the exact boundary conditions of the digital transformation were unknown, the decision was taken to develop a hardware solution for the IoT connection. The possible consequences of this were largely unknown at that time, including what additional opportunities would be opened as a result. The options ranged from providing the hardware, data generation, providing data and methods of data analysis, to providing the data and conclusions from the analysis.

Structure: The company and R&D were not structurally changed except that the technology development was concentrated in an existing, separate R&D office

(separate organizational unit, located in Slovenia). The project was completely decoupled from the headquarters in terms of development.

4.3.2 Impact on the R&D Organisation

Structure: The previous activities can be divided into two phases. In the first phase, a hardware was developed which enabled communication with the Internet, and thus created the basic prerequisite for IoT. In the second phase, a programming interface (API) was developed that allowed customers to use the hardware with their own software applications.

No structural changes were necessary in Phase I. The hardware development was developed using the existing structures and processes, in an existing R&D branch office. This had been founded shortly before, for reasons of employee availability. The development of the programming interface in phase II has brought some unintentionally structural changes. There was a shift in competence from electronics hardware and mechanical engineering, to software development. The change in the development focus has presented the relatively small team with great challenges, since there a lack of resources arose on the software side and a surplus on the hardware side.

Thinking about the future, there will be even more structural changes. The step from data generation and data management to data analysis, means an even more dramatic shift in competencies.

Process: The development of the hardware and the programming interface did not pose any major challenges to the process. All the methods, tools and processes had already been established in the branch office. Only the exceptionally high need for coordination between product management and development, across national borders, created some difficulties. Due to the lack of strategic planning in the development phases, the expectations for the product were not clearly defined. Because of the communication difficulty, the lack of strategic planning and too long unreviewed development phases, a lot of time and effort flowed in an unsuccessful

direction which delayed the project. There is a risk that the products will be ready for the market too late and miss the trend.

Culture: The strategic planning of the digital transformation was largely driven by marketing; the R&D department was only partially involved in the planning process. In addition, all strategic and operational issues were coordinated directly with the external R&D branch. On the one hand, the local R&D department's additional involvement would have made communication even more complicated, on the other hand, a lot of existing know-how could not be used. In addition, the local R&D department did not become committed to this project.

4.3.3 VOM approach

Structure: In the first phase of the project, hardware development, the VOM would have made it possible to form an operative unit very quickly and to process the tasks within the established processes. There would have been no major differences in processing. However, the second phase of development brought with it a shift in skills which has brought challenges to the small external organisation. It would have been easier to relocate competencies at short notice in the larger, agile organization. Medium-term shifts in competencies would have been identified through local coordination's reporting and corresponding recruiting measures could have been initiated by operational management. By integrating R&D strategic management into the business unit and corporate strategy, an early reaction would have been possible.

In contrast to the development department's previous tasks, digital transformation requires a long-term specialization of competencies (expansion of core competencies) or at least a strong focus. The VOM offers the option of installing a medium/long term OU, which would take care of this aspect. However, the model's agility and flexibility can no longer be fully exploited and the advantages of the VOM cannot be used. A separation of this aspect into a separate organizational unit seems to be a possible and meaningful solution

Process: The operative and strategic planning methods for R&D tasks and the project categorization methods would have enabled a conscious planning of the development phases. This would have made it possible to carry out the development in smaller but conscious, steps and to incorporate market requirements and new findings more quickly. All processes and methods are available for developmental phases I and II. For the further steps, for example the development of predictive data analysis, new roles, processes and responsibilities would have had to be defined in the VOM.

Culture: The regulated integration of strategic management in the process of defining the task in the VOM, would have created commitment to the task. The R&D management's experience and that of the technical know-how carriers, could have been an important input for strategic planning and could have promoted a "WE" idea. In summary, however, apart from the task planning, a spin-off into a separate organisational unit would not be a significant problem to the VOM. Of course, the VOM can be transferred to the separate R&D field offices as a concept, in order to reap its benefits.

5 Discussion and Conclusion [Daniel Kollreider, Mario Flucher]

The final chapter of this thesis provides a summary of the entire content of its individual sections. Finally, general conclusions are drawn which characterize the VOM and the framework conditions in which the model can be meaningfully used, in the opinion of the authors.

5.1 Summary

This thesis mainly deals with the design of an ambidextrous R&D organization to meet the challenges of rapidly changing and complex requirements in a turbulent global environment.

