Beyond certification:
QMS implementation roadmap for technology startups

Master Thesis Report in the Master's Programme Quality and Operations Management

Ebrou Shayegh Patat
Keerthana Jayaprakash

Division of Science, Technology and Society
Chalmers University of Technology
Gothenburg, Sweden 2018
Report No. E2018:108

Master's Thesis E2018:108

Beyond certification:
QMS implementation roadmap for technology startups

Ebrou Shayegh Patat
Keerthana Jayaprakash

Supervisor and Examiner, Chalmers: Sverker Alänge
Supervisor, ReVibe Energy: Erik Godtman Kling, Viktor Börjesson

Department of Technology Management and Economics
Division of Science, Technology and Society
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden, 2018

Beyond certification:
QMS implementation framework for technology startups

Ebru Shayegh Patat, ebru_shayegh@outlook.com

Keerthana Jayaprakash, keerthana_rao@hotmail.com

Master's Thesis E 2018:108

Supervisor: Sverker Alänge

Examiner: Sverker Alänge

sverker.alange@chalmers.se

Department of Technology Management and Economics

Division of Science, Technology and Society

Chalmers University of Technology

SE-412 96 Gothenburg, Sweden

Telephone: +46 (0)31-772 1000

Chalmers

Gothenburg, Sweden 2018

Abstract

The aim of this research is to investigate the benefits of a Quality Management System beyond a quality standard certification for technology start-ups operating in the B2B model. The study is grounded in the role of quality management in improving strategic alignment in these scaling start-ups considering the change in their organisation context rather than adopting a best practice approach, focused on compliance.

The initial focus was to develop a QMS which would support, the startup company, ReVibe Energy's scaling strategy, and also to investigate the certification process. Discovering limited existing research and practical examples around the topic, a qualitative and abductive research strategy was adopted. The results were based on, empirical data from ReVibe Energy, six case studies established on observations, interviews and document analysis complemented with theoretical framework.

It is concluded that a start-up's contingency variables (external: environment uncertainty, customer requirements and internal: strategy, culture and customer type) interact with Quality Management (QM) practices and help shape strategic alignment between start-ups and their surrounding environment. QM practices in turn should not be designed with the best practice approach, rather be classified into Quality Assurance: focused on conformance to requirements and standards, Total Quality Control: focused on customer satisfaction and continuous improvement and Total Quality Learning: focused on organisational learning and continuous innovation. The result to ReVibe Energy is presented in the form of a roadmap for a QMS to support strategic alignment while scaling and also achieve quality certification to the ISO 9001:2015 quality standard.

Acknowledgement

With immense love and gratitude, we extend our heartfelt appreciation to all the people who helped us successfully conduct this study. This has been a period of intense learning for us, academically and on a personal level. We would like to specially thank the following people, whose support has been vital.

We are grateful to our supervisor and mentor Sverker Alänge for sharing his expertise and tremendous academic support. His constant encouragement, challenging questions and patient attitude have steered us to put forth our best efforts and widened our research from various perspectives.

We owe a special thanks to the team at ReVibe Energy, under the leadership of Erik Godtman Kling, and Viktor Börjesson who have welcomed us into their family. Their insights, participation and genuine interest to learn have kept us motivated to achieve the best possible results. The work environment at ReVibe Energy has been remarkable and a great inspiration.

We are immensely indebted to have had the opportunity to interact with the remarkable people from various companies during this research. We are thankful to the representatives from Simplex Motion, Nimbell, LumenRadio, Powercell AB, Vehco, Amparo Solutions, Qamcom Technology, Volvo Cars and SKF for taking the time to provide us with the information that was crucial for the success of this research. Their assistance and transparency has been encouraging.

A special thanks to the representatives from Frontside Electronics, Jan Lenning, Sr. External Audit Manager at Sony Mobile Communications and Peter Hallberg, Lead Auditor from Scandinavian Business Certification for generously contributing with their learned insights on the industry. Consulting with them has helped us produce accurate results.

