

MASTER THESIS

“Analyzing and testing a newly introduced innovation measurement method by comparing it to key performance indicators and performing a case study at a technical driven company.”

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Management summary

Leading in a turbulent time and an increasingly entrepreneurial and competitive economy, being innovative is becoming a more and more important to companies and organizations. Although many organizations state that innovation is an important topic within their daily business and being innovative is one of their main competences, not so many really measure their performance within this field.

Within this study the Innovation Management Model of S.J.A. Löwik (2017), a new innovation measurement method, is being described, analyzed and tested by performing a case study at a selected company.

Main goal within this research is to provide insight in the IMM of Löwik and into whether this new type of measuring innovation performance comprises the crucial components which are requested and critical in innovation measurement methods. This is being performed by helps of the following research question: To what extent does the newly created innovation measurement tool Löwik (2017) meet the critical innovation measurement components and does it provide insights to help improve an organization's innovation management in a systematic way?

By analyzing three well-known and established innovation measurement methods: the Malcolm Baldrige, European Foundation for Quality Management and the Balanced Scorecard six key performance indicators (KPI's) which are used as reflection-criteria for the IMM of Löwik were discovered: Multidisciplinary approach internal and external focus, skilled working staff, customer focus, intercorrelation and innovative management, these KPI's By reflecting the IMM to the discovered KPI's we can conclude that the IMM contains all discovered KPI's at least partially, out of which four of the discovered KPI's are fully present within the IMM.

Also the case study produces positive results regarding the usability of the IMM, by analyzing the tool results it can be concluded that Techstall wields a Defender strategy which fits to the organizational factors within Techstall. Which is also confirmed by Techstall's management.

Overall this research concludes that the IMM of Löwik (2017) meets critical innovation measurement KPI's and provides insights to help improve an organization's innovation management in a systematic way. Furthermore it must be seen as a welcome strengthening and addition in the existing and available scope of innovation measurement methods.

Points that remain after producing this research is that a more detailed study on how the IMM can be measured in practice should be done. Further points of discussion are that the IMM of Löwik makes use of no less than 12 disciplines, which is quite more than the well-known and established innovation measurement methods that have been analyzed. Important questions that remains are therefore: what is the maximum number of disciplines that an innovation measurement method should measure and is the IMM of Löwik to extensive?

Table of Contents

Management summary	2
1. Introduction	4
1.1 Situation.....	4
1.2 Research Goal	4
1.3 Research Question.....	4
1.4 Theoretical Framework	4
1.5 Relevance of the paper.....	5
1.6 Thesis Structure	5
2. Theory	6
2.1 A view from scientific literature / what makes a good tool?	6
2.2 A view from existing IMM's	8
2.3 Developing key performance indicators	12
2.4 The innovation management model of Löwik.....	15
3. Methodology.....	24
3.1 Research Design.....	24
3.2 Selection and Sample	25
3.3 Measurement Technique and Data Collection.....	25
3.4 Data Analysis.....	26
4. Case: Techstall.....	27
Innovation Measurement Tool.....	27
Results & advise Case	29
Conclusion & Advice Techstall Case	30
5. Findings	32
5.1 Functionality of the IMM.....	32
5.2 Outcomings Innovation Measurement Model Analysis.....	32
6. Discussion and conclusion	35
7. Reference List.....	36
8. Appendix	40
Appendix 2: Miles & Snow, define innovation Typologies.....	57
Appendix 3: Techstall test results	61
Appendix 4: case results as presented at Techstall	69

1. Introduction

In the first chapter of this research proposal an introduction to this scientific paper will be given. To create a clear overview this introduction distinguishes six aspects: situation, research goal, research question, theoretical framework, relevance of the research and thesis structure

1.1 Situation

In today's market being innovative and being successful as a company are as good as causally connected. Because of the great importance of being innovative all companies strive to be innovative and like to put themselves in the market like an innovative leader. Although most companies present themselves as innovative, they often find it hard to explain why they are innovative and how well they perform in being innovative. Gary Hamel (2002) defines the innovation process as follows: *'Innovation process is a sequence of activities aimed at creation and implementation of innovation. It includes activities related to generating innovative ideas, their evaluation, creation of innovation and ensuring its spreading among customers.'* As can be concluded from this definition, being innovative is much more than coming up with a new product or methodology.

To increase the innovation process of a company it is important to discover where the company lacks in the field of innovation, in this way a focused approach can be drawn up. To measure how an organization performs in the field of organization multiple theories and methods have been created in the past. A new method of measuring innovation has been recognized by Sandor Löwik (2017) who created the innovation management model (IMM). This model can be used to identify a company's overall performance on innovation based on multiple intercorrelated factors. In order to find out how a company performs on each individual aspect a standardized question list that aims on these topics is created.

Whether this new method can provide new or better insights has not been determined yet and needs to be tested in practice.

1.2 Research Goal

Main goal within this research is to provide insight in the IMM of Löwik, the additional value of the IMM in the field of innovation measurement and into whether this new type of measuring innovation performance comprises the crucial components which are requested and critical in innovation measurement methods

1.3 Research Question

To what extent does the newly created innovation measurement tool Löwik (2017) meet the critical innovation measurement components and does it provide insights to help improve an organization's innovation management in a systematic way?

1.4 Theoretical Framework

This study builds on existing literature about innovation management and compares several findings about multiple factors of the IMM of Löwik (2017). As stated before the literature review on innovation management shows that many companies find it hard to find out how well they perform and how to improve when it comes to innovation. The first part of the theory can be find

in the second chapter of this report and will analyze critical components in measuring innovation performance. The second part of the theory is given in chapter four, in this part the theory used to create the IMT (innovation measurement tool) will be treated.

1.5 Relevance of the paper

As mentioned by Gu et al. (2017) innovation is becoming increasingly important in gaining competitive advantage for their business development and performance. Therefore, understanding and mapping innovation performance is a crucial competence. This research offers a relative easy way for companies to address their overall innovation performance but will also help in addressing shortcomings on several specific factors. Furthermore it analyses the usefulness of existing innovation measure methods and compares it to the IMT composed in this thesis. This research is relevant because of its contribution to the general understanding of innovation management and simplification in addressing innovation management performance.

In practice this thesis will contribute in understanding and implementing the innovation management model of Löwik. Furthermore it will analyze the IMT and will reflect it to critical success components of innovation measurement models that can be found in former academic thesiss. After this analysis it can be concluded whether the IMT suffices to the critical components and is therefore useful for analyzing an organization's innovation performance.

1.6 Thesis Structure

This literature review will be structured as follows: In the next chapter the theoretical framework will be given, in this chapter underlying theory will be analyzed comprehensive. In the third chapter the research methodology will be described. In the fourth chapter a case thesis is given in which the IMT will be tested in practice. Finally, chapter 5 discusses the results, after which the main findings will be given and conclusions will be made along with the research limitations, recommendations and further research options.

2. Theory

In the second chapter the theory that I will use to perform this thesis is treated. First we take a look at scientific literature about what makes a good innovation measurement method. In the second subchapter of this chapter we describe three established and well known innovation measurement methods. Once these methods have been described, these will be analyzed and compared to each other to discover and identify which key performance indicators can be found among these 'established' innovation measurement methods. In the final subchapter the Innovation Measurement Model (IMM) by Sandor Löwik (2017) has been described in order to provide a solid basis for analyzing the IMM within chapter five.

2.1 A view from scientific literature / what makes a good tool?

When studying scientific literature it becomes clear that measuring innovation is an abstract concept in which many scientists have their own ideas about how to deal with the measurement of innovation performance. Because a consistent vision on innovation and the measurement of innovation is not yet produced, multiple points of view will be analyzed out of which the most convenient and matching visions will be analyzed in chapter four.

That mapping an organization's innovation performance is a complex process is also been recognized by Ivanov & Avasilăi (2014) who state that: "*The measurement of innovation has been always a challenge for most of the organizations because most of time it has to track intangible assets.*" Although measuring innovation is a complex process, some helpful tools have been defined that can provide insight. Organizations have to purposefully search for sources of innovation, changes and the symptoms out of which innovation can be indicated. Developing innovation capabilities is seen as one of the most important conditions for any firm or organization. (Ivanov & Avasilăi, 2014)

Although Banu et al. (2018) focus on performing innovation they mention some interesting points that help in keeping the data measurable. As they state: "*When undertaking innovation, an enterprise should perform an in-depth assay of the main characteristics of the innovation process in order to properly understand the requirements of successful innovation.*"

Banu et al. (2018) also mention key performance indicators that should be considered when creating innovation measure models :

- The KPIs should support implementing project activities and achieving project objectives;
- The KPIs should rely on clearly identified and rated measures;
- The KPIs should impact also the results of the organization's activities and not only those of project activities.
- The KPIs should allow for reevaluation and further improvement;
- The KPIs should reflect only available data;

That how to measure innovation and what tool to use, is a very important question that has to be taken seriously is also supported by Bilodeau & Rigby (2007). Organizations that intent using a management tool first should consider and decide if they have the right people and skills that are needed to develop this tool and to achieve the objectives that are set concerning the tool. After these decisions have been made, an achievable and realistic set of expectations regarding the

level of complexity and investment of implementation have to be set. Finally all personnel should be informed about the implementation process of the tool and its importance.

In an earlier study Darrel Rigby already mentioned that measuring innovation is something that starts with picking the right innovation model. The company or organization has to choose the tools that supports the strategic objectives at best and has to focus on implementing this limited set of tools.

When taking a look at literature about tool design most studies agree that when analyzing an organization's innovation performance a multi factor perspective should be applied. Tohidi & Jabbari (2012) discovered in their study "Providing a Framework for Measuring Innovation within Companies" that it is the need to view the process of innovation as changes in a complete system of not only hardware but also market environment, production facilities & knowledge, & the social contexts of the innovating organization.

Also Saunila (2016) insists on a multi-faceted construct in measuring innovation. Within this construct an organization should aim for maximum innovation capability, which is described as an internal capability aiming to describe the determinants affecting an organization's ability to achieve innovations continuously and add value for the organization and its stakeholders

Saunila (2016) distinguishes seven determinants that affect an organization's capability to manage innovation and can therefore be seen as important variables that should be measured when mapping an organizations innovation:

- Leadership Culture: The overall atmosphere of the organization that supports and motivates innovation, and also leadership that facilitates innovation
- Work climate and well-being: Represent the well-being of the employees and further the work climate for innovation development, including collaboration and values
- Ideation- and organizing structures: Related to the structures and systems that successful innovation requires. This includes the generation, development and implementation of innovations, and the ways how the work tasks of the organization are organized
- Know-how development: Skills and knowledge of the employees play an important role in innovation capability. This includes the utilization of knowledge as well as the improvement of employee skills
- Exploiting external knowledge: The importance of the proper behavior of exploiting external networks and knowledge to the overall organizational innovation capability
- Regeneration: An organization's ability to learn from earlier experience and to use that experience to create innovations and develop their operations
- Individual activity: Employees' individual innovation capability and activity is needed to form the organization's overall innovation capability

Saunila (2016) also mentions two enablers that help organizations to be innovative.

- Resources: Resources that make it possible to develop organizational capability to produce innovations
- Vision and strategy: Vision and strategy that direct an organization's innovation activities and capability development

In chapter 4 of this thesis a broad analysis of the literature will be given, furthermore we will make a comparison of this literature with the IMM of Löwik (2017).

2.2 A view from existing IMM's

To identify which characteristics can be found in innovation measurement model, multiple models will be analyzed. Because in most cases a method is presented in a model or systematic way, it is important that not only details are studied but also how a model is functioning. For example if factors or determinants are interconnected.

Within this chapter the following three methods have been analyzed: Malcolm Baldrige, European Foundation for Quality Management (EFQM) and the Balanced Scorecard. Although not all of these models have been composed to only measure an organization's innovation performance, all measurement models possess components that can measure the innovation process. (Ivanov & Avasilcăi, 2014)

Malcolm Baldrige model

The first model that is analyzed is the Malcolm Baldrige Model (MCM). This model is known for its ability to attain an organizations objectives, to improve the organization's results and to become more competitive in: aligning its processes, peoples, decisions, plans, actions and results. The model contains seven criteria that help measuring an organization's performance and to measure its innovation performance. The MCM contains the following criteria: leadership, strategic planning, customer focus, measurement, analysis and knowledge management, workforce focus, operations focus and results.

The MCM was originally created to practice an efficient control of quality for services and products. Furthermore the model offers a quality standard and helps organizations to achieve a high level of (innovation) performance. Malcolm Baldrige can measure innovation performance through the following criteria: leadership, strategic planning, operation focus, workforce focus. (GSQC, 2010)

Within the MCM (figure 2.2) the multiple criteria are intercorrelated, this is marked with the arrows. The Granite State Quality Council who wrote the article: *"The Malcolm Baldrige Criteria for Performance Excellence"*, discovered the following roles per criteria.

- Leadership, examines how senior executives guide and sustain the organization and how the organization addresses Governance, ethical, legal and community responsibilities. ·
- Strategic planning, examines how the organization sets strategic directions and how it determines and deploys key action plans. ·
- Customer focus, examines how the organization determines requirements and expectations of customers and markets; builds relationships with customers; and acquires, satisfies, and retains customers.

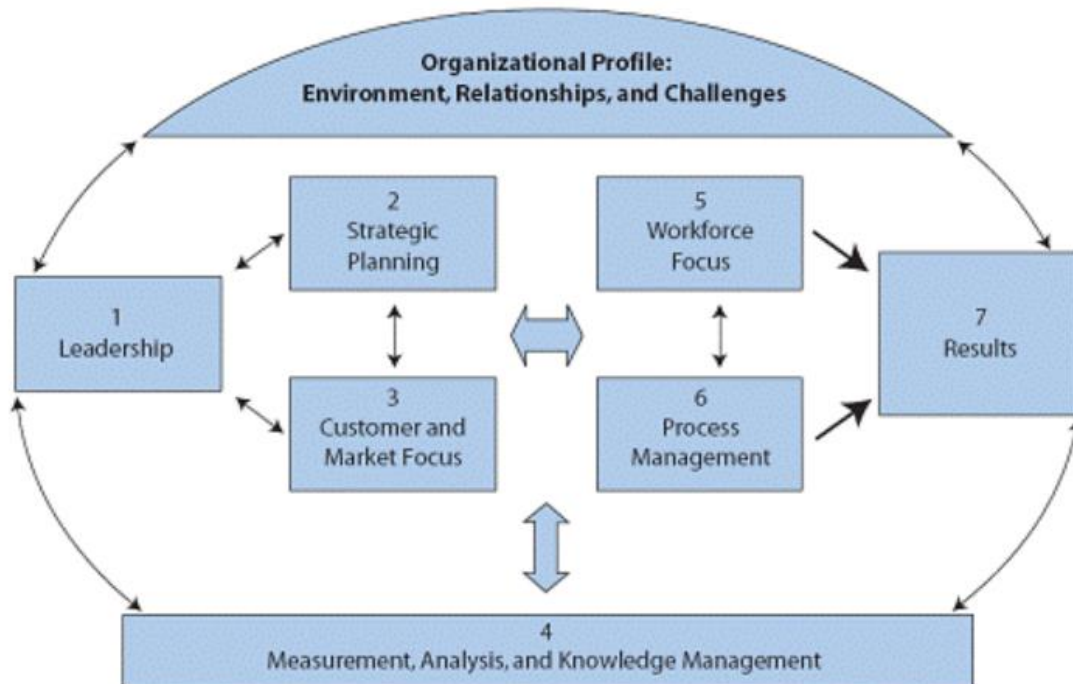


Figure 2.2 Malcolm Baldrige Model (GSQC, 2010)

- Measurement, analysis, and knowledge management, examines the management, use, analysis, and improvement of data and information to support key organization processes as well as how the organization reviews its performance. ·
- Workforce focus, examines how the organization engages, manages, and develops all those actively involved in accomplishing the work of the organization to develop full potential and how the workforce is aligned with the organization’s objectives. ·
- Process management, examines aspects of how key production/delivery and support processes are designed, managed, and improved. ·
- Results, examines the organization’s performance and improvement in its key business areas: customer satisfaction, financial and marketplace performance, workforce, product/service, and operational effectiveness, and leadership. The category also examines how the organization performs relative to competitors.

European Foundation for Quality Management (EFQM)

The second innovation measurement method that I have analyzed is the European Foundation for Quality Management method (EFQM). Because this method uses multiple criteria: Leadership, People, Strategy, Partnership & Resources and processes, products and services this method is seen as one of the most complete methods in measuring innovation performance.

The above mentioned criteria are also seen as the “Enablers”, in other words: the variables that influence a company’s innovation performance. The Enablers influence can be interpreted as follows:

- Leadership: Leaders within high level organizations help achieving objectives and focus on building a great future, furthermore they inspire trust and behave ethically.
- Strategy: High level organizations use their vision and mission to develop and implement a stakeholder based strategy.
- People: High level organizations have an above average interest in their employees/people and are willing to invest in improving their people’s capabilities. Furthermore they promote equity and fairness and motivate their employees to increase company growth by obtaining better results.
- Partnerships and resources: High level organizations use their strategy to manage supplier relations and internal resources.
- Processes, products and services: High level organizations continuously try to improve their processes, products and services to become more valuable for their customers and other stakeholders. (Ivanov & Avasilcăi, 2014)

Within the EFQM method the Enablers are presented as guiding criteria by which innovative organizations should play to in order to be innovative. As can be seen in the EFQM model presented below this model also is interrelated, because strategy is seen as the main criterion this is presented in a central position.