In order to be able to handle these different tasks efficiently and flexibly, this thesis proposes a new R&D design; the Versatile Organization Model (VOM). As a basis for its development, both the relevant traditional and new, modern methods and approaches for structures and processes in R&D are reviewed in Chapter 2. The Viable System Model, as well as Holacracy, in combination with Scrum and the Stage-Gate Model, serve as the main bases for the developed VOM. Chapter 2 also addresses the importance of additional supporting factors, such as culture and motivation, which later serve as a basis for the VOM's successful establishment. Organizations' changes and innovations throughout history are described in Chapter 2. From this, future trends in organizational development can be derived. In addition, section 2.1 describes the main phases of organizational change. Triggers of change, crises and concepts for solving the crises, are described and indicate the necessity of agile organization.

Chapter 3 describes the Versatile Organization Model that was actually developed with elements from all the previously listed theoretical bases. As described in Chapter 2, the organization's environment has a significant influence on the company's structure, processes and strategy. Section 3.1 describes Logicdata's environment and more specifically, that of the company's R&D department. The

peculiarities of this environment have had a major impact on the design of the VOM. The model is designed to show its advantages in this environment particularly.

Section 3.2 describes the VOM's structure. The model is characterized by four core elements: the operational units, the local coordination system, operational management and strategic management. Section 3.2 describes the four core elements, the most important roles and their tasks and responsibilities, and the four building blocks' interaction. It refers to Holacracy, the Viable System Model and the actor-oriented scheme described in section 2.2.1. Distributed authority is an essential characteristic of the VOM. This work distinguishes between technical, operational and strategic management.

Due to the demands on R&D to be both flexible and competitive in the areas of quality, speed and resource allocation, we address the design of R&D processes in section 3.3. One of our main challenges is the distribution of authority and control to those persons who have the information necessary for "good" decisions. The VOM clearly regulates which roles can and should make which decisions best. In order to support these decision-makers in their activities, in section 3.3.2 we present the necessary basis for obtaining commitment and thus being able to exercise the predefined roles in VOM.

Because of the interplay of complexity, richness and dynamism, which is defined in sum as 'uncertainty', we propose an Ansoff matrix for making the basic decision about the respective entry point (so-called gates) into our adapted Stage-Gate-Model. In this way, depending on the project category, it is possible in VOM, to apply different development methods like Scrum, Lean and Waterfall, and still work in a structured way according to a given process. This is exactly what enables us to be both flexible and competitive at the same time.

Because we are aware that even a good model only works with the right people, we deal with the cultural aspects in section 3.4. Most important is to ensure that only the right people, we call them A-players, are hired. With the people who have the

right skills and characters, we can provide the right motivation for all employees with the career model and support measures that we have in place. Career steps are not only possible for people with personnel responsibility, but also for professional careers. With the help of the objective key results method, the purpose of what we do is transmitted to the entire team using a transparent system. Purpose, mastery and autonomy are described in section 3.4.4 as one key element in motivating employees to go the extra mile.

To test the VOM in chapter 4, 3 real use cases were applied in theory and the results derived from these were compared with those from real situations that we have experienced. Although VOM has advantages in several areas, there are some limitations, especially when a high degree of specialization is required.

The strength of VOM is that it is flexible and allows fast adaptions, depending on the fast-changing requirements of the R&D environment. Chapter 5 highlights specific situations in which VOM can be beneficial, but also illustrates the supporting measures which are necessary to make it work.

5.2 Conclusion

- VOM does not impose the maximum decentralization of decisions which is required by many other modern methods, but it does support decisions being made at the point where the best information is available about the situation. This also includes management.

- In our view, new organizational models are better suited to meet today's requirements. However, we are also aware that in many companies, even at Logicdata, changes that are too radical could possibly fail due to lack of acceptance from both management and employees with many years of know-how.

  VOM is therefore built on decentralized responsibility, based on conceptual approaches from various well-known models such as Holacracy and VSM, but with adaptations to meet the organization’s specific requirements.

In addition, we added central strategic planning, which makes VOM a modern hybrid model.

- During our research, it quickly became clear that any adaptations of the structure alone are not sufficient unless appropriate processes and a supporting culture are in place. In today's fast-moving world, it is generally impossible to completely avoid uncertainties. However, it is important to have appropriate structures, processes and a culture within the company, so that the company knows exactly how to deal with the challenges of uncertainties and can also take advantage of opportunities that arise at short notice and at the same time, being sustainable.

- The more volatile the environment, the more agile the methods have to be. With the VOM approach, a company can be very agile if a volatile environment demands it. We consider VOM is more than a contemporary, intermediate step for companies on the way to even more radical new approaches.

- In our view, VOM can be applied not only in R&D but also for other areas, such as production or logistics.

- For long-term tasks that also require a high degree of specialisation, the integration of these aspects into the VOM does not offer all the advantages listed here. This could also lead to an overload of operational and strategic management, as the specialised aspects do not show any synergies with those from other areas and would have to be managed separately. In this case, the new task can be separated organizationally, but the new organization can also be set up according to the VOM approach.

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