We sincerely admire the contribution from all our professors and friends at Chalmers University of Technology. Their unfailing motivation, productive critics and engagement throughout the course have helped us grow both professionally and personally.

Finally and above all our sincere gratitude goes out to our parents and families for the constant support and encouragement. Like every other good thing in our lives, we dedicate the success of this research to them and thank them wholeheartedly for the eternal guidance and love.

Nomenclature

B2B	Business to Business
BAU	Business As Usual
CRM	Customer Relationship Management
ERP	Enterprise Resource Planning
KM	Knowledge Management
MRP	Material Resource Planning
OEM	Original Equipment Manufacturer
OM	Operational Management
POC	Proof of Concept
QM	Quality Management
QMS	Quality Management System
SME	Small and Medium sized Enterprises
SRM	Supplier Relationship Management
TQM	Total Quality Management
TQC	Total Quality Control
TQL	Total Quality Learning

Contents

1
Introduction

This chapter presents the business and theoretical background related to the research. It also includes the problem statement from various perspectives, based on academic, industrial, and the company case study. It also provides, delimitations, and a purpose of conducting the research.

1.1. Background

1.1.1. Business environment

European economy has been thriving in the recent times. However, it still trails other markets in terms of available finance and collaboration (Larkin and O'Halloran, 2018). Yet, the pace of new business creation has been accelerating in Sweden since the 1990s and the country is excelling in promoting this, specially formation of technology-based startups (Semuels, 2018). In 2015, by investing 3.3 percent of GDP in R&D, Sweden is now one of Europe's top three spenders in this area. Compared to the EU-wide intention of 3 percent GDP investment by 2020, Sweden is well ahead of the target (sweden.se, 2018). This data indicates the strong entrepreneurial culture that is a characteristic of Sweden. Nonetheless, European economy's continued success requires better collaboration between the two worlds: the traditional businesses and new markets. Hence both "two worlds" would struggle in attempt to maintain their competitiveness and create markets independently. Thus, the resolution is collaboration. (Larkin and O'Halloran, 2018).

Furthermore, it is a known fact that not all startups enjoy success. Some eight of ten business fail within the first three years and nine of ten venture-backed startups fail to generate meaningful returns (Feinleib, 2012). It is important to have in mind, that knowledge is the basis of entrepreneurial actions. That means startups, in an economic system that intensively use knowledge such as, technological markets, must work dynamically and learn how to deal with risk and uncertainty by exploiting new opportunities and take well calculated actions (J. Hodges and Link, 2018). There has been literature that has captured certain common mistakes: key decisions that led to the failure of early stage startups. These include poor product-market fit,

investment decisions that are misaligned with the business strategy, wasting effort without pivoting out of bad markets, to name a few (Feinleib, 2012). Nonetheless, the reasons for the failure of a startup could be presented in several different ways depending on the experience and expertise of the one presenting it. This could be rooted back to the fundamental difference in the definition of a startup and its modelled growth stages. To simplify and structure this research, companies are classified using pivotal contingency factors to adequately generalise the findings. The subject concerns startups, therefore it is important to clarify the definition of a startup in this research, which is defined as: *Start-ups are firms in the beginning of their growth stages in their lifecycle, aiming at fast growth through technological innovation with their knowledge intensity.*

Collaboration between technology startups and large corporations is currently the focus in Europe (Larkin and O'Halloran, 2018). With a changing attitude to leverage the disruption from the start-up world, established European businesses have been making numerous attempts for successful collaborations. Most of them fail due to a clash of mind-sets between passionate entrepreneurial start-ups, and more process-oriented, complex and risk-averse corporations (Larkin and O'Halloran, 2018). Business to Business (B2B) startups in the high technology industry usually start with an innovative idea and strive to develop and commercialise that idea to create new value streams in the market. In this context, collaboration with corporations, often takes the view of co-creating value with their customers. Revenue is often a key incentive for early stage companies to free themselves from outside investments (Larkin and O'Halloran, 2018). In the B2B scenario, successful collaboration is not only the source for this revenue but reference cases from successful projects also enhance the reputation of start-ups thus expanding their market share. As described by O'Reilly and Tushman, (2013), the fundamental challenge for startups in the early stage is to exploit the existing but limited assets and explore the different opportunities at the same time.