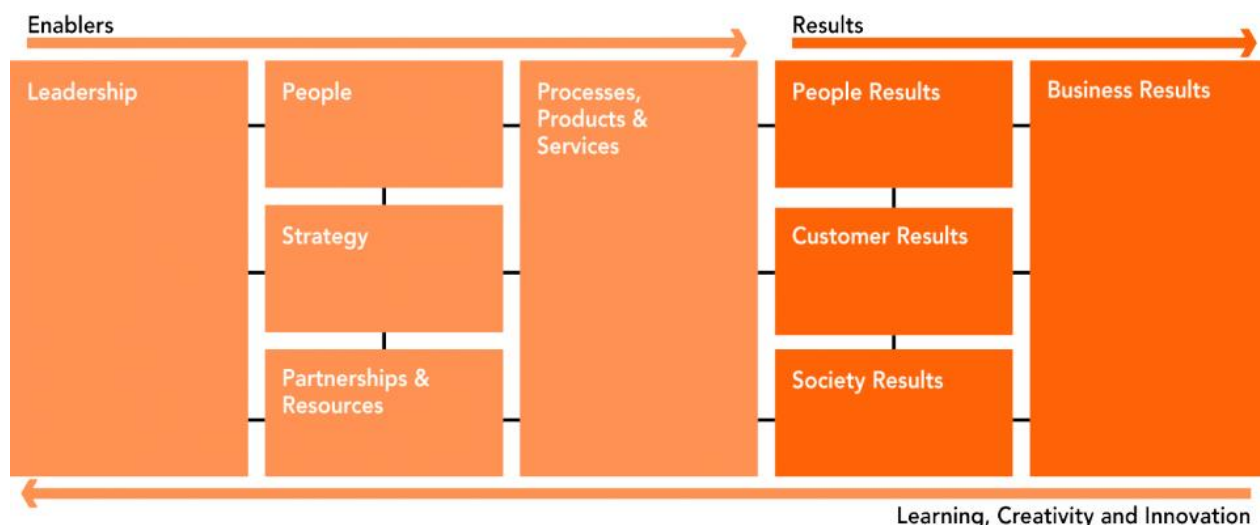


Figure 2.3 EFQM Model (management, 2012)

Ivanov & Avasilcai (2014) state that: “EFQM is one of the most complete models that can be used to measure the performance of the innovation process, because it can be done through all of its criteria: leadership, people, strategy, partnership and resources and processes, products and services.”

Balanced Scorecard

In 1996 Kaplan and Norton presented the Balanced Scorecard model (BSC) as a tool that is useful for managers to help obtain and maintain competitive advantage. In modern times the BSC is still

a very common method that helps translating an organization's mission and strategy into a set of performance indicators. (Kaplan & Norton, 1996)

The BSC contains four perspectives, which together represent a balance between interrelated indicators of critical processes, innovation learning and development and external indicators for stakeholders. The four perspectives are: Customer perspective, Internal business perspective, Financial perspective and a Learning and growth perspective. This can also be seen in figure 2.4, where the balance scorecard is presented. The four perspectives can be interpreted as follows:

Customer perspective

Although all four Balanced Scorecard's perspectives are of the same importance, customers have to be seen as the main reason of existence for any organization/Company. It is important for employees to know how customers can affect their daily business. Customer concerns can be classified in four categories: performance, service, time and quality.

Internal business perspective

This is the first BSC perspective that can be used to measure an organization's innovation performance, it focuses on all processes and activities that are important for an organization in providing the expected value for customers. The main goal of analyzing the internal process is to discover processes that can be improved to get a product/service with a higher quality standard.

Financial perspective

It is very important to know from where to get your money and how to invest them to become profitable. The financial indicators that are analyzed differ from company to company. The most common mistake that most of the organizations do is to focus too much on the financial indicators ignoring totally or partially the other perspectives. (Ivanov & Avasilcăi, 2014)

Learning and growth perspective

The second BSC perspective that can be used to measure an organization's innovation performance is the learning and growth perspective. It is very important for organizations to realize that employees can be a main source for developing new ideas and to become creative as an organization. An organization should appeal on an employee abilities, skills and knowledge to gain advantage in creating new technologies and processes.



Figure 2.4 Balanced Scorecard (Kaplan & Norton, 1996)

2.3 Developing key performance indicators

In this subchapter I will analyze and summarize which key performance indicators (KPI's) can be determined out of the three innovation measurement methods that have been described in chapter 2.2. In this case the KPI's that we will determine are similarities that we can discover among the Malcolm Baldrige, EFQM and the Balanced Scorecard. Therefore within this study we take these three innovation measurement methods as examples of successful methods.

To determine whether the IMM of Sandor Löwik (2017) can be used to measure an organization's innovation performance will depend on to what extent the IMM corresponds with the developed KPI's. To map the similarities and differences between the three methods we take a look at to which disciplines these methods focus and how each method intercorrelates between its disciplines.

Disciplines

In order to map similarities and differences between the three methods more easier I created a table in which the multiple disciplines that help measure an organizations innovation have been listed. Because the several methods make use of different terminology, "Disciplines" has been chosen as a collective name for Factors, Innovation Criteria, Enablers and Perspectives. Because of the fact all innovation measurement methods makes use of more different terms we also look at what is the underlying theory among all perspectives and disciplines.

Disciplines	Malcolm Baldrige	EFQM	Balanced Scorecard
Leadership discipline	<i>Leadership</i>	<i>Leadership</i>	
Workforce capital discipline	<i>Workforce focus</i>	<i>People</i>	<i>Learning and growth perspective</i>
Strategic discipline	<i>Strategic planning</i>	<i>Strategy</i>	
Learning and Growth	<i>Measurement, Analysis and Knowledge management</i>	<i>Partnership and resources</i>	<i>Financial perspective</i>
Market focus discipline	<i>Customer and Market focus</i>		<i>Customer perspective</i>
Process focus discipline	<i>Process Management</i>	<i>Processes, products and services</i>	<i>Internal process, perspective</i>

Figure 2.5 Innovation criteria overview

The first conclusion we can take out of this table (figure 2.5) is that all three methods make use of a multi-disciplinary approach in which multiple fields within and outside of the organization needs to be analyzed. We can therefore state that in order to measure innovation properly a innovation measurement method in any case should focus on both the internal as external situation of the organization.

When taking a more close look at the disciplines we can tell that also on a more detailed level the methods show quite some similarities. To start all three methods aim at measuring the level of innovation among the working staff of the organization that is analyzed. Measuring

whether an organization has a working staff that is fit for being innovative is considered as highly important by all three factors. The reason why organizations should measure this is that without skilled and well trained personnel the recognition, development and exploitation of possible innovations will not be possible. Another discipline that is measured in all three methods is the way how organizations focus on their customers. As is described in subchapter 2.2 at the balanced scorecard section is that customers have to be seen as the main reason of existence for any organization/Company. It is therefore important for an organization to know what these customers are looking for in the field of products and/or services.

Besides the disciplines that can be found in all three innovation measurement methods that are being analyzed we also find some double-matching disciplines.

- Leadership, this being an important discipline to be analyzed can be found at both the Malcolm Baldrige as the EFQM method. As is described within the EFQM section in subchapter 2.2 that within high level organizations innovative leaders help achieving objectives and focus on building a great future, furthermore they inspire trust and behave ethically
- Strategic planning/Strategy, examines how the organization sets strategic directions and how it determines and deploys key action plans.
- Measurement, analysis and knowledge management and Partnership and resources, focus on analyzing to what extent an organization is willing to drill external organizations for their knowledge or other competences.
- Process management/Internal process perspective, the main goal of analyzing the internal process is to discover processes that can be improved to get a product/service with a higher quality standard and gain a higher level of innovation.

Intercorrelation

An important reason for many innovation measurement methods being presented in a model is to show how multiple disciplines are intercorrelated. Before we take a closer look at how the Malcolm Baldrige, EFQM and the Balanced Scorecard are intercorrelated we first define intercorrelation as follows: A mutual relationship or connection between two or more things. (Oxford-Dictionary, 2019)

When looking at the three methods that we analyze within this study, we can see that all three methods make use of arrows and links to indicate the intercorrelation between disciplines.

Malcolm Baldrige

The Malcolm Baldrige model (figure 2.2) shows six intercorrelated disciplines that together form the input out of which the results of the organization will be the output. Within the Malcolm Baldrige the first three disciplines: Leadership, Strategic Planning and Customer and Market Focus together present the foundation about how, on a higher level, the organization should functionate. These three disciplines should be attuned to each other in order to provide a solid foundation for the Workforce Focus and Process Management of the organization. The fourth discipline that should impact an organizations Workforce Focus and Process Management is the Measurement, Analysis and Knowledge Management discipline.

In case the first four disciplines are in balance, the disciplines have been attuned to each other and the organization design is of good quality. In other words: an organization with balanced disciplines will most likely get better results.

European Foundation for Quality Management

As mentioned before also the EFQM makes use of a model to present how the several disciplines are intercorrelated (Figure 2.3). Within the EFQM a central position is created for the Strategy discipline, which indicates that an organization's strategy influences all its activities. Furthermore we can see that all other disciplines (within EFQM model called Enablers) affect three other disciplines.

Leadership, People, Strategy and Partnerships & Resources together form the basis for the Processes, Products & Services that are being offered. The Processes, Products & Services will provide People Results, Customer Results and Society Results which will eventually together form the Business Results.

The Balanced Scorecard

Within the Balanced Scorecard model no intercorrelations arrows have been pointed out. Nevertheless the BSC does contain intercorrelation, the center of the model points at the four disciplines/perspectives: Learning and growth, financial, customer and the internal process perspective. Within the scorecard these four perspectives should be created in such way that there will be minimal friction between factor boundaries. All perspectives should be adapted to each other and need to be in line in order to create a flowing and smoothly running innovation process. If this is not the case, innovation projects will take more time, be more expensive or will not succeed at all.

It can therefore be said that the balanced scorecard is intercorrelated although this is not indicated as clear as in the Malcolm Baldrige and the EFQM. An example of the BSC being intercorrelated can be given as follows: increasing an organization's manufacturing capacity can both stimulate customer satisfaction as financial results.

Overview Intercorrelation

By analyzing the Malcolm Baldrige, EFQM and the Balanced Scorecard we can conclude that all three methods contain intercorrelation. As mentioned before intercorrelation presents the way in which one organizational factor influences another. Out of this we can conclude that for an innovation measurement method it is important to measure to which extent these multiple factors have been adjusted to one another.

Key Performance Indicators

In the above analysis of the three innovation measurement methods, multiple key performance indicators have been identified. These KPI's will serve as reflection criteria to measure whether the IMM has the potential of a well performing innovation measurement method.

By analyzing the Malcolm Baldrige, EFQM and the Balanced Scorecard we presume to have a good view on well-established innovation measurement methods. The methods have been analyzed on both their disciplines as how they are intercorrelated. We identified the following key performance indicators:

Well established innovation measurement methods:

- Make use of a multidisciplinary approach.
- Measure both the internal as external situation of the organization.
- Well established innovation measurement methods measure the innovation capacity of the working staff within organizations
- Well established innovation measurement methods measure the way how organizations focus on their current/potential customers.
- Well established innovation measurement methods measure the intercorrelation between the to be measured disciplines.
- Well established innovation measurement methods measure if an organization is controlled with an innovative mindset by analyzing the organization’s strategy and leadership.

2.4 The innovation management model of Löwik

As can be seen in figure 2.1 the innovation management model (IMM) of Löwik (2017) exists out of several internal factors (within the pyramid + leadership) and external factors (outside the pyramid without leadership). As expressed by the arrows external factors have their influence on the internal factors.

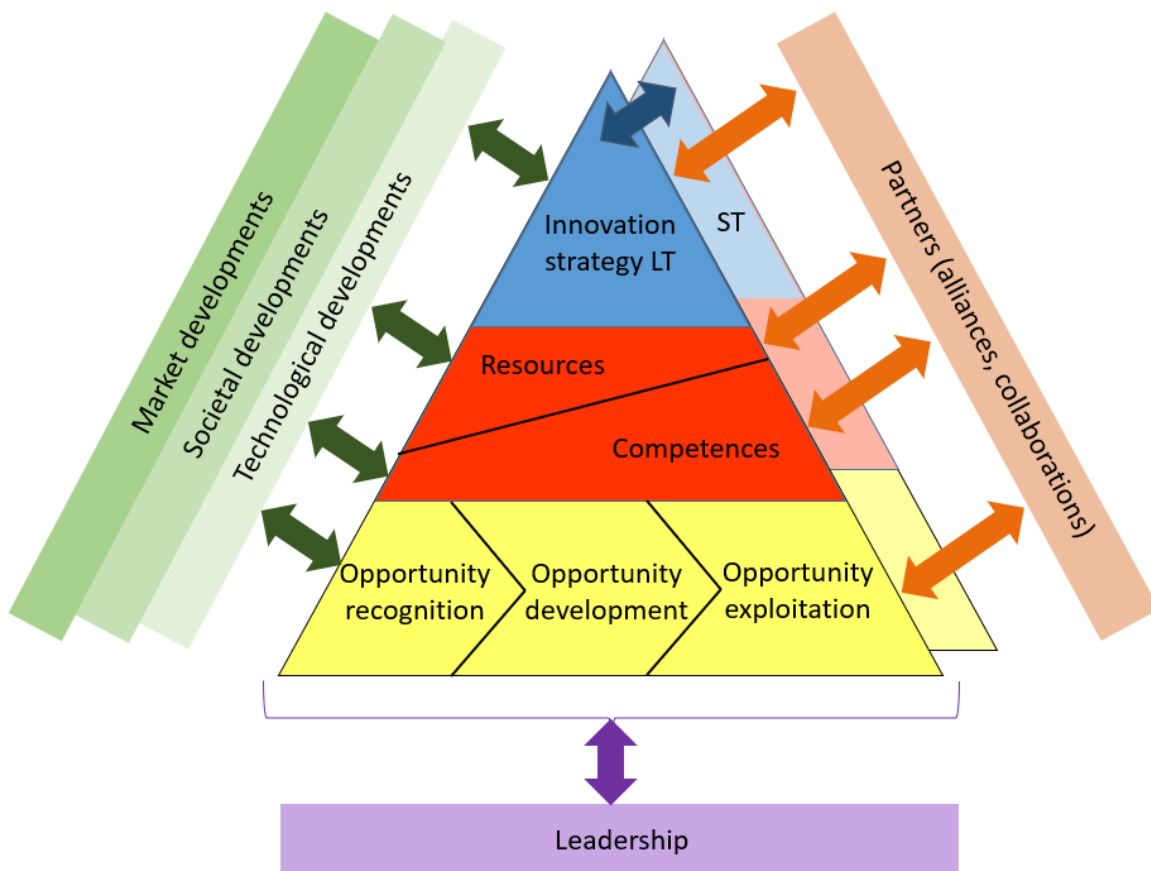


Figure 2.6 innovation management model (Löwik, Innovation management model, 2017)

For example: if there are hardly technological developments in a certain market, it is likely that it will also be hard to recognize opportunities to innovate. On the other hand, if technological developments are full of present and a company still does not recognize these developments, a problem has occurred. When a company fails in recognizing opportunities this also has its effect on opportunity development and opportunity exploitation. Opportunity recognition can therefore be seen as a crucial step within the IMM.

Pyramid Levels

As can be seen in figure 2.1, the IMM of Löwik (2017) consists out of three levels. Strategic level (top blue level), tactical level (middle red level) and operational level (bottom yellow level).

On the strategic level organizations define how they prescribe to gain competitive advantage in bringing heterogeneous services, processes or products to its customers. The middle level of the innovation management model supports the top level by describing which resources and competences are needed in order to achieve and to carry out the innovation strategy. The operational level presents the practical output of the innovation strategy and represents the organization's capability of handling opportunities.

Short-Term versus Long-Term Innovation Strategy

In order to fulfill a long term strategy, companies need to make strategic short-term decisions first. Finding balance between pushing for short term innovations without disturbing the long term strategic innovation strategy is often prescribed as one of the toughest challenges in innovation management. A smart way in finding balance between short-term and long-term innovation is an ambidextrous organizational setup, exploitation and exploration are playing an important role in this setup. (O'Reilly, Tushman, & L., 2014)

Interrelationships

Within the IMM challenges can arise between the edges of the several internal factors. For a company it is essential to fill in the internal factors in such way that there will be minimal friction between factor boundaries. In other words: all internal factors should be adapted to each other and need to be in line in order to create a flowing and smoothly running innovation process. If this is not the case, innovation projects will take more time, be more expensive or will not succeed at all. For example: if a company aims at product leadership, this company should have strong knowledgeable resources like a highly educated engineering staff, if this is not the case, friction arises.

Internal Factors

As mentioned before the factors within the Pyramid by Löwik (2017) can be defined as the Internal Factors. The factors being inside of the pyramid symbolizes that these factors are within the control of the organization. That internal factors can be manipulated to achieve results in the field of innovation is also shared by Daniel I. Prajogo (2016) who state that innovation has to be seen as an activity that is within the control of a firm which management can control or manipulate.

Innovation Strategy

Theoretically, innovation strategy is about helping a company to distinguish itself in bringing heterogeneous services, processes or products to the market that have the potential to shape consumer behavior and preferences. Cai et al. (2017) have recognized: *“a firm's innovation strategy, the degree to which a venture develops and introduces new products in their market, can improve the venture's productivity and profitability and ultimately the venture's success”*. An important aspect of innovation is bringing something new, a firm that focusses on innovation strategy may therefore gain advantage in bringing a product to the market. Such a strategy can be important when the innovation requires scarce resources like occupying the most fit location or knowledgeable staff is limited.

Love et al. (2014) also recognize innovation strategy as a crucial factor in taking the lead in the field of innovation. They state that creating a strong combination of internal and external knowledge sources can be seen as a key element of a successful innovation strategy. Love et al. (2014) also mention the importance of ‘open innovation’ as a means of innovation performance. They state that: *“effective boundary spanning between the internal and external aspects of innovation becomes central to a successful innovation strategy.”* As open innovation is a possible innovation strategy, so is closed innovation. When a company decides to start a closed innovation project, the company chooses to innovate on their own, without allowing ideas or design propositions from the ‘outside’.

Looking at innovation strategy, there is no specific strategy that fits all organizations and will bring them success. Pisano (2015) states that: *“strategy is nothing more than a commitment to a set of coherent, mutually reinforcing policies or behaviors aimed at achieving a specific competitive goal.”* The best possible strategy an organization is able to carry out is therefore the strategy which: promotes alignment among diverse groups within an organization, clarifies objectives and priorities and helps in focusing the other factors around it. The importance of creating and carrying out a clear strategy is also supported by Miles & Snow (1978) which identified three innovation typologies. Organizations should focus on one of these three typologies in order to be successful.

Ambidexterity

The word ambidextrous comes from Latin and means as much as: ‘both favorable’. On an organizational level ambidextrous means that an organization has a perfect balance between exploitation (incremental innovation) and exploration (radical innovation). Exploitation is about doing current activities in an efficient way, exploration is about trying new opportunities.

O’Reilly & Tushman (2014) discovered that companies who are successful at both exploiting the present as exploring the future shared important common characteristics. In particular, these companies separated their new, exploratory units from their traditional, exploitative ones, allowing for different cultures, structures, and processes; at the same time, they maintained tight links across units at the senior executive level. In other words, they manage organizational separation through a tightly integrated senior team. O’Reilly and Tushman also discovered that when it comes to launching breakthrough products or services, ambidextrous organizations are significantly more successful than other companies. Stafford et al. (2012) also discover positive correlation between average company performance and balancing exploration and exploitation.

Resources

According to Hunt & Madhavaram (2006) resources are *“tangible and intangible entities available to the firm that enable it to produce efficiently and effectively a market offering that has value for some market segment”*. Looking at resources it can therefore be concluded that the most important and at the same time the most difficult challenge is creating certainty and dependability that resources will be available at all time.

Clausen et al. (2013) describe market resources as key antecedents in renewing products that are looked upon as sources of persistent performance. As can be cited: *“Renewal of a firms technological and market resources are particularly important and it is hypothesized that firms need well-developed technological resources to develop new products that differ from previously developed innovations, and need superior market resources to introduce new products onto the market successfully.”*

One way to determine strategic resources is by using the resource based view, this is a managerial framework which can be used to deliver comparative advantage to a company. An insight of the resource based view is that not all resources are of equal importance and not all resources have the potential to be a sustainable competitive advantage. (Barney, 1991)

Gerlach and Brem (2017) state that: *“To generate ideas, ideators need to be creative, a characteristic that is influenced by different personal factors, for instance, the ideators occupational personalities as well as their job contents and job complexities point out the need for a permanent input of market and technological know-how to be able to generate successful ideas. Sources for creativity can be external customers, in-house thesis, personal interviews, team meetings, or competitions.”* Gerlach en Brem (2017) also sum up several success factors for ideators (people who recognize opportunities) in recognizing opportunities:

- Ideators have to believe in their ability to produce ideas, otherwise they will not submit them.
- Ideators with a broader expertise are more creative
- Ideators with a high network centrality provide ideas that tend to be of higher quality.
- The participation of employees is crucial as they provide the input for the program, the ideas.
- The ability to discern the quality of an idea reduces the number of bad ideas
- Rewards are important for ideators to be motivated and feel valued.

Competences

For an organization to be successful in innovation it is important that its culture and competences are aimed at being innovative. A concept that can be seen as an indicator for an organization's success in innovation management is the dynamic capabilities theory by Teece et al. (1997). They define dynamic capabilities as: *“the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments”* It can therefore be said that the dynamic capabilities theory mainly focusses on how an organization designs its resources in order to deal with the external factors: market, societal and technological development.

Dziallas & Blind also identify some important competences: Flexibility and rapid adaption to customers, clear internal communication, willingness to invest and conduct new research projects.

Although successful innovation management in general is about finetuning and adapting factors and strategy, some theories are good indicators of a firm's innovation performance. One of these theories is absorptive capacity, which can be defined as a firm's ability to recognize valuable new information, process information and use it for commercial activities. According to Cohen and Levinthal (1990) an organization's absorptive capacity has a great influence on its innovation performance. An organization's absorptive capacity represents an overall complete score on the internal factors: opportunity recognition, development and exploitation.

Other competences that contribute to effective innovation management are: project management capabilities, risk management capabilities, interface management capabilities, Portfolio management capabilities, Flexible and agile processes.

Opportunity recognition

The first of the three internal opportunity factors of the IMM of Löwik (2017) is recognizing opportunities. Without the competence of identifying and recognizing opportunities all other internal factors will get superfluous, for example: if you do not recognize an opportunity, there is no need for development or exploitation.

According to Bagheri (2017) opportunity recognition starts with good leadership: *"In particular, leaders of high technology businesses, defined as the businesses that allocate significantly high financial resources to scientific, technological, research and development activities, need to develop new leadership competencies in order to effectively direct the process of innovation and opportunity recognition in their business."*

Maine et al. (2015) distinguish three entrepreneurial challenges in opportunity recognition: First, recognition of entrepreneurial opportunities do not necessarily have to begin with clearly defined market needs or known benefits to prospective customers. Secondly, entrepreneurial opportunities do not necessarily need to represent a more productive use of existing capabilities or resources in a competitive market. Third and last, (new) companies have to deal with sustained high degrees of market uncertainty even if they develop new drugs through clinical stages, which means that information about desired outcomes will remain unknown for prolonged time periods.

Opportunity development

After an opportunity is discovered by a company, the next phase occurs: the development phase. Important in this phase is to funnel all possible innovations until a few best development opportunities remain, a balance between expected benefits, costs, development time and realizability should be decisive. The importance of selecting a few really promising innovation opportunities is also mentioned by Stock et al. (2017) which state that theory targeted development of new sustainable innovations is per consequence a key activity in the push towards sustainable industrial growth.

Besides, Ostendorf et al. (2014) mention that a firm's ability to converse is crucial in getting an opportunity from the recognizing phase into the development phase. They quote: *"research confirms that there are specific factors that influence the conversion rate, which include expertise, the number of ideas and speed to market In other words, companies with the highest conversion ability are those that: 1) focus on a moderate number of ideas that are of importance,*

in their areas of expertise, and 2) deliberate by adopting a moderate level of speed in product development.”

Gerlach and Brem (2017) state that not all ideas should be developed but only a selection of generated ideas. In order to develop these ideas an idea management program is expected to have positive influence on successful innovation behavior: *“a methodical and sustainable process is needed to successfully review and implement submitted ideas.”* Gerlach and Brem also state that the development phase can also be seen as an improvement phase. The improvement phase can be seen as an incremental process with several information stages. In every stage, an idea is enriched by additional information, for example, scientific experiments or market studies. The duration of the improvement phase can vary a lot. It can stop after a relatively short period of time, but it might also take two to three months or even longer before an idea challenge is completed.

Opportunity exploitation

After an opportunity is developed, the product has to be exploited and set on the market. As told before the process of opportunity recognition to opportunity development can be seen as a Funnel Model, in which ideas got filtered out before the development phase but also before the exploitation phase. Although some opportunities might survive the first selection (before the development phase), the same opportunities later may disappoint. Possible reasons of disappointing opportunities could be: costs of development may turn out higher as expected, technical demands may not be achievable or market demand turns out lower as expected.

Opportunities that do survive the funnel model thus, need to be exploited and set on the market as an innovative product. Gerlach and Brem (2017) summed up several success factors for exploiting a new product or process:

- Enthusiasm is an important factor to produce high-quality results.
- The actual implementation of the idea is important to demonstrate the practicability of the idea management program and serves as a motivation for further submissions.
- The publication of successful ideas serves as an organization-wide appreciation for the ideators and motivation for others.
- The implemented idea has to be promoted to its target group. This so-called deployment phase is managed by a deployment team, which sells the new product to clients and business partners
- Success metrics are required to control the effectiveness of the idea management program based on its defined goals.

Because a firm that brings a new product or process on the market probably has to deal with competition and other uncertainties, a scenario based market approach will be useful. Krane et al. (2014) indicate that: *“in many projects there is a lot more that can go wrong or not according to plans and that uncertainty management therefore is more about identifying and dealing with threats than exploiting new opportunities.”*

Leadership

As we mention before in this chapter, good leadership is of great importance to create an innovative culture within a firm. Tung and Yu (2016) mention that in high-tech industries employee innovation and creativity are not produced automatically, it is a leaders task to support employees and encourage them to be creative.

According to Bagheri (2017): *“In particular, leaders of high technology businesses, defined as the businesses that allocate significantly high financial resources to scientific, technological, research and development activities, need to develop new leadership competencies in order to effectively direct the process of innovation and opportunity recognition in their business.”* Bagheri (2017) also state that: *“SME leaders enact their roles and tasks based on entrepreneurial leadership principles and not only create new ideas to solve the problems and deal with difficulties but also value and support new idea creation by employees and develop strategies and.”*

Van Minh et al. (2017) have investigated the relationship between a leaders technical competences and to what extend its employees are innovative. After investigating the relationship it could be concluded that a leaders technical competences positively influences innovative and learning work behavior of their co-workers/employees. In order to exploit an organization’s innovation strategy within the organization, good leadership is needed. Leaders must learn how to create an organizational climate where others apply innovative thinking to solve problems and develop new products and services. Horth & Buchner (2014) identified three main tasks in leadership:

- setting direction
- creating alignment
- building commitment

Chen et al. (2015) state that literature about innovation and leadership is largely unanimous in recognizing that transformative leadership promotes overall innovation within an organization.

Bass & Avolio (1994) mention four main components within transformational leadership:

- idealized influence
- inspirational motivation
- intellectual stimulation
- individual consideration

External Factors

Market Developments

For a company to be innovative it is important to have enough knowledge of market developments. By analyzing market developments a company is more likely to discover trends that will help in mapping market opportunities and threats. In order to keep market developments mapped, David A. Aaker (2014) defined seven dimensions of a market that should be analyzed. These dimensions are: market size (current and future), market growth rate, market profitability, industry cost structure, distribution channels, market trends and key success factors. By analyzing these dimensions, companies are likely to recognize opportunities faster.

In order to achieve the benefits of being well informed about external developments, it is important that an organization spends both time and money in the expansion of their market

intelligence. Making strategic plans and decisions based on external intelligence help forming a competitive organizational strategy. (Navarro-Garcia, Arenas-Gaitán, & Rondán-Cataluna, 2014)

Societal Developments

Another external factor that should be taken into account are societal developments. Being well aware of societal developments helps companies to explain why institutions or individuals make certain choices. Where societal developments can offer innovation possibilities like emerging markets and a higher acceptance grade of technological developments it can also cause troubles. For example: one societal development at this moment is that technical personnel is very scarce, a shortage in skilled personnel can lead to delays in innovative projects. Other examples of societal developments that influence companies externally are: population growth, age distribution, geographic shifts in populations and distribution by gender.

Technological Developments

Because of growing digitalization and internationalization, analyzing technological developments in the external environment is becoming more and more important. Developments in technology can be discovered more easily not only by the company itself but also by its competitors, moving fast is therefore crucial. As Wang et al. (2015) state: “*Identification of technology development trends is essential for supporting decision makers in forecasting and identifying related innovation activities and industrial growth.*” Being an early adopter and recognize technological development trends in an early stage can provide huge benefits for a company.

Partners

Because innovations often require a broad range of knowledge, a large amount of companies often struggles with completing an innovation project successfully. When starting an innovation project, companies should question if their own capabilities will suffice in achieving their end goal. When companies conclude that their own capabilities do not suffice, a strategic partnership with a company, institution or university could provide a solution towards a successful innovation project. According to Sadvnikova et al. (2016) a balanced combination of managerial flexibility and a strong formal administrative structure creates an environment conducive to breakthrough innovations. Sadvnikov et al. (2016) also notice some successful partnership elements: mutual resource access, strategic compatibility, knowledge complementarity and relational competence.

Another possibility to benefit from ‘external knowledge’ is open innovation. According to Henry Chesbrough (2003) open Innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. Possible open innovation activities could be: selling R&D results that will not be used by the company or buy promising R&D results of other companies.

When companies conclude that their own capabilities do not suffice, a strategic partnership with a company, institution or university could provide a solution towards a successful innovation project. Wildridge et al. (2004) have identified 20 critical success factors grouped into six categories that lead to a successful partnership:

- Environment: history of collaboration or co-operation, collaborative group seen as a legitimate leader, favorable political and social climate.

- Membership: mutual respect, understanding and trust, appropriate cross section of members, members see collaboration as in their self-interest and ability to compromise.
- Process and structure: members share a stake, multiple layers of participation flexibility, clear roles and policy guidelines, adaptability and appropriate pace of development.
- Communication: open and frequent, informal relationships and communication links.
- Purpose: concrete, attainable goals and objectives, shared vision and unique purpose.
- Resources: sufficient funds, staff, materials and time and skilled leadership

3. Methodology

In this chapter the research methodology will be treated and explained, to consider different aspects multiple subchapters are drawn up. In the first subchapter a general design of the empirical approach will be made, the following subchapters will be about selection and sample, measurement technique, data collection and data analysis

3.1 Research Design

The research design forms the framework for finding the answer to the research question. The research goal of this thesis is making an analysis of the innovation management model (IMM) of Löwik (2017) by comparing it with established and well known innovation measurement methods. After these models have been compared and analyzed we will indicate whether the IMM overperforms the existing methods and if it is a welcome contribution to the current offer of innovation measurement methods. To achieve this goal an empirical qualitative literature study on existing innovation measurement methods and the IMM has to be made.

To start we analyzed three well known and established innovation measurement methods out of which we determined multiple key performance indicators. Secondly we focused on how the IMM functionates by describing all internal and external factors that have been placed within the model. Furthermore we describe how these factors are intercorrelated with each other and to which purpose the IMM can be used. This research has been done in the previous chapter.

Now we have both the IMM as the other methods described we can start with the analysis and comparison of the three well established innovation measurement methods, which will result in an extensive overview of method characteristics per method. Once this overview has been made we take a look how these methods overlap and differ from each other to provide a basis for determining the KPI's. Finally we will determine how these KPI's are of meaning regarding the judgement of the IMM and whether the IMM adds value to the existing offer of innovation measurement methods.

A second perspective of the usability of the IMM will be created by making use of a case study in which we perform an "IMM innovation measurement" at Techstall. In order to measure Techstall's innovation performance we first needed to set up a tool that enables us to translate the IMM to concrete variables that can be measured at Techstall. After creating the tool this has been handed to four members of the management board of Techstall, who filled in the innovation measurement tool. After this tool has been filled in we have analyzed the results by making use of the Miles & Snow typology (1978), furthermore we used the Miles & Snow typology (1978) to come up with a customized advise about how the improve innovation performance at Techstall.

After creating the results and advise about Techstall's innovation performance we take a look at to what extent the IMM has helped us to measure Techstall's innovation performance. By combining this outcome with the outcome of the comparison with other innovation measurement methods we will come up with a conclusion about the usability of the IMM of Löwik (2017).

3.2 Selection and Sample

To analyze, determine the usability and find out the added value of the IMM we have selected three existing and established innovation measurement methods. The selected methods are: The Malcolm Baldrige Model (1991), European Foundation for Quality Management (2013) and the balanced scorecard (1996).

In order to test the newly created IMT we selected a company that was suitable and willing to cooperate with this thesis. The tool that will be made has to be tested at Techstall. Techstall is a medium sized enterprise which is specialized in integrating technical systems and automation. Techstall likes to take responsibility for design and realization of solutions in automation and electrotechnical installations, in doing so Techstall wants to offer innovative products and processes.

3.3 Measurement Technique and Data Collection

In the first part of this thesis we focus on describing and understanding the IMM of Löwik, therefore literature about the defined innovation factors is analyzed and put to use. In this search, articles that were already focusing on developing or analyzing a measurement tool for a specific innovation factor have gained extra attention. Because all innovation factors defined in the IMM ask for a specific approach, an important criterion for the selected literature was that they were written with innovative background.

Once the IMM has been described, we focus on collecting data about the selected established and well known innovation measurement methods. Obviously, because these methods are established and well known, a lot of literature about these topics can be found. To make sure I collect original and 'undisturbed' data we focus on the originally created literature about these methods.

Because of time consuming issues the three existing methods will not be tested at Techstall but instead we analyze how these methods are designed to collect and indicate an organizations innovation performance. By comparing how the IMM functionates in comparison to the determined KPI's of the other innovation measurement methods I can partially determine whether the IMM will provide unique insights or another measurement method perhaps will provide more intel in the intended field.

To test and demonstrate if the IMM of Löwik is fit to map an organizations innovation performance a tool that enables a company to fill in the innovation management model of Löwik has been created. This tool has been created by putting multiple existing lists of questions about measuring the 'internal factors' together. These lists of questions have mostly been found within scientific literature about a specific internal factor as for example resources.

This IMM has been validated by using the tool to measure the innovation performance of Techstall. By performing this analysis at Techstall we will get a good indication whether the IMM is able to measure the intended field: an organizations innovation performance.

In order to increase reliability and validity, this thesis is making use of trustworthy academic platforms like ScienceDirect, Scopus and Find-UT, furthermore the tool will be tested at Techstall and outcomes will be analyzed critically by dr. ir. S.J.A. Löwik.

To improve the reliability of this thesis we took multiple variables into account: all four question list respondents received the same list of questions, needed to fill in the list of questions individually, received questions to check if it has been filled individually (time spend etc.), a broad

explanation of how to fill in has been given and bias has been calculated. Furthermore we increased reliability by comparing the IMM with three well established innovation measurement methods.

3.4 Data Analysis

The main goal of analyzing qualitative data is turning unstructured data found in literature and other artifacts into a detailed description about the most important aspects of the problem under consideration or the situation.

Within this research we have two major parts in which we have to analyze data, starting with the comparison between the established methods and the IMM, second we have to analyze the results that we generate by the tool that has been filled in by four managers of Techstall.

In case of the first part we make an analysis in which we will take a look how the three established methods and the IMM correspond and differentiate from each other. This will be done by determining multiple key performance indicators that can be drawn up out of the analysis of these three innovation measurement methods. By analyzing whether the IMM contains these determined KPI's we can make an indication about the quality of the innovation measurement method of Löwik.

In the second part we will test if the IMM's profile has indeed measured the innovation performance as we expected it. Out of the comparison of the different innovation measurement methods we than can make an analysis if the IMM was indeed most fit to measure Techstall's innovation performance or that perhaps another method should have been more fit.

Because this study's intention is to develop research about innovation management and theoretical discussions on this specific topic, this study can be characterized as an explorative case study in which a conceptualization of a tool for measuring and analyzing a firms overall innovation strategy and performance can be measured.

4. Case: Techstall

Because this research will be published the analyzed company has chosen to stay anonymous, it is therefore that we will use "Techstall" as code name. Techstall is characterized as a family business in which mutual solidarity and involvement among staff and management is recognized as the greatest strength within the company. With 85 years of experience in electrical engineering, nowadays Techstall focuses on the following areas of knowledge: advice & engineering, industrial automation, industrial installations, measurement and control technology, fire alarm systems, panel construction and management & maintenance. In 2018 Techstall realized a revenue of 17 million with a total of 142 employees.

Background innovation analysis Techstall

As a graduation assignment for the Business Administration course at the University of Twente, an analysis of the innovation measurement model created by Dr. Ir. Sandor Löwik at the University of Twente has been made. In order to test the usability of this method a tool which corresponds with the innovation measurement method has been developed by which companies can map where they stand in the field of innovation. The innovation measurement tool has been filled in by four of Techstall's managers.

After filling the tool, the results have been analyzed after which the results were, as part of validation, presented to the respondents and Dr. Ir. Sandor Löwik at Techstall. During further discussion of the results, the respondents showed a lot of understanding and agreed that the results of the analysis reflects Techstall's situation regarding innovation. The results of this business case can be found within this chapter, results as presented at Techstall can be found in the appendix.

Innovation Measurement Tool

The "Innovation Measurement Tool" or IMT was created to be able to sketch an innovation profile of companies / organizations based on the IMM. The IMT can be characterized as a questionnaire and consists eight different sections, each focusing on one specific factor. The following sections are tested: A: Innovation Strategy, B: Ambidexterity, C: Resources, D: Competences, E: Technology -recognition / development / exploitation, F: Innovative Leadership, G: Strategic Alliances, H: Market, Societal and Technological developments.

Innovation strategy is an overarching factor within this analysis. To protect, create or improve innovations, it is important that all other factors are in line with the innovation strategy. The innovation strategy is determined on the basis of the Miles & Snow typology. The tool has been created in such way that respondents are able to answer all questions by reading the manual/explanation that comes with it. After selecting the respondents in dialogue with the general manager of Techstall the tool has been send by mail to all respondents individually. After filling in, all results have been analyzed and presented anonymously to make sure answers were not manipulated by personnel interests. The Innovation measurement tool can be found in the appendix.

As mentioned before all factors that can be found within the IMM have been tested separately. To provide an overview of how each factor has been measured the table below shows the indicator, measurement and source(s) per factor.

Factor	Indicator	Question / Statement	Source
A: Innovation Strategy	Miles & Snow typology	List of questions by Conant et al.	(Conant, Mokwa, & Varadarajan, 1990)
B: Ambidexterity	Exploitation vs Exploration	Statements drawn up by Lubatkin et al.	(Lubatkin, Simsek, Ling, & Veiga, 2006)
C: Resources	<ol style="list-style-type: none"> I. Financial capital II. Physical capital III. Human capital IV. Organizational capital 	<ol style="list-style-type: none"> I. R&D spending's II. Patenting III. Company culture IV. Company structure 	(Lopez-Cabrales, Pérez-Luno, & Valle Cabrera, 2009)
D: Competences	<ul style="list-style-type: none"> • Absorptive capacity • Project management capabilities • Interface management capabilities • Portfolio management capabilities • Flexible and agile processes 	<p>List of questions by jansen et al.</p> <p>Combined questions about left-mentioned capabilities Kahn et al. and Cooper et al.</p>	<p>(Jansen et al, 2005; Lichtenthaler, 2009; Jaworski & Kohli (1993))</p> <p>Kahn, Barczak & Moss (2006)</p> <p>Cooper et al. (2004)</p>
E: Technology - recognition / development/ exploitation	<ul style="list-style-type: none"> • Conversion ability • New product development processes • Maturity stages/best practices 	Product development in several stages	<p>Cooper et al. (2004)</p> <p>Kahn, Barczak & Moss (2006)</p> <p>Dziallas & Blind (2018)</p>
F: Innovative Leadership	<ul style="list-style-type: none"> • Innovative Leadership Capabilities 	Five-point scale statements	(Arnold, Arad, Rhoades, & Drasgow, 2000)
G: strategic alliances	<ul style="list-style-type: none"> • Number of collaborations with universities and other knowledge institutions. 	Collaborations with different types of partners and reason of collaboration	(Löwik, Berkelland innovatie vragenlijst, 2017)
H: Market, Societal and Technological developments	Dynamism Munificence	Five-point scale statements	(Baum & Wally, 2003)

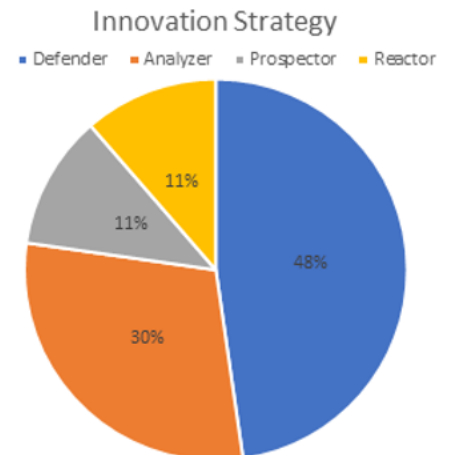
Figure 4.1 Tool overview

Results & advise Case

In this chapter the outcomings of the performed Case at Techstall have been summarized and presented on a section level. Within every section one innovation factor of the innovation measurement model is treated by making use of an average and a standard deviation. The full set of outcomings and test analysis can be found in the appendix.

Section A: Innovation Strategy

As mentioned earlier, the innovation strategy serves as the overarching factor and is therefore a starting point for the assessment of the other factors. To determine to which typology Techstall can be appointed, 11 statements have been submitted with four different answer options, each answer represents one typology. It emerged that Techstall uses a clear Defender strategy. The graph on the right shows that no less than 48% of the answers correspond with the Defender strategy. The explanation of the Defender Strategy can be found above.



Other factors

In order to keep the results of this study clear and concise, the results of the other factors have been presented in the table below. Most factors are tested by means of statements, in order to gain results out of choosing statements points are attached to the degree of agreement/disagreement with every statement. An average is then obtained out of which we can tell how Techstall is performing within this field of innovation.

Section	results
B: Ambidexterity	<ul style="list-style-type: none"> - Within Ambidexterity exploration 3.0 and exploitation 3.4 have both been tested on a average level. From this we can conclude that Techstall is focusing a bit more on exploitation as exploration. - Standard deviation exploration: 1.58 - Standard deviation exploitation: 1.60
C: Resources	<ul style="list-style-type: none"> - Within this section four different sections have been tested: Financial capital, physical capital, human capital and organizational capital. In all sections Techstall scores above average out of which we can state that Techstall's resources are fit to be innovative in their current market.
D: Competences	<ul style="list-style-type: none"> - In the field of competences Techstall shows varying results. In the first section 4,4 (out of 7) and in the second part 2,4 (out of 4). Which tells us that Techstall is suited for developing new products on an average level. - Standard deviation part 1: 2.2 - Standard deviation part 2: 1.1
E: Technology – recognition / development / exploitation	<ul style="list-style-type: none"> - Among the respondents varying answers concerning the spent hours a week on innovation have been given. This varies from 0 to 4 hours a week, with a standard deviation of 3.25.

	<ul style="list-style-type: none"> - Looking at working environment, Techstall scores an average of 3.25 (out of 5) and is therefore pretty suitable for innovation. Standard deviation: 1.4. - This year Techstall recognized 8 different innovation opportunities, out of these recognized opportunities only one opportunity has been implemented in the past two years. - The duration of these innovation projects has been estimated between a half and a one entire year. 60% of these projects met the profit expectations.
F: Innovative Leadership	<ul style="list-style-type: none"> - Techstall scores good points in the field of innovative leadership, with an average of 4.1 on a scale of 5. The standard deviation is 1.8.
G: Strategic Alliances	<ul style="list-style-type: none"> - Techstall is performing bad in the field of strategic alliances. Although Techstall has a few alliances with customers and suppliers there are hardly any corporations with other potential partners like universities, consultancy agents or competitors. - The most common reason for Techstall to start strategic alliances is a partners expertise, getting access to markets and selling channels and on request of customers or suppliers.
H: Market, societal and technological developments	<ul style="list-style-type: none"> - In the final section Techstall scores below average. In other words, Techstall performs substandard in recognizing market, societal and technological developments. In the first part an average of 2.9 (out of 5) and in the second part 2.7 (out of 5) is scored. - Standard deviation part 1: 1.4 - Standard deviation part 2: 1.5

Figure 4.2 Tool Scores

Summarized

Since the main purpose of the IMT is to visualize the Innovation strategy in combination with the underlying factors, we can say that this research was successful. If we list all the scores, we can conclude that Techstall scores on average in almost all factors. Within the factors Techstall possesses the basic elements which are needed to stay competitive in their current market. If we look at the Defender characteristics of the Miles & Snow typology, we can conclude that the measured scores fit this typology.

Conclusion & Advice Techstall Case

This research has shown that the innovation factors from the IMM are in line with the tested innovation strategy that Techstall applies, namely: Defender. Techstall is therefore not, or hardly, concerned with the development of new products or services, but focuses primarily on maintaining, but certainly also on strengthening its position in the market. When presenting the results of this case study to the respondents at Techstall, the respondents showed a lot of recognition in the case results.

Although Techstall has a clear Defender strategy as result, this does not mean that Techstall also aspires this strategy. It is therefore very important for Techstall to determine whether, with a view to the future, it will continue to trust the Defender strategy, or whether it wants to focus more on exploratory Innovation.

In case Techstall wants to focus more on innovation, Techstall will have to try to maneuver itself more towards the Analyzer profile. If this is the case, Techstall should consider a couple of pitfalls. For example, Techstall must be well aware that defending its current products/services in combination with an intensive commitment to innovation is a costly and time-consuming strategy. The biggest pitfall of the Analyzer strategy is in the so-called "half" implementation of both areas.

In case Techstall wants to keep focusing on the Defender strategy, it will have to increase its focus on its existing products and services. In this case, Techstall will have to focus primarily on incremental innovation, in other words improving the current range of products and services. This strategy involves a lot less risk and costs.

In short: in order to determine which strategy is most fit and viable for Techstall's future, Techstall has to pay close attention to the developments within the market. After choosing this strategy it is important that Techstall show full commitment to this strategy in order to avoid a situation in which Techstall lacks in performance in two fields.

5. Findings

Within this chapter we distinguish our findings in two different sections, the functionality of the IMM and the outcomings of the analysis of the Innovation Management Model. In which the first part represents the practical approach of testing the IMM of Löwik (Löwik, Innovation management model, 2017) and the second part the theoretical approach.

5.1 Functionality of the IMM

In order to test the functionality of the IMM we performed a case study at Techstall BV, which can be found in the previous chapter. Main goal of this case study was to discover whether the IMM of Löwik was able to provide the expected and intended results of an innovation measurement study. In this the intended results are as follows: The outcomings of the IMM should present a “profile sketch” of the organizations current situation regarding innovation activities and the organizations “fitness” to perform innovation.

As can be seen in the analysis of the results of Techstall, we conclude that by combining the IMM with the Miles & Snow typology, a defender innovation strategy can be defined. Because Miles & Snow define four different types of innovation typologies, each typology has its own characteristics. These can be found in the appendix.

With performing the case study at Techstall we can conclude that the IMM can provide solid basis to analyze an organization’s innovation performance and to sketch a profile of this organization. This because of its practical usability, firm results and respondents experience.

A side note is that because the IMM does not offer a corresponding measurement method yet a specific tool was created to fill in the IMM. In order to let the IMM functionate we needed another theory or approach that enables researchers to measure how an organization performs in the multiple disciplines/factors.

5.2 Outcomings Innovation Measurement Model Analysis

Secondly we focus on answering the research question: To what extent does the newly created innovation measurement tool of Löwik (2017) meet the critical innovation measurement components and does it provide insights to help improve an organization’s innovation management in a systematic way?

To answer this question we discovered multiple key performance indicators by analyzing three well established innovation measurement methods, the Malcolm Baldrige, EFQM and the Balanced Scorecard. By analyzing these three methods we discovered the following six KPI’s:

- 1) Well established innovation measurement methods make use of a multidisciplinary approach.
- 2) Well established innovation measurement methods measure both the internal as external situation of the organization.
- 3) Well established innovation measurement methods measure the innovation capacity of the working staff within organizations
- 4) Well established innovation measurement methods measure the way how organizations focus on their current/potential customers.
- 5) Well established innovation measurement methods measure the intercorrelation between the to be measured disciplines.

- 6) Well established innovation measurement methods measure if an organization is controlled with an innovative mindset by analyzing the organization's strategy, partnerships and leadership.

1. multidisciplinary approach

The first Key performance indicator is that well established innovation measurement methods make use of a multidisciplinary approach. When looking at the Innovation Measurement Method of Löwik (2017) we can see that the IMM in total mentions 12 different factors namely: Innovation strategy long-term, Innovation strategy short-term, resources, competences, opportunity recognition, opportunity development, opportunity exploitation, leadership, market developments, societal developments, technological developments and partners.

The IMM is therefore compared to the Malcolm Baldrige, EFQM and the Balanced Scorecard the innovation measurement method with the most extensive multidisciplinary approach. It can thus be said that the IMM fits the KPI of having a multidisciplinary approach.

2. Internal and external focus

The second KPI is that well established innovation measurement methods measure both the internal as external situation of the organization. By looking at the chapter 2.4 in which the IMM has been described we noticed that the IMM indeed contains both internal as external factors. To represent the internal factors (the factors that can directly be influenced by the organization) these have been placed within the pyramid, the external factors have been placed outside of the pyramid. It can thus be said that the IMM also fits the internal and external focus KPI.

3. Working staff

The third KPI that has been analyzed within well-established innovation measurement methods is that they measure the innovation capacity of the working staff within organizations. When looking at the IMM of Löwik we can determine that the innovation capacity of the working staff has common ground with Competences. The competences factor is an internal factor and has been presented on the pyramids tactical level (middle level). The fact that competences has been placed on the middle level shows that it is of great importance for achieving the innovation strategy (which is presented in the top of the pyramid). Although working force and competences have common ground it is not possible to put both variables on a same level. It can therefore be said that the working staff KPI is fulfilled only partially.

4. Customer focus

The fourth KPI that has been discovered within the Malcolm Baldrige, EFQM and the Balanced Scorecard is that well established innovation measurement methods measure the way how organizations focus on their current/potential customers.

As we take a look at the IMM we can see that although customer focus has not been mentioned explicitly, it does play a role. Instead of focusing on customers specifically, the IMM has chosen to analyze developments on the market. We can therefore state that the IMM also only partially fulfills this KPI.

5. Intercorrelation

The fifth KPI to which we reflect the IMM is that well established innovation measurement methods measure the intercorrelation between the to be measured disciplines. That intercorrelation is an important topic within the IMM of Löwik can in first instance be seen at the ‘arrows’ between the factors within the pyramid and the external factors. Besides the presented arrows other intercorrelation can be found between the lines within the pyramid. It can therefore be said that IMM also contains the fifth KPI that has been discovered.

6. Innovative management

The final key performance indicator well established innovation measurement methods contain is that they measure if an organization is controlled with an innovative mindset by analyzing the organization’s strategy, partnerships and leadership. By looking at the IMM Pyramid we can see that all three components (strategy, partnerships and leadership) are present. Strategy is positioned in the top of the pyramid as innovation strategy long-term and innovation strategy short-term. Strategy is presented within the top of the pyramid because within an innovative organization it should functionate as an overarching factor to which other factors will have to adapt.

Overview

Whether the IMM fulfills the multiple key performance indicators has been presented in figure 5.1. Because no KPI’s were fully absent we distinguish the KPI’s in green, fully present, and orange, partially present.

Key performance indicator	The IMM by Löwik (2017).....
1. multidisciplinary approach	has a very extensive multidisciplinary approach
2. Internal and external focus	focuses on both the internal as external situation
3. Working staff	the IMM only partially analyses working staff
4. Customer focus	the IMM only partially analyses costumer focus
5. Intercorrelation	looks for intercorrelation on multiple levels
6. Innovative management	analyses whether an organization is controlled with an innovative mindset

Figure 5.1 KPI Score IMM

6. Discussion and conclusion

This paper contributes to the research about measuring an organizations innovation performance. Within this paper the following research questions is answered: To what extent does the newly created innovation measurement tool Löwik (2017) meet the critical innovation measurement components and does it provide insights to help improve an organization's innovation management in a systematic way?

To answer this research question we made use of two types of analysis, a case study at Techstall and a comparison of the innovation measurement method (IMM) with well-known and established innovation measurement methods. In order to perform the case study, an innovation measurement tool based on the IMM is created, this tool has been filled in by multiple managers of Techstall. By analyzing the tool results it can be concluded that Techstall wields a Defender strategy which fits to the organizational factors within Techstall. By presenting and discussing the results of the tool, the respondents confirmed that Techstall can be recognized within the produced results.

By comparing and analyzing the Malcolm Baldrige, the EFQM and the Balanced Scorecard we were able to draw up multiple key performance indicators that can be recognized in well-established innovation measurement methods. By reflecting the discovered KPI's with the IMM, it can be concluded that the IMM possesses all KPI's that make a useful innovation measurement method at least partially.

When putting both results together we can conclude that the IMM of Löwik (2017) meets critical innovation measurement KPI's and provides insights to help improve an organization's innovation management in a systematic way. Furthermore it must be seen as a welcome strengthening and addition in the existing and available scope of innovation measurement methods.

After reading this paper multiple issues should be taken into consideration. As this research mainly focuses on testing and analyzing the IMM, the innovation measurement tool was composed with acceptable care. It can therefore be advised that in future occasions a more detailed study on how the IMM can be measured in practice should be performed.

Another issue that should be taken into account is that the IMM of Löwik makes use of no less than 12 disciplines, which is quite more than the well-known and established innovation measurement methods that have been analyzed. Important questions that remain are therefore: what is the maximum number of disciplines that an innovation measurement method should measure and is the IMM of Löwik to extensive?

To lift the IMM to a higher level I would therefore recommend to decrease the number of factors to a maximum of 8 factors in order to be easy interpreted and applied by new adopters. An additional benefit of decreasing the number of factors will be that applying the IMM will be less time-consuming and results can be more easier analyzed.

Another suggestion for the IMM to be easier interpreted is to give a clear visualization of which factors can be affected by organizations and which factors are beyond the control of the organization.

With today's knowledge an improvement within this study could have been made by performing a more in-depth research in the antecedents of innovation and to what extent these can be found in the IMM of Löwik.

7. Reference List

- Aaker, D. A. (2014). *Strategic Market Analysis*. Berkeley: University of California at Berkeley.
- Arnold, J., Arad, S., Rhoades, J., & Drasgow, F. (2000). The empowering leadership questionnaire: the construction and validation of a new scale for measuring leader behaviors. *Journal of organizational behavior*, 249-269.
- Bagheri, A. (2017). The impact of entrepreneurial leadership on innovation work behavior and opportunity recognition in high-technology SMEs. *The Journal of High Technology Management Research*, 159-166.
- Banu, G. S. (2018). Measuring innovation using key performance indicators. *Procedia Manufacturing*, 906-911.
- Barney, J. (1991). Firm Resources and Sustained competitive advantage. *Journal of Management*, 99-120.
- Bass, B., & Avolio, B. (1994). *Improving Organizational Effectiveness Through Transformational Leadership*. Thousand Oaks: Sage Publications Inc.
- Baum, R., & Wally, S. (2003). STRATEGIC DECISION SPEED AND FIRM PERFORMANCE. *Strategic Management Journal*, 1107-1129.
- Bilodeau, B., & Rigby, D. (2007). Selecting Management Tools Wisely. *Harvard Business Review*.
- Cai, L., Chen, B., Chen, J., & Bruton, G. (2017). Dysfunctional competition & innovation strategy of new ventures as they mature. *Elsevier*, 111-118.
- Calik, E., Calisir, F., & Cetinguc, B. (2017). A Scale Development for Innovation Capability. *Journal of Advanced Management Science*, 69-76.
- Chen, T.-J., Wu, C.-M., & Wang, Y.-C. (2015). Impact of Transformational Leadership Behaviors and Psychological Optimism on Subordinate Performance in Taiwan's Tourism Hotel Industry. *Open Journal of Social Sciences*, 174-179.
- Chesbrough, H. (2003). *The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press.
- Clausen, T. H., Korneliusson, T., & Madsen, E. L. (2013). Modes of innovation, resources and their influence on product innovation: Empirical evidence from R&D active firms in Norway. *Technovation*, 225-233.
- Cohen, W., & Levinthal, D. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 128-152.
- Conant, J., Mokwa, M., & Varadarajan, R. (1990). Strategic Types, Distinctive Marketing Competencies and Organizational Performance: A. *Jstor*, 365-383.
- Cooper, R., Edgett, S., & Kleinschmidt, E. (2004). BENCHMARKING BEST NPD PRACTICES—I. *Research Technology Management*, 31-44.
- Dawes, J. (2007). Do data characteristics change according to the number of scale points used? *International Journal of Market Research*, 61-77.
- Dziallas, M., & Blind, K. (2018). Innovation indicators throughout the innovation process: An extensive literature analysis. *Technovation*.
- EFQM, E. F. (2013). EFQM Excellence Model. *EFQM*.
- Garvin, D. A. (1991). How the Baldrige award really works. *Harvard Business Review*, 1.
- Gerlach, S., & Brem, A. (2017). Idea management revisited: A review of the literature and guide for implementation. *International Journal of Innovation Studies*, 144-161.

- Ghosh, A., Kato, T., & Morita, H. (2017). Incremental innovation and competitive pressure in the presence of discrete innovation. *Journal of Economic Behavior & Organization*, 1-14.
- GSQC, G. S. (2010). The Malcolm Baldrige Criteria for Performance Excellence. *Baldrige National Quality Program*.
- Gu, H., Duverger, P., & Yu, L. (2017). Can innovative behavior be led by management? A study from the lodging business. *Elsevier*, 144-157.
- Guisado-González, M., Vila-Alonso, M., & Guisado-Tato, M. (2016). Radical innovation, incremental innovation and training: Analysis of complementarity. *Technology in Society*, 48-54.
- Hamel, G. (2002). Leading the revolution. *Plume*, 1.
- Henderson, B. (1970). Product Portfolio. *Boston Consulting Matrix*.
- Horth, D., & Buchner, D. (2014). Innovation Leadership: How to use innovation to lead effectively, work collaboratively, and drive results. *Center for creative leadership*.
- Hunt, S., & Madhavaram, S. (2006). The service-dominant logic of marketing: dialog, debate, and directions,. *Elsevier*, 67-84.
- Ivanov, C.-I., & Avasilcăi, S. (2014). Measuring the performance of innovation processes: A Balanced Scorecard Perspective. *Social and Behavioral Sciences 109* , 1190-1193.
- Ivanov, C.-I., & Avasilcăi, S. (2014). Performance measurement models: an analysis for measuring innovation processes performance. *Procedia - Social and Behavioral Sciences* , 397-404.
- Jansen, J., & Van den Bosch, J. (2005). Managing Potential and Realized Absorptive Capacity: How do Organizational Antecedents matter? *ERIM REPORT SERIES RESEARCH IN MANAGEMENT*, 1-44.
- Jaworski, B., & Kohli, A. (1993). Market Orientation: Antecedents and Consequences. *Journal of Marketing*, 53-70.
- Johnson, D., & Young, R. (2011). Toward Best Practices in Analyzing Datasets with Missing Data: Comparisons and Recommendations. *Journal of Marriage and Family*, 926-945.
- Kahn, K., Barczak, G., & Moss, R. (2006). PERSPECTIVE: Establishing an NPD Best Practices Framework. *Product Innovation Management*, 106-116.
- Kaplan, R. S., & Norton, D. P. (1996). strategic learning & the balanced scorecard. *Strategy & Leadership*, 18-24.
- Krane, H. P., Johansen, A., & Alstad, R. (2014). Exploiting Opportunities in the Uncertainty Management. *Procedia - Social and Behavioral Sciences*, 615-624.
- Kwon, B. G., Chung, S., Park, S., & Saido, K. (2018). Qualitative assessment to determine internal and external factors influencing the origin of styrene oligomers pollution by polystyrene plastic in coastal marine environments. *Environmental pollution*, 167-173.
- Lavie, D., Stettner, U., & Tushman, M. (2010). Exploration and Exploitation Within and across organizations. *The Academy of Management Annals*, 109-155.
- Lazar, J., Feng, J. H., & Hochheiser, H. (2017). Chapter 11 – Analyzing qualitative data. *Research Methods in Human Computer Interaction (Second Edition)*, 299-327.
- Lendel, V., Hittmár, S., & Siantová, E. (2015). Management of Innovation Processes in Company. *Elsevier*, 861-866.

- Lichtenthaler, U. (2009). Absorptive Capacity, Environmental Turbulence, and the Complementarity of Organizational Learning Processes. *Academy of Management Journal*, 822-846.
- Lopez-Cabralez, A., Pérez-Luno, A., & Valle Cabrera, R. (2009). Knowledge as a mediator between HRM practices and innovative activity. *Human Resource Management*, 485-503.
- Love, J., Roper, S., & Vather, P. (2014). Dynamic complementarities in innovation strategies. *Elsevier*, 1774-1784.
- Löwik, S. (2017). Berkelland innovatie vragenlijst. *University of Twente*.
- Löwik, S. (2017). Innovation management model. *University of Twente*.
- Lubatkin, M., Simsek, Z., Ling, Y., & Veiga, J. F. (2006). Ambidexterity and Performance in Small-to Medium-Sized Firms: The Pivotal Role of Top Management Team Behavioral Integration. *Journal of Management*, 646-672.
- Lumpkin, G., & Dess, G. (2001). Linking two dimensions of entrepreneurial orientation to firm performance: The moderating role of environment and industry life cycle. *Journal of Business Venturing*, , 429-451.
- Maine, E., Soh, P.-H., & Dos Santos, N. (2015). The role of entrepreneurial decision-making in opportunity creation and recognition. *Technovation*, 53-72.
- management, P. o. (2012, November 30). *EFQM excellence model*. Retrieved from principles of management: <http://principlesofmanagement.org/blog/2012/11/30/efqm-excellence-model/>
- Mattes, F., & Ohr, R.-C. (2013). Balancing Innovation Via Organizational Ambidexterity. *Organization & Culture*, Part 1.
- Miles, R., Snow, C., Meyer, A., & Coleman, H. (1978). Organizational Strategy, Structure, and Process. *The Academy of Management Review*, 546-562.
- Navarro-Garcia, A., Arenas-Gaitán, J., & Rondán-Cataluna, J. (2014). External environment and the moderating role of export market orientation. *Journal of Business Research*, 740-745.
- Neitzel, J., & Earle, T. (2014). Dual-tier approach to societal evolution and types. *Journal of Anthropological Archaeology*, 181-195.
- Nicholas, J., Ledwith, A., & Perks, H. (2011). New product development best practice in SME and large organisations: theory vs practice. *European Journal of Innovation Management*, 227-251.
- O'Reilly, C., Tushman, & L., M. (2014). The Ambidextrous Organization. *Harvard Business Review*.
- Ostendorf, J., Mouzas, S., & Chakrabarti, R. (2014). Innovation in business networks: The role of leveraging resources. *Industrial Marketing Management*, 504-511.
- Oxford-Dictionary. (2019, December 16). *Intercorrelation*. Retrieved from Lexico: <https://www.lexico.com/definition/intercorrelation>
- Ozkaya, E., Droge, C., Hult, T., Calantone, R., & Ozkayaa, E. (2015). Market orientation, knowledge competence, and innovation. *International Journal of Research in Marketing*, 309-318.
- Park, J. Y., & Nagy, Z. (2018). Comprehensive analysis of the relationship between thermal comfort and building control research - A data-driven literature review. *Renewable and Sustainable Energy Reviews*, 2664-2679.

- Parnell, J. A., & Wright, P. (1993). Generic strategy and performance: an empirical test of the Miles and Snow typology. *British Journal of Management*, 29-36.
- Pasban, M., & Nojehdeh, S. (2016). A Review of the Role of Human Capital in the Organization. *Procedia - Social and behavioral sciences*, 249-253.
- Piccoli, G., & Ives, B. (2005). IT-Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review, Synthesis, and analysis. *The Oxford Handbook of Management Information Systems*, 747-776.
- Pisano, G. (2015). You Need an Innovation Strategy. *Harvard Business Review*, 44-54.
- Prajogo, D. (2016). The strategic fit between innovation strategies and business environment in delivering business performance. *Elsevier*, 241-249.
- Rigby, D. (2001). Management Tools and Techniques: A Survey. *California Management Review*, 139-160.
- Sadovnikova, A., Pujari, A., & Mikhailitchenko, A. (2016). Radical innovation in strategic partnerships: A framework for analysis. *Journal of Business Research*, 1829-18233.
- Saunila, M. (2016). Performance measurement approach for innovation capability in SME's. *International Journal of productivity and performance management*, 162-176.
- Stafford, T., Thirkettle, M., & Walton, T. (2012). A Novel Task for the Investigation of Action Acquisition. *PlosOne*.
- Stemler, S. (2001). An overview of content analysis. *Practical Assessment, Research & Evaluation*, 137-146.
- Stock, T., Obenaus, M., Slaymaker, A., & Seliger, G. (2017). A Model for the Development of Sustainable Innovations for the Early Phase of the Innovation Process. *Procedia Manufacturing*, 215-222.
- Teece, D., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 509-533.
- Tohidi, H., & Jabbari, M. M. (2012). Providing a Framework for Measuring Innovation within Companies. *Procedia Technology*, 583-585.
- Treacy, M., & Wiersema, F. (1993). Customer Intimacy and Other Value Disciplines. *Harvard Business Review*, .
- Tung, F., & Yu, T. (2016). Does innovation leadership enhance creativity in high-tech industries? *Leadership & Organization Development Journal*, 579-592.
- Van Minh, N., Badir, Y., Ngoc Quang, N., & Afsar, B. (2017). The impact of leaders' technical competence on employees' innovation and learning. *Journal of Engineering and Technology Management*, 44-57.
- Wang, Q., Qiu, P., Zhu, D., & Mitkova, L. (2015). Identification of technology development trends based on subject-action-object analysis: The case of dye-sensitized solar cells. *Technological Forecasting and Social Change*, 24-46.
- Wernerfelt, B. (1984). A Resource-Based View of the Firm. *Strategic Management Journal*, 171-180.
- Wildridge, V., Childs, S., Cawthra, L., & Madge, B. (2004). How to create successful partnerships—a review of the literature. *Health information and libraries journal*, 3-19.
- Wittkuhn, K. (2011). A FRAMEWORK FOR PERFORMANCE MODELS. *Performance Improvement*, 26-31.

8. Appendix

Innovation Measurement Tool

*Analyzing innovation performance at
Techstall*

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Date: July 20, 2018

Name & Function:

Fill in date:

Duration of filling in:

Introduction page

First I would like to thank you for finding time to take part in this thesis. On this page you will find a brief introduction about the list of questions, the goal of this thesis, questioning and how your inputs are processed.

Please print this list of questions and scan after filling in.

Goal of the thesis

Goal of this thesis is providing insight and analyze the innovation process of the organization in which you are active. Output of this list of questions will be used as input for further analysis, to which a comprehensive advice about how to improve the organizations innovation process will be given.

Questioning

The list of questions will exist out of multiple different types of questions which in most cases will be easily understood. Besides questions, statements will be used which can be answered on a 5 or 7 point scale (fully agree – fully disagree). Watch out! In some parts scales are turned (Fully disagree – Fully agree)

Processing input

In order to give full freedom in answering/filling in the list of questions, outputs will be presented anonymously. The reason why we do ask your name is to solve possible distortions that might occur after filling in the list of questions.

Contact

In case parts or questions within the list of questions are unclear please get in contact with the contacts presented on the front page.

- Section A: Innovation Strategy
- Section B: Ambidexterity
- Section C: Resources
- Section D: Competences
- Section E: Technology -recognition / development/ exploitation
- Section F: Innovative Leadership
- Section G: Strategic Alliances
- Section H: Market, Societal and Technological developments

Section A: Innovation Strategy

The first list of questions is drawn and validated by Conant et al. (Conant, Mokwa, & Varadarajan, 1990) The 11 scale items comprising the final instrument correspond to the 11 adaptive cycle dimensions in the Miles and Snow typology. After each answering possibility the belonging typology is given: (D) = Defender, (P) = Prospector, (A) = Analyzer and (R) = Reactor.

1. Entrepreneurial-product market domain. In comparison to other competitors, the services which we provide to our members are best characterized as:
 - a) Services which are more innovative, continually changing and broader in nature throughout the organization and marketplace.
 - b) Services which are fairly stable in certain units/departments and markets while innovative in other units/departments and markets
 - c) Services which are well focused, relatively stable and consistently defined throughout the organization and marketplace.
 - d) Services which are in a state of transition, and largely based on responding to opportunities or threats from the marketplace or environment.
2. In contrast to our competitors, we have an image in the marketplace as a firm which:
 - a) Offers fewer, selective services which are high in quality.
 - b) Adopts new ideas and innovations, but only after careful analysis.
 - c) Reacts to opportunities or threats in the marketplace to maintain or enhance our position.
 - d) Has a reputation for being innovative and creative.
3. The amount of time our company spends on monitoring changes and trends in the marketplace can best be described as:
 - a) Lengthy: We are continually monitoring the marketplace.
 - b) Minimal: We really do not spend much time monitoring the marketplace.
 - c) Average: We spend a reasonable amount of time monitoring the marketplace.
 - d) Sporadic: We sometimes spend a great deal of time and at other times spend little time monitoring the marketplace.
4. In comparison to our competitors, the increases or losses in demand which we have experienced are due most probably to:

- a) Our practice of concentrating on more fully developing those markets which we currently serve.
 - b) Our practice of responding to the pressures of the marketplace by taking few risks.
 - c) Our practice of aggressively entering into new markets with new types of service offerings and programs.
 - d) Our practice of assertively penetrating more deeply into markets we currently serve, while adopting new services only after careful review of their potential.
5. In comparison to other firms in our industry, one of our most important goals is our dedication and commitment to:
- a) Keep costs under control.
 - b) Analyze our costs and revenues carefully, to keep costs under control and to selectively generate new products and services or enter new markets.
 - c) Insure that the people, resources and equipment required to develop new products and services and new markets are available and accessible.
 - d) Make sure that we guard against critical threats by taking whatever action is necessary.
6. In contrast to others in our industry, the skills which our managers possess can best be characterized as:
- a) Analytical: their skills enable them to both identify trends and then develop new offerings or markets.
 - b) Specialized: their skills are concentrated into one or a few specific areas.
 - c) Broad and Entrepreneurial: their skills are diverse, flexible, and enable change to be created.
 - d) Fluid: their skills are related to near-term demands of the marketplace.
7. The one thing that differentiates products from our company from others in the industry is that we:
- a) Are able to carefully analyze emerging trends and adopt only those which have proven potential.
 - b) Are able to do a limited number of things exceptionally well.
 - c) Are able to respond to trends even though they may possess only moderate potential as they arise.
 - d) Are able to develop consistently new products, services, and markets.
8. More than many other firms in our industry, our management staff tends to concentrate on:
- a) Maintaining a secure financial position through cost and quality control measures.
 - b) Analyzing opportunities in the marketplace and selecting only those opportunities with proven potential, while protecting a secure financial position.
 - c) Activities or business functions which most need attention given the opportunities or problems we currently confront.
 - d) Developing new products and services and expanding into new markets or market segments.

9. In contrast to many other firms in our industry, our organization prepares for the future by:
- Identifying the best possible solutions to those problems or challenges which require immediate attention.
 - Identifying trends and opportunities in the marketplace which can result in the creation of products or services which are new to the industry or which reach new markets.
 - Identifying those problems which, if solved, will maintain and then improve our current service offerings and market position.
 - Identifying those trends in the industry which other firms have proven possess long-term potential while also solving problems related to our current offerings and our current customers' needs.
10. In comparison to others in the industry, the structure of my organization is:
- Functional in nature: organized by department-marketing, accounting, personnel, etc.
 - Product, service or market-oriented: organized by product or service offered or by market served.
 - Primarily functional in nature; however, a product, service or market-oriented structure does exist in newer or larger areas.
 - Continually changing to enable us to meet opportunities and solve problems as they arise.
11. Unlike many of our competitors, the procedures used in our organization to evaluate our performance are best described as:
- Decentralized and participatory, encouraging many organizational members to be involved.
 - Heavily oriented toward those reporting requirements which demand immediate attention.
 - Highly centralized and primarily the responsibility of senior management.
 - Centralized in more established areas and more participatory in newer areas.

Section B: Ambidexterity

The following questions are about the field of orientation of your organization at this moment. Please mark the rate of agreement or non-agreement per quote.

		Fully Disagree			Fully Agree	
1	Our firm commits to improve quality and lower cost	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	Our firm looks for novel ideas by thinking "outside the box"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	Our firm continuously improves the reliability of its products and services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	Our firm bases its success on its ability to explore new techniques and methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	Our firm creates products or services that are innovative to the firm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6	Our firm increases the levels of automation in its operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	Our firm looks for creative ways to satisfy its internal or external customers' needs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	Our firm constantly thesiss existing internal or external customers' satisfaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	Our firm fine-tunes what it offers to keep its current internal or external customers satisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	Our firm aggressively ventures into new knowledge domains	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	Our firm penetrates more deeply into its internal or external existing customer base	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	Our firm actively targets new internal or external customer groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section C: Resources

This section consist out of four components: Financial capital, Physical capital, Human capital and organizational capital.

Financial capital

What percentage of revenues is spend on R&D?

The following calculation method is fit:

R&D as % of sales = (R&D spending's/total sales revenue) x 100%= _____

Physical capital

_____ % of our products is patented

Our company is characterized by its open and innovative culture.

Fully agree					Fully disagree	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In most cases our organization has the right features and technologies to exploit ideas and potential innovations.

Fully agree					Fully disagree	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Human capital

The following part contains questions about the culture within your organization at this moment.

De volgende vragen gaan over de cultuur binnen uw bedrijf op dit moment. Please mark the rate of agreement or non-agreement per quote.

		Zeer mee eens				zeer mee oneens			
1	In ons bedrijf begrijpen medewerkers het belang van kennis voor het succes van het bedrijf	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
2	In ons bedrijf worden medewerkers aangemoedigd om anderen om hulp te vragen waar nodig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
3	In ons bedrijf wordt een hoge mate van inzet verwacht bij het verkrijgen en delen van kennis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
4	In ons bedrijf worden medewerkers aangemoedigd om te onderzoeken en te experimenteren	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
5	In ons bedrijf is de algehele visie duidelijk vastgesteld	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
6	In ons bedrijf worden praktijkopleiding en scholing gewaardeerd	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
7	In ons bedrijf worden medewerkers aangemoedigd om met andere afdelingen contacten te onderhouden	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
8	In ons bedrijf worden medewerkers gewaardeerd om hun individuele vakkennis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
9	In ons bedrijf worden medewerkers gestimuleerd om hun werk met andere afdelingen te bespreken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
10	In ons bedrijf worden medewerkers gestimuleerd om kennis te delen met externe organisaties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
11	In ons bedrijf geloven we dat de voordelen van kennisdelen opwegen tegen de kosten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
12	In ons bedrijf zijn de doelstellingen duidelijk geformuleerd	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
13	De leiding van ons bedrijf erkent duidelijk de rol van kennis voor het succes van het bedrijf	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Organizational capital

Our organizational structure is fit for the development of new ideas and innovations.

Fully agree				Fully disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Within our organization a high level of flexibility exists, promising projects in all times get the space they need to develop and exploit it selves.

Fully agree				Fully disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section D: Competences

Absorptive Capacity (Jansen et al, 2005; Lichtenthaler, 2009; Jaworski & Kohli (1993))

Part I

		Zeer mee oneens				zeer mee eens			
1	Our department frequently scans the environment for new knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	Our department thoroughly observes new trends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	Our department observes in detail external sources of new knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	Our department thoroughly collects external knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	In our department we have information on the state-of-the-art external developments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	Our department collects industry information through informal means (e.g. during lunch or during other informal meetings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	In our department we meet with (internal) clients at least once a year to find out what products or services they will need in the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	Employees of our department regularly visit other firms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	Other firms are hardly visited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	Our department periodically organizes special meetings with customers or third parties to acquire new knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	Employees of our department regularly approach third parties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12	Our department is slow to recognize shifts in our industry (e.g. competition, regulation, technology)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	In our department new opportunities to serve our (internal) clients are quickly understood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	Our department quickly analyzes and interpret changing market demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	When our department finds out something important about competitors, it is slow to alert other departments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16	When something important happens to a major customer or market, the whole department knows it in a short period	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17	Our department regularly considers the consequences of changing (market) demands in terms of new products, services or processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18	In our department employees record and store newly acquired knowledge for future reference	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19	Our department quickly recognizes the usefulness of new external knowledge to existing knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20	In our department employees hardly share practical experiences (reverse coded)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21	We laboriously grasp the opportunities for our department from new external knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22	Our department periodically meets to discuss consequences of market trends and new product development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23	It is clearly known how activities within our department should be performed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24	(Internal) Client complaints fall on deaf ears in our department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25	Our department has a clear division of roles and responsibilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26	Our department constantly considers how to better exploit knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

27	Our department has difficulty implementing new products and services (reverse coded)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28	In our department employees have a common language regarding our products, services or processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Part II

1. Role of NPD in achieving overall business goals

- a) Pet projects are prevalent
- b) NPD goals are clearly aligned with organization mission and strategic plan
- c) Pet projects are minimized
- d) Most NPD projects fit with mission, but some pet projects that do not fit mission may exist

2. Strategic arenas defined (strategic focus):

- a) NPD products, programs or services are identified for regular updating
- b) Strategic plan identifies areas of opportunity
- c) Mission and strategic plan help define strategic arenas for new opportunities.
- d) NPD projects are identified during budget processes and resources allocated accordingly

3. Clearly defined NPD goals

- a) Clearly defined and organization awareness of NPD goals
- b) No goals
- c) Clearly defined and organizationally visible NPD goals
- d) Unclear NPD goals

4. Long term commitment

- a) Long-term, strategic view of NPD
- b) Our NPD is strategically mid-long term aimed
- c) Short term, tactical view of NPD
- d) Our NPD is operationally short mid-long aimed

5. Portfolio management: prioritization

- a) No prioritization of NPD projects
- b) NPD prioritization is based on categories of risks and rewards
- c) NPD prioritization occurs during annual budget process
- d) There is a systematic ranking or prioritization of projects

6. A formal process for NPD:

- a) Informal, decentralized NPD process exists where different groups use their own tailored process
- b) A common NPD process cuts across organizational groups

- c) One formal stage-gate type process is employed for the entire organization
 - d) No NPD process exists
7. Clearly defined criteria to evaluate projects at gates
- a) Only high-risk project have formal 'go/no go/ criteria.
 - b) Criteria for evaluating NPD projects are not defined
 - c) Go/no go criteria are clear and pre-defined for each review gate
 - d) A few standard criteria are used for evaluation of project activity
8. Designated manager or process owner:
- a) There is no NPD process owner or champion
 - b) One individual or group can be readily identified as the process manager
 - c) There is a clearly designated manager or process owner
 - d) The process can be readily circumvented by anyone
9. Selection of projects:
- a) Projects are never killed
 - b) Some projects may be killed/dropped
 - c) Projects can be killed/stopped at any time
 - d) After serious evaluation, at a No-Go projects really do get killed
10. Use of cross-functional teams:
- a) NPD is decentralized within each business unit/department
 - b) Cross-functional teams underlie the NPD process
 - c) Department liaisons comprise established NPD teams
 - d) NPD is performed by individuals
11. Test market/concept testing or trial to a limited set of customers:
- a) Concept testing, product testing and market testing are used in some, but not all NPD projects
 - b) Vindt No concept, product or market testing undertaken
 - c) Concept, product and market testing is consistently undertaken and expected with all NPD projects
 - d) Pilot testing predominant form of testing
12. Methods like lean start-up, design thinking, scrum development and rapid prototyping
- a) We do not know
 - b) Are especially used by people who work within the NPD department.
 - c) Some aspects are incidentally used.
 - d) Are part of our organization and processes.

Section E: Technology -recognition / development/ exploitation

1. How many time do you spend on average a week on the development of innovations regarding existing products?

2. The working environment I am currently in has a positive influence on generating new ideas

Fully agree					Fully disagree	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Which ideas regarding existing or new products or processes have been recognized the past two years?

4. Which of these ideas are currently still in the development stage?

5. Which of these ideas have currently been implemented successfully?

6. Looking at the past two years, an average innovation project (opportunity recognition – exploitation) within our organization has had an average duration of:

7. Succes ratio, what percentage of the innovation projects that have been exploited the past two years met with profit expectations?

Section F: Innovative Leadership

		Fully Agree		Fully Disagree		
1	My manager listens to our ideas and suggestions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	My manager uses our suggestions to make decisions that affect us	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	My manager gives all of us a chance to voice their opinions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	My manager considers our ideas when he/she disagrees with them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	My manager makes decisions that are based only on his/her own ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	My manager gets the right people involved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	My manager gets key decision makers involved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	My manager gets problems into the hands of those who can solve them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section G: Strategic Alliances

- Please fill in the number of collaborations concerning innovation projects your organization has had with different types of partners in the last three years (2016-2018)

		1	2	3	4	5	6
	Number of Partners	0	1-2	3-5	6-10	11-25	>25
1	Clients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Consultants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Competitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5	Government agencies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Knowledge institutions (Universities, TNO, Kema)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Educational institutions (VMBO, MBO, HBO)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Companies from other workfields.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Regarding the past 12 months, please rate the following collaboration motives on importance

		zeer onbelangrijk			zeer belangrijk	
1	Share risks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	Share costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	Partner's expertise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	Access to markets/sales channels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	Request of a client/supplier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	Usage of intellectual licences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	Being short in capacity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	other,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section H: Market, Societal and Technological developments

The following quotes concern the external orientation of your organization at this moment. Please fill in the extent of agreement on the multiple quotes.

Part I

		Fully Agree			Fully Disagree	
	Dynamism	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	Our firm must frequently change its products and practices to keep up with competitors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	Products/services quickly become obsolete in our industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	Actions of competitors are quite easy to predict	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	Consumer tastes are fairly easy to forecast in our industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	Technology changes quickly in our industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Munificence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	There are few external threats to the survival and well-being of our firm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	Our markets are rich in investment capital	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	Economic development programs offer sufficient support for our business community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	Our markets are rich in profitable opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	Our firm operates in a threatening business environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Part II

		Fully Agree			Fully Disagree	
1	Typerend voor ons bedrijf is dat wij acties initiëren waarop de concurrentie reageert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	Over het algemeen legt de directie een sterke nadruk op onderzoek & ontwikkeling, technisch leiderschap en innovatie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	Ons bedrijf heeft de voorkeur voor risicovolle projecten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4	Ons bedrijf heeft ook als doelstelling (impliciet of expliciet) om de concurrentie hard aan te pakken	0	0	0	0	0	
5	Ons bedrijf is zelden de eerste die innovaties introduceert	0	0	0	0	0	
6	Vanwege de omgeving waarin wij opereren zijn er ingrijpende en risicovolle acties nodig om de doelstellingen van ons bedrijf te halen	0	0	0	0	0	
7	Ons bedrijf heeft de afgelopen 5 jaar heel veel innovaties in de markt gezet	0	0	0	0	0	
8	In vergelijking met onze concurrenten is ons bedrijf uiterst agressief en intens competitief	0	0	0	0	0	
9	Wat betreft de introductie van nieuwe producten heeft het management team de neiging de marktleider te volgen	0	0	0	0	0	
10	In ons bedrijf zijn veranderingen in productlijnen of dienstesoorten meestal erg ingrijpend	0	0	0	0	0	
11	In zekere zin zetten wij alles op alles om er zeker van te zijn dat we kansen benutten	0	0	0	0	0	
12	Onze verkoopmedewerkers wisselen regelmatig gegevens uit over strategieën van concurrenten	0	0	0	0	0	
13	Onze bedrijfsdoelen zijn voornamelijk gericht op klanttevredenheid	0	0	0	0	0	
14	We reageren snel op bedreigende acties van concurrenten	0	0	0	0	0	
15	In onze organisatie worden zowel positieve als negatieve ervaringen met klanten openlijk met alle afdelingen uitgewisseld	0	0	0	0	0	
		Fully Agree			Fully Disagree		

16	We meten voortdurend de mate waarin onze producten en diensten geïnteresseerd zijn aan en georiënteerd zijn op de wensen van de klant	0	0	0	0	0
17	Onze strategie om concurrentievoordeel te realiseren is gebaseerd op onze kennis over de behoeften van klanten	0	0	0	0	0
18	Alle bedrijfsonderdelen (bijv. marketing, verkoop, R&D, financiën, etc.) werken intensief samen om aan de behoeften van onze klanten tegemoet te komen	0	0	0	0	0
19	Onze bedrijfsstrategieën worden gestuurd door onze overtuigingen over hoe we meerwaarde kunnen bieden aan klanten	0	0	0	0	0
20	Het management team bespreekt regelmatig de sterke punten en strategieën van concurrenten	0	0	0	0	0
21	Al onze managers begrijpen hoe iedereen in ons bedrijf kan bijdragen aan het creëren van waarde voor de klant	0	0	0	0	0
22	Klantentevredenheid wordt regelmatig gemeten	0	0	0	0	0
23	We schenken veel aandacht aan service na verkoop	0	0	0	0	0
24	We delen middelen met andere business units	0	0	0	0	0
25	We richten ons op markten waarin we concurrentievoordelen kunnen behalen	0	0	0	0	0

Section I: Comments

In case any questions or comments come up, please write down in the text box below.

Appendix 2: Miles & Snow, define innovation Typologies

Miles & Snow (1978) have distinguished four different innovation roles in which a company can be placed. In this research, roles are linked on exploration (radical innovation) and exploitation (incremental innovation), which resulted in a four-quadrant framework (figure 2.2).

Analyzer

Companies that score high on both exploration and exploitation are defined as ambidextrous and therefore as Analyzer. By scoring high on both aspects a company shows it is able to explore for new ideas without disturbing or damaging its current activities. Although performing on both aspects might look easy, focusing on two different aspects can be very dangerous. Miles & Snow (1978) therefore state that the successful Analyzer must have the capability to respond quickly when following the lead of key Prospectors while at the same time maintaining operating efficiency in its stable product and market segments.

A major pitfall for an Analyzer is that focusing on both stability and flexibility at the same time, limits the organization's ability to move fully in either direction. Investing time in both exploration and exploitation could lead to inefficiency and ineffectiveness if balance is not maintained.

Lavie et al. (2010) mention that prior research has identified four fundamental solutions for coping with the conflicting demands of exploitation and exploration:

- Contextual Ambidexterity (no separation) / helps resolving tension between exploitation and exploration by suggesting that these activities are maintained simultaneously at any given organizational level.
- Organizational Separation / is a form of spatial buffering, whereby exploration and exploitation occur simultaneously but are positioned within different organizational units.
- Temporal Separation / exploration and exploitation coexist in the same organizational unit but at different points in time, in this way organizations switch between exploration and exploitation.
- Domain Separation / suggests that organizations specialize in either exploitation or exploration in particular organizational domains while balancing these activities across multiple domains. Unlike organizational separation, which buffers exploitation from exploration across organizational units, domain separation can involve the same unit that simultaneously exploits in one domain and explores in another.

Defender

Companies who score low on exploration but high on exploitation are considered to be Defender. A Defender fails or does not try to explore new opportunities which in most cases can be explained by a focus on operational efficiency and incremental innovations. As the name says a Defender tries to defend its current market and techniques by making incremental innovations.

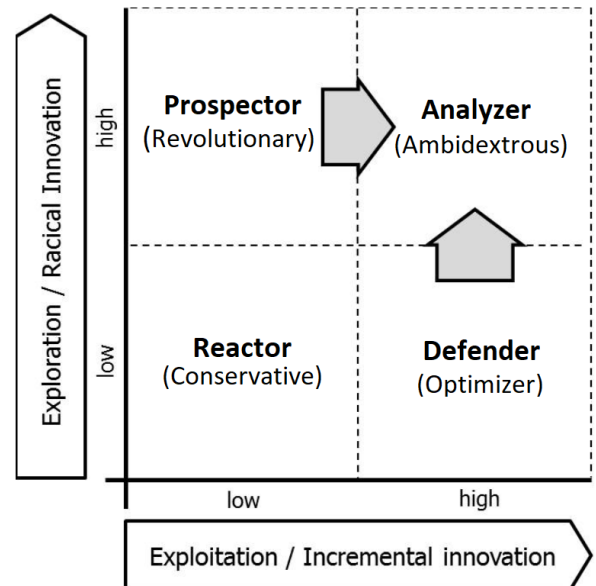


Figure 2.2 Ambidextrous Organization (Reimert, 2018)

These innovations mostly are made upon existing technology and are often improvements in product capacity or production efficiency. (Miles, Snow, Meyer, & Coleman, 1978)

Guisado-González et al. (2016) state that although focusing on exploitation often are well thought decisions, multiple studies find that investing in radical innovation has a positive effect on incremental innovation.

Prospector

Companies who score high on exploration but low on exploitation are considered to be Prospector. Prospector companies want to be revolutionary and therefore focus on radical innovations and try to explore and invent new technologies, products or production methods. A major pitfall for many revolutionary companies is producibility, in other words: can there new development be easily produced and exploited? On the other hand, Ghosh et al. (2017) state that greater competition reduces incremental innovation when radical innovation exists.

For a Revolutionary to become ambidextrous, it should proceed current activities with an addition on the producibility side. The production of innovations with proofed value has to become more efficient in order to keep ahead of competitors that will try to offer similar value.

Reactor

Companies who score low on both exploration as exploitation are defined as Reactor. By fully focusing on current products or services without any innovation activities, companies are acting conservative and are therefore taking huge risks. Henderson (1970) suggests that a 'milking strategy' can be the right strategy for products that are in the 'cash cow quadrant', characteristically these products generate a large amount of cash but are not investment worthy. Henderson (1970) also states that profitability of all products eventually will run out when competition catches up. Thus, companies who do not invest in innovation will be swallowed up by their competitors and do not have right of existence.

To become ambidextrous, conservators need to invest a lot of time and money to create a cultural switch towards a more innovative culture. This includes steps like expanding or creating R&D activities, employing R&D staff and investing in both radical and incremental innovation.

Typology overview

Where the first three typologies can be seen as innovation strategies, Miles and Snow state that the Reactor typology lacks a set of response mechanisms which it can consistently put into effect when faced with a changing environment. The Reactor strategy can therefore be seen as an 'residual strategy', which arises when one of the other three strategies is improperly pursued. Because 'Reactor organizations' are inconsistent, unstable and do not proactively carry out a strategy, IMM factors will not be reflected with the Reactor typology.

Based on characteristics given in the article of Miles & Snow (1978) a profile sketch of the typologies Defender, Analyzer and Prospector is made. Miles & Snow distinguish characteristics on three levels: entrepreneurial level, engineering level and administrative level. To give an elementary overview of a typology's characteristics and the way a typology differentiates with the other two typologies a schematic representation is given in following table.

	Defender	Analyzer	Prospector
Entrepreneurial Level			
Productoffer Domain	Narrow and stable development domain	Hybrid domain that is both stable and changing	Broad and continuously developing domain
Domain Dynamics	Aggressive maintenance of domain	The Analyzer must learn how to achieve and protect an equilibrium between conflicting demands for technological flexibility and for technological stability.	Monitors wide range of environmental conditions and events
Growth Strategy	Cautious and incremental growth primarily through market penetration	Steady growth through market penetration and product-market development	Growth through product and market development
Outside Focus	Tendency to ignore developments outside of domain	Surveillance mechanisms mostly limited to marketing; some research and development	Focus on outside, creating change in the industry
Product Development	Some product development but closely related to current goods or services	Develop solutions that match the organization's existing technological capabilities with the new products desired by product managers.	Creating new products and business in existing or new markets is of great importance
Engineering Level			
Production Strategy	Cost-efficient technology	Dual technological core (stable and flexible component)	Flexible, prototypical technologies.
Production Technology	Single core technology	Large and influential applied engineering group	Multiple production technologies
Possible Integration	Tendency towards vertical integration	Moderate tendency to both horizontal as vertical integration	Tendency towards horizontal integration
Production Design	Continuous improvements in technology to maintain efficiency.	Moderate degree of technical rationality	Low degree of routinization and mechanization; technology

			embedded in people..
Administrative Level			
Important Roles	Financial and production experts most powerful members of the dominant coalition; limited environmental scanning	Marketing and engineering most influential members of dominant coalition, followed closely by production	Marketing and research and development experts most powerful members of the dominant coalition
Production Planning	Planning is intensive, cost oriented, and completed before action is taken	Intensive planning between marketing and production concerning stable portion of domain; comprehensive planning among marketing, engineering, and product managers concerning new products and markets	Planning is comprehensive, problem oriented, and cannot be finalized before action is taken
Organizational Structure	Tendency toward functional structure with extensive division of labor and high degree of formalization	"Loose" matrix structure combining both functional divisions and product groups	Tendency toward product structure with low division of labor and low degree of formalization
Control Structure	Centralized control, simple coordination mechanisms and conflict resolved through hierarchical channels	Moderately centralized control system with vertical and horizontal feedback loops	Decentralized control and short-looped horizontal information systems
Measuring Performance	Organizational performance measured against previous years; reward system favors production and finance.	Performance appraisal based on both effectiveness and efficiency measures, most rewards to marketing and engineering.	Organizational performance measured against important competitors; reward system favors marketing and research and development

Figure 2.3 *typology characteristics* (Miles, Snow, Meyer, & Coleman, 1978)

Appendix 3: Techstall test results

Section A: Innovation Strategy

In the first section of the IMT, respondents was presented a list of questions drawn up by Conant et al. (1990). Within this list of questions, respondents had four answering possibilities all representing one of four Miles & Snow (1978) typologies. Because section A has 11 questions, a total of 44 points can be divided among the typologies. As can be seen in figure 5.1, respondents answered the defender option the most, with an total of 21.

Defender	Analyzer	Prospector	Reactor
21	13	5	5

Figure 5.1 Outcomings section A

As Conant et al. (1990) state in their research, the answering possibility that has been chosen the most can be appointed as the typology the organization executes. In the case of Techstall it can be stated that the innovation strategy is Defender. To give a clear representation about how the outcomings are portioned, a disk chart is presented beside.

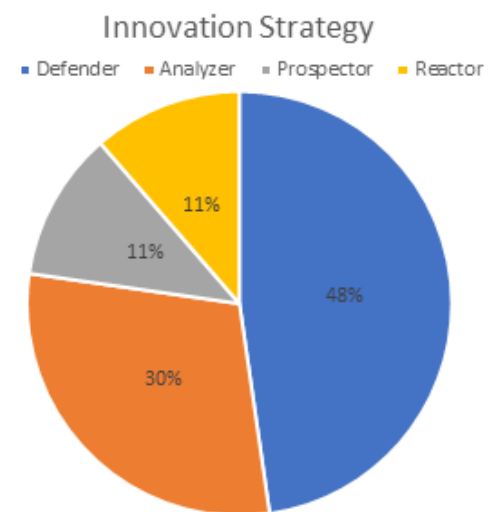


Figure 5.2 percentage outcomings

Section B: Ambidexterity

In the second section of the IMT, twelve statements developed by Lubatkin et al. (2006) had to be answered on a five-point scale in which answering possibilities varied from “fully disagree” to “fully agree”. Looking at the answers given by the four respondents of Techstall in figure 5.3, we can see that most answers are centered in the the middle three answering possibilities.

1	2	3	4	5
3x	9x	14x	20x	2x

Figure 5.3 outcomings section B

As determined by Lubatkin et al. (2006) answers can be analyzed by calculating the average of all answers that were given. In this case, calculation goes as follows:

Exploration					Exploitation						
1	2	3	4	5	1	2	3	4	5		
1	7	8	7	1	x	2	2	6	13	1	x
1	14	24	28	5		2	4	18	52	5	
1 + 14 + 24 + 28 + 5 = 62 total score / 24 answers = 3,0 average					2 + 4 + 18 + 52 + 5 = 81 total score / 24 answers = 3,4 average						

Figure 5.4 average ambidexterity

As can be seen in the calculation above an average score of 3,0 is achieved on the statements about exploration and an average of 3,4 in the field of exploitation. From this we can conclude that although Techstall is slightly more focused on exploitation, they actually are performing quite average in the field of both types of innovation.

Section C: Resources

The C section exists out of four different components: Financial capital, Physical capital, Human capital and organizational capital. Because these components all measure a different angle of an organization’s resources, they all have been measured differently.

In the financial part the organization’s expenditure on R&D was used to evaluate in which extent the organization puts its financial resources in service of innovation. To measure R&D expenditure firm specific, the percentage of total revenue spend in R&D was asked. Looking at the answers (figure 5.5) given by respondents there is a lot disunity. Where 5% of total revenue represents a high commitment to innovation 0% clearly represents the opposite. Because of this large disunity, it is likely that respondents do not have the same intel on the organization’s R&D expenditure.

Respondent I	Respondent II	Respondent III	Respondent IV
2%	0%	0%	5%

Figure 5.5 R&D expenditure

In the Physical capital part of the organization’s resources, all respondents mentioned 0% of all products have been patented. Although Techstall is a company that provides services instead of own made products, patenting products can help Techstall in presenting an innovative character. In the second part of Physical capital, two statements based on Dziallas & Blind (2018) measured that Techstall scores 3.1 (five-point scale) on in which extent there is presence of innovative physical capital.

Human capital was measured by using 12 statements which could be answered on a 7-point scale varying from “fully agree”: 1 to ‘fully disagree’: 7. The outcomings of section C can be found in figure 5.6.

1	2	3	4	5	6	7
1x	7x	7x	8x	5x	20x	4x

Figure 5.6 outcomings human capital

$28 + 120 + 25 + 32 + 21 + 14 + 1 = 241 \text{ total score} / 52 \text{ total answers} = 4,6 \text{ average}$

Figure 5.7 average human capital

Because the answer-scale was turned in comparison to other sections, the calculation of the average (figure 5.7) is slightly different. In this case the answers will present the opposite, 1 will present a score of 7 and the answering possibility 7 will present a score of 1. For human capital a score of 4,6 has been measured which is above the middle point. It can therefore be concluded that Techstall decorates is human capital in a quite innovative way.

The final component of the resources section measures organizational capital, in this part the organization’s fitness for innovation is measured by two statements based on Dziallas & Blind

(2018). The result of this measure was an average of 3,9, which represents that Techstall's organizational capital is fit for being innovative.

Section D: Competences

Section D consists out of two parts, the first part is a list of 28 statements which can be answered on a 7-point scale, the second part consists 12 semi-finished sentences drawn up by Kahn et al. (2006) which have four answering possibilities.

Looking at the answer distribution of part 1 (figure 5.8) and the average calculation in figure 5.9 we can see that an average score of 4,4 has been measured.

1	2	3	4	5	6	7
2	18	9	19	31	30	3

Figure 5.8 outcomings competences part I

1	2	3	4	5	6	7
2	18	9	19	31	30	3
2	36	27	76	155	180	21
2 + 18 + 9 + 19 + 31 + 31 + 30 + 3 total score 497 / 112 total answers = 4,4 average						

Figure 5.9 average competences part I

As mentioned above Kahn et al. (2006) developed 12 semi-finished sentences, respondents are provided four answering possibilities all representing a different level of controlling the competence.

Competence	Level 1	Level 2	Level 3	Level 4
Role of NPD in achieving overall business goals	0	4	0	0
Strategic arenas defined (strategic focus)	0	2	0	4
Clearly defined NPD goals	0	3	0	1
Long term commitment for NPD	1	0	3	0
Portfolio management: prioritization	1	0	1	2
A formal process for NPD	3	1	0	0
Clearly defined criteria to evaluate projects at gates	2	2	0	0
Designated manager or process owner	0	1	2	1
Quality of project selection	0	4	0	0
Use of cross-functional teams	3	0	0	1
Test market/concept testing or trial to a limited set of customers	0	3	1	0
Methods like lean start-up, design thinking, scrum development and rapid prototyping	0	4	0	0
Total:	10	24	7	9

Figure 5.10 outcomings competences part II

To map the average score calculation method is: $10 \times 1 + 24 \times 2 + 7 \times 3 + 9 \times 4 = 115 / 48$ answers = 2,4 which is because of the even scoring possibilities slightly below the middle score ($1+2+3+4=10 / 4 = 2,5$). It can therefore be concluded that Techstall has developed its competences on a middle level, improvements in these competences will help Techstall to perform higher in the field of innovation.

Section E: Technology -recognition / development/ exploitation

In section E, 7 items help to measure three components: conversion ability, new product development process and maturity stages. First, respondents was asked how many hours a week they spend in average on the development of existing products which was answered as follows:

Respondent I	Respondent II	Respondent III	Respondent IV
4 hours	½ hour	0 hours	4 hours

Figure 5.11 hours spend on existing products

In the second item a statement about how Techstall scores on having an innovative working environment was given that could be answered on a five-point scale. In this Techstall scored a 3.25 average out of the four respondents.

Questions 3, 4 and 5 are all related to each other, in this respondents was asked which ideas regarding existing or new products or processes have been recognized the past two years, which of these ideas are still in the development phase and which ones have been implemented successfully. Important notice, there was one respondent that started working at Techstall just recently and could therefore not give any response. Looking at the answers of the other respondents, it can be concluded that although Techstall recognized and started 8 different ideas only one idea has been implemented in the last two years.

In question six respondents mention that the process of opportunity recognition until exploitation takes an average duration of ½ - 1 year. In the seventh question three respondents were unknown with the percentage of exploited innovation projects that met with profit expectations. The respondent that did manage to answer this question scaled this on 60%.

Section F: Innovative Leadership

In the section F a 8 statement long list about innovation strategy by Arnold et al. (2000) has been used. Within this list respondents were able to answer on a 5-point scale varying from “fully agree” to “fully disagree”. To keep in line with other sections, scores again will be turned (see section C). Outcomings of this measure can be found in figure 5.12, how the average score is calculated can be found in figure 5.13.

1	2	3	4	5
1x	1x	7x	9x	14x

Figure 5.12 outcomings section F

	1	2	3	4	5	
	1	1	7	9	14	x
	1	2	21	36	70	

1 + 2 + 21 + 36 + 70 = 130 total score / 32 total answers = **4,1 average**

Figure 5.13 average innovative leadership

Looking at the outcomings we can conclude that Techstall is performing really good in the field of innovative leadership.

Section G: Strategic Alliances

In this section the number of collaborations the organization’s has had with different types of partners in the last three years and the reasons to collaborate are measured.

		1	2	3	4	5	6
	Number of Partners	0	1-2	3-5	6-10	11-25	>25
1	Clients		4x				
2	Suppliers		2x	2x			
3	Consultants	2x	2x				
4	Competitors	2x	2x				
5	Government agencies	2x	2x				
6	Knowledge institutions (Universities, TNO, Kema)	2x	2x				
7	Educational institutions (VMBO, MBO, HBO)	2x	1x	1x			
8	Companies from other workfields.	2x	2x				

Figure 5.14 outcomings strategic alliances part I

As can be seen in figure 5.14, Techstall is performing quite poor on having strategic alliances. The fact that only collaborations with clients and suppliers have no “0” answers is very striking. This shows when looking at the other possible collaborations, at least two members of the management team (respondents) are not aware of these collaborations.

In the second part of section G reasons to collaborate have been mapped, to create a clear overview, the average score per “reason” has been calculated and presented in the figure 5.15 below. Out of this we can conclude that the main reason’s of Techstall to collaborate are the partner’s expertise, to get access to markets/sales channels and on request of an client or supplier.

Reason	Average score (1 very unimportant-5 very important)
Share risks	2,5
Share costs	2,75
Partner’s expertise	4
Access to markets/sales channels	3,5
Request of a client/supplier	3,5

Usage of intellectual licences	2,5
Being short in capacity	2,25
other,	Using Techstall knowledge

Figure 5.15 average score collaboration reasons

Section H: Market, Societal and Technological developments

The last section of the IMT consists out of two parts, both list of statements that could be answered on a five-point scale varying from “fully agree” to “fully disagree”. Because in the second part some statements are “reversed” scores will also be calculated in a reversed way.

In part I the organizations view on dynamism and munificence has been measured by using a list of statements created by Baum & Wally (2003). The outcomings of part I can be found in figure 5.16, the average has been calculated and presented in figure 5.17.

1	2	3	4	5
2x	12x	15x	9x	2x

Figure 5.16 outcomings section H part I

5	4	3	2	1	
2	9	15	12	2	x
<hr/>					
10	36	45	24	2	
10 + 36 + 45 + 24 + 2 = total score 117 / 40 total answers = 2,9 average					

Figure 5.17 average section H part I

In the second part a 25 statements long list drawn up by Lumpkin and Dess (2001) has been used to map how the organization’s external orientation is focused. Like other five-point scale lists, total scores and the average will be calculated in order to make conclusions.

1	2	3	4	5
7x	46x	19x	24x	4x

Figure 5.18 outcomings section H part II

5	4	3	2	1	
4	24	19	46	7	x
<hr/>					
20	96	57	92	7	
20 + 96 + 57 + 92 + 7 = 272 total score / 100 total answers = 2,7 average					

Figure 5.19 average section H part II

In this final section about the company’s focus on external developments measurements show that Techstall is performing on the bad side of the five-point scale.

Summarizing the scores

To provide clarification on how Techstall scored in total, all scores have been summarized after which a conclusion can be drawn.

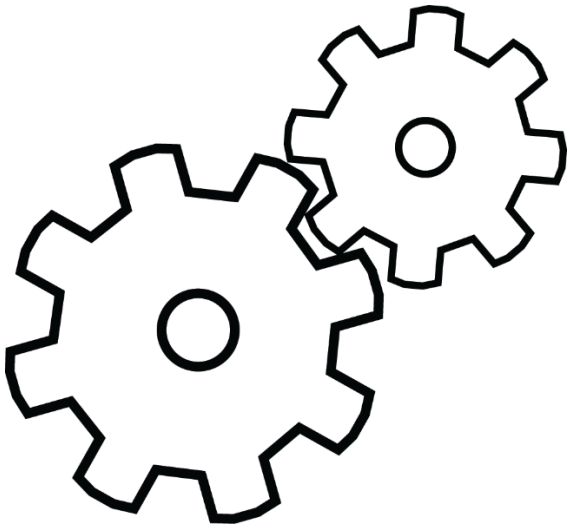
In Section A it has been measured that Techstall is maintaining the Defender strategy. Which, when looking at the Miles & Snow (1978) theory, shows that Techstall is especially focused on maintaining and defending their current products and markets. In order to make this 'Defender typology' work, other factors that have been measured on the other sections should be 'in line'. In the table below, a summary of all measures is given.

Section	Measured
B: Ambidexterity	The average scores on Ambidexterity were: 3.0 and 3.4. Techstall is therefore scoring slightly above middle level.
C: Resources	Financial capital: R&D expenditure, answers varied largely between 0% and 5%. The physical capital average was: 3.1% On human capital the average score was 4,6 (out of 7) Organizational capital: an average score of 3.9 on a five-point scale has been measured
D: Competences	4,4 (out of 7) and Level 2,4 (slightly below the middle point)
E: Technology – recognition / development / exploitation	Respondents spend various time on innovation, varying from 0 to 4u a week. Techstall's working environment scores 3.25 on having a positive influence on innovation. Techstall recognized and started 8 different ideas only one idea has been implemented in the last two years. The average duration of these innovation projects is estimated between ½ till 1 year. 60% of these projects met profit expectations.
F: Innovative Leadership	Techstall scores high on having innovative leadership: 4.1 average on a scale of five.
G: Strategic Alliances	Techstall is performing quite poor on having strategic alliances. Although they do have some collaborations with clients and suppliers, other possible collaborations are answered variously from 0 to 2 collaborations. The main reasons of Techstall to collaborate are the partner's expertise, to get access to

	markets/sales channels and on request of an client or supplier.
H: Market, societal and technological developments	In section H, Techstall scored on both parts below the middle point: part 1: 2.9 and 2, 7

After putting all scores in a row it can be concluded that Techstall in almost all cases scores on a middle level. Looking at the characteristics of the Defender typology by Miles & Snow (1978), it can be said that the measured scores could fit this typology. Scoring on a middle level may indicate that Techstall is not focusing on putting new products on the market but especially tries to keep and maintain their position on the market.

TECHSTALL B.V.



UNIVERSITEIT TWENTE

26 MAART 2019, DEVENTER

SAMENVATTING

In dit verslag vindt u de uitkomsten en bevindingen die tot stand zijn gekomen op basis van een door de Universiteit Twente uitgevoerde innovatieanalyse. Resultaten in dit onderzoek zijn vertrouwd en zullen puur dienen ter validatie van de in dit onderzoek gecreëerde innovatie tool.

Stijn Reimert

Student of the University of Twente

Techstall

Techstall kenmerkt zich als een familiebedrijf waarin onderlinge saamhorigheid en betrokkenheid onder het personeel en directie als grootste kracht wordt beschouwd. Met haar inmiddels 85 jarige ervaring in elektrotechniek, focust X zich anno 2019 op de volgende kennisgebieden: advies & engineering, industriële automatisering, industriële installaties, meet en regeltechniek, brandmeldinstallaties, paneelbouw, beheer & onderhoud. De kernwaarden respect, betrouwbaar/eerlijk en ambitieus staan hierin centraal.

Achtergrond innovatie-onderzoek

Als afstudeeropdracht voor de opleiding Business Administration aan de Universiteit Twente is er een tool ontwikkeld waarmee bedrijven in kaart kunnen brengen waar ze staan op gebied van innovatie. Deze tool correspondeert met het innovatie management model gecreëerd door dr. Ir. Sandor Löwik van de Universiteit Twente. De Tool (lijst met vragen) is door vier managers van X ingevuld waarvan de resultaten in dit rapport zijn terug te vinden.

Innovation Management Model

Zoals te zien in onderstaande figuur: de 'Innovation Management Model' (IMT) door Löwik (2017), bestaat uit interne (binnen de Pyramide + Leadership) en externe factoren (buiten de Pyramide). De pijlen tussen de interne en externe factoren representeren de invloed die de factoren op elkander uitvoeren.

Op het moment dat er nauwelijks technologische ontwikkelingen binnen een markt zijn is het zeer aannemelijk dat het ontdekken van ontwikkelingen complex zal zijn. Aan de andere kant, op het moment dat technologische ontwikkelingen volop aanwezig zijn in de markt en een organisatie nog steeds problemen heeft met het herkennen van deze technologische ontwikkelingen kan dit leiden tot een problematische situatie. Het herkennen van technologische ontwikkelingen is belangrijk voor het herkennen van kansen op de markt en de ontwikkelingen en exploitatie hiervan.



Innovation Measurement Tool

De 'Innovation Measurement Tool' oftewel IMT is gemaakt om een innovatieprofiel te kunnen schetsen van bedrijven/organisaties op basis van het IMM. Het IMT kan worden getypeerd als een vragenlijst en bestaat uit acht verschillende secties, elk gefocused op één specifieke factor. De volgende secties worden getoetst: A: Innovation Strategy, B: Ambidexterity, C: Resources, D: Competences, E: Technology -recognition / development/ exploitation, F: Innovative Leadership, G: Strategic Alliances, H: Market, Societal and Technological developments.

Binnen deze analyse geldt innovation strategy als een overkoepelende factor. Om innovaties te beschermen, te creëren of te verbeteren is het belangrijk dat alle overige factoren in lijn staan met de innovatie strategie. De innovatie strategie wordt bepaald aan de hand van de Miles & Snow typologie.

Miles & Snow typeren namelijk drie verschillende typologieën waar binnen een organisatie/bedrijf zich kan positioneren wat betreft innovatie. De volgende drie typologieën worden gespecificeerd:

- Defender: deze organisaties/bedrijven brengen over het algemeen weinig nieuwe producten op de markt. Ze typeren zich door goed te zijn in één dienst/product en zijn ook niet van plan om er iets nieuws bij te gaan doen. Ze jagen niet actief op nieuwe mogelijkheden in een veranderlijke markt zoals nieuwe technologieën. Defenders sturen met name op dat wat ze doen nog beter doen. Efficiënt produceren, tegen een lage prijs met goede service.
- Prospector: Prospectors zijn continu aan het experimenteren met nieuwe technologieën of toepassingen. Gedurende het op zoek zijn naar nieuw product of toepassing schuwen zij onzekerheid of risico's niet. Deze bedrijven zijn dus vooral bezig met het ontdekken, ontwikkelen en exploiteren van innovatieve mogelijkheden op de markt.
- Analyzer: enerzijds hebben deze bedrijven een stevig product in een markt, anderzijds experimenteren deze organisaties met nieuwe ontwikkelingen. Ze vallen dus tussen de defenders en prospectors in. Het product dat de analyzers al aanbieden wordt zo efficiënt mogelijk gemaakt met een zo hoog mogelijke value voor de klant en tegelijkertijd ontwikkelt men nieuwe producten en diensten die aansluiten bij nieuwe trends.

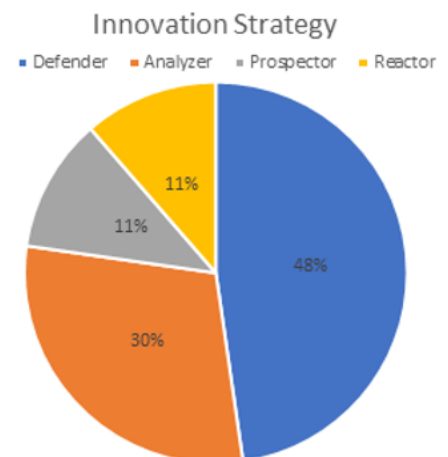
Naast de bovengenoemde drie typologieën wordt er ook nog een vierde typologie genoemd, namelijk de Reactor. Dit type bedrijf weet zich vaak geen raad met nieuwe ontwikkelingen en kampt met grote onzekerheid wat betreft succesvol innoveren. Deze bedrijven durven vaak niet een nieuwe stap te zetten en stellen het innoveren uit totdat de markt hen dwingt en ze niet anders meer kunnen. Over het algemeen weten deze bedrijven dus ook geen onderscheidend vermogen op te bouwen en gaan sneller ten onder dan concurrenten met een duidelijke strategie.

Resultaten

In dit hoofdstuk worden de resultaten uit het IMT kort en bondig weergegeven aan de hand van de eerder besproken secties. Binnen elke sectie zal de uitkomst middels een gemiddelde en de standaardafwijking worden weergegeven.

Section A: Innovation Strategy

Zoals eerder genoemd dient de innovatie strategie als overkoepelende factor en is derhalve een uitgangspunt voor de beoordeling van de andere factoren. Om te bepalen onder welke typologie X valt zijn er 11 statements voorgelegd met vier verschillende antwoord mogelijkheden waarvan elk antwoord één typologie representeert. Hier is uitgekomen dat X een duidelijke Defender strategie hanteert. In de grafiek hiernaast is te zien dat maar liefst 48% van de antwoorden met de Defender strategie correspondeert. Zie hierboven de uitleg van de Defender Strategie.



Overige factoren

Om de resultaten van dit onderzoek overzichtelijk en bondig te houden zijn de uitkomsten van de overige factoren op de volgende pagina in een tabel weergegeven. De meeste factoren worden getoetst middels statements, om hier een resultaat aan te geven worden er punten aan de mate van eens/oneens gehangen. Hier wordt vervolgens een gemiddelde uitgehaald waardoor er een uitspraak kan worden gedaan over hoe X op dit innovatie-gebied/factor presteert.

Sectie	Uitkomsten
B: Ambidexterity	<ul style="list-style-type: none"> - Om de Ambidexterity van X te testen zijn de exploration 3.0 gemiddeld, en exploitation 3.4 gemiddeld getoetst. We kunnen hieruit concluderen dat X zich iets meer op exploitation dan op exploration richt. - Standaardafwijking exploration: 1.58 - Standaardafwijking exploitation: 1.60
C: Resources	<ul style="list-style-type: none"> - In deze sectie zijn vier verschillende onderdelen getoetst: Financial capital, physical capital, human capital en organizational capital. Op al deze vlakken scoort X bovengemiddeld. Dit wil zeggen dat de organisatie X zeer geschikt is voor Innovatie.
D: Competences	<ul style="list-style-type: none"> - Op gebied van competenties scoort X wisselend, in het eerste gedeelte 4,4 (uit 7) en in het tweede gedeelte 2,4 uit 4. Dit wil zeggen dat de Competenties van X middelmatig geschikt zijn voor het ontwikkelen van nieuwe producten. - Standaardafwijking deel 1: 2.2 - Standaardafwijking deel 2: 1.1
E: Technology – recognition / development / exploitation	<ul style="list-style-type: none"> - Er wordt door de ondervraagden wisselend geantwoord over het aantal besteedde uren aan innovatie in de week. Dit varieert van 0 tot en met 4 uur in de week. Standaardafwijking: 3.25 - X's werk omgeving scoort gemiddeld 3.25 uit 5. En is daarom redelijk geschikt voor innovatie. Standaardafwijking: 1.4 - X heeft dit jaar 8 verschillende innovatie mogelijkheden herkent waarvan tot op heden slechts één mogelijkheid is geïmplementeerd in de afgelopen twee jaar. - De gemiddelde duur van deze innovatieprojecten is geschat tussen een half en een volledig jaar. 60% van deze projecten hebben voldaan aan de winst verwachtingen.
F: Innovative Leadership	<ul style="list-style-type: none"> - X scoort hoog op gebied van innovatief leiderschap. 4.1 op een schaal van 5. Standaardafwijking: 1.8
G: Strategic Alliances	<ul style="list-style-type: none"> - X scoort lag op gebied van strategische allianties. Ondanks een aantal samenwerkingen met klanten en leveranciers wordt er nauwelijks samengewerkt met andere potentiële partners zoals universiteiten, consultancy bureaus of concurrenten. - De voornaamste reden tot samenwerking voor X is de expertise van de partner, toegang krijgen tot markt en verkoopkanalen en op verzoek van de klant of leverancier.
H: Market, societal and technological developments	<ul style="list-style-type: none"> - In de laatste sectie scoor X onder het gemiddelde. Wat wil zeggen dat X ondermaats presteert in het herkennen van markt, maatschappelijke en technologische ontwikkelingen. In het eerste gedeelte wordt er een gemiddelde van 2.9 uit 5 gescoord. In het 2^e gedeelte is dit 2.7 - Standaardafwijking deel 1: 1.4 - Standaardafwijking deel 2: 1.5

Samengevat

Aangezien het voornaamste doel van de IMT het in beeld brengen van de Innovatie strategie in combinatie met de onderliggende factoren is kunnen we zeggen dit onderzoek goed is geslaagd. Als we alle scores op een rij zetten kunnen we concluderen dat X in bijna alle gevallen gemiddeld scoort. Als we kijken naar de karaktereigenschappen van de Defender uit de Miles & Snow typologie, kunnen we concluderen dat de gemeten scores bij deze typologie passen.

Advies

Uit dit onderzoek is gebleken dat de innovatiefactoren uit het IMM goed in lijn staan met de getoetste innovatie strategie die X er op na houdt, namelijk: Defender. X houdt zich dan ook niet of nauwelijks bezig met het ontwikkelen van nieuwe producten of diensten maar focust zich met name op het behouden maar ook zeker het verstevigen van haar positie in de markt.

Hoewel de Defender strategie is getoetst bij X, wil dit niet zeggen dat X deze strategie ook ambieert. Het is voor X dan ook zeer belangrijk te bepalen of het met het oog op de toekomst in de Defender strategie blijft vertrouwen, of dat het zich meer wil inzetten op exploratieve Innovatie, oftewel het ontdekken en aangaan van nieuwe mogelijkheden.

Indien X zich meer wil inzetten op innovatie, zal X moeten proberen zich in het Analyzer profiel te positioneren. Hierin schuilen echter wel een aantal gevaren. Zo zal X zich goed moeten beseffen dat het verdedigen van haar huidige producten/diensten bestand in combinatie met intensief inzetten op innovatie een prijzige en tijdrovende strategie is. De grootste valkuil van de Analyzer strategie zit namelijk in het zogenaamde 'half' uitvoeren van beide gebieden.

Indien X zich op de Defender strategie wil blijven focussen zal het zich in toenemende mate moeten blijven richten op haar bestaande producten/dienstenaanbod. In dit geval zal X zich met name op incrementele innovatie moeten richten, oftewel het verbeteren van het huidige producten/diensten aanbod. Deze strategie neemt een stuk minder risico en kosten met zich mee.

X zal dus goed naar de ontwikkelingen in de markt moeten kijken en via deze weg moeten bepalen wat men op den duur de meest levensvatbare strategie acht. Vervolgens is het van belang dat er vol overgave op deze strategie wordt ingezet zodat een situatie waarin X tussen 'het wal en het schip' valt wordt voorkomen.