Startups scaling at a high rate face significant managerial challenges as they grow beyond the boundaries of informal interactions. Managerial concerns change frequently in young companies in the early stage of their growth phase (Greiner (1998). Everett and Watson (1998) studied 5196 start-ups and found that besides capital, a majority of start-ups fail due to the lack of managerial skills to lead the company and secure continued growth. Along with the increasing environmental complexity the company is also confronted with the need for an internal transformation (Sandino, 2007). At this early growth stage, the formal practices

introduced at the company not only lays down a foundation to support its continued growth but also underpins the culture of the company. Thus, in such an uncertain and resource constrained environment it becomes crucial to ensure that the management practices introduced provide a basis for the sustained growth of the company. Although there have been studies emphasising the importance of and challenges in introducing management practices in start-ups (Greiner, 1998; Sandino, 2007; Feinleib, 2012), research on choice of management practices that can be introduced at start-ups has been scarce.

1.1.2. Quality Management System

Quality management system (QMS) is the way in which an organization directs and controls its activities that are related (either directly or indirectly) to achieving its intended results (Iso.org, 2016). Broadly, it consists of defining the company's organisational context, its processes and their interactions that are used to achieve the set organisational objectives. The purpose of a Quality Management System is to specify good management practices in order to achieve quality, in the organisation but without referencing any particular type of product or service (Iso.org, 2016). In the context of a fast growing startup, a strategic decision to design a QMS in tandem with the business plan would provide a sound basis for the sustainable development activities and needed systemic approach to achieve the intended results (Cox, 2016). While the management models may differ between organisations, theories and ideas can be considered as building blocks. These sets of ideas are present in all levels of the organisations in both explicit (normally spoken and documented) and tacit (includes intuition, routines, hidden assumptions) levels (Marmgren et al., 2016). The management practices and supporting documentation described in the QMS can be considered a form of explicit idea in the organisation. Marmgren et al., (2016), study the interactions between ideas and behaviour in organisations and emphasise the importance of coherence between explicit and tacit ideas. In order for explicit ideas and theories to become operational, they have to become naturalized as a part of the organisations process. Instead, frequently, organisations that try to develop a process-oriented thinking rely on process maps and documents that don't reflect their reality. Hence, this limits their genuine change and improvement in the organisation, which results in inefficient and transient actions. Considering this, it is clear that start-ups and young companies find it challenging to develop and introduce suitable management practices as they aim to scale in rapidly changing business environments. Also, the initial growth stage of these startups, which is characterised by constant organisational changes (eg, adding capabilities) adds to the challenge of introducing a relevant QMS and management practices which shape the behaviour

of the organisation. Thus gaps have been identified from both an academic and industry perspective to guide start-ups while designing a QMS or choosing management practices would lead to genuine improvement, thus supporting required organisational innovation for their growth.

From the industry perspective, most international standards for quality management systems are aimed to support global enterprises. Their role in affecting the efficiency in small and medium sized enterprises (SMEs) and start-ups in particular has been unexplored. The latest ISO 9000:2015 standard, however claims to consider challenges faced by a small company while implementing QMS in terms of its size, number of employees and the way it is managed (Iso.org, 2016). According to them, the time and money spent on implementing a QMS should be considered just like another investment decision. For it to be viable to the organisation, they have to be able to achieve a return for the effort spent, through improvement of processes and marketability of products and services. They also clarify that conformity of the QMS to ISO 9000 standard does not necessarily require a third-party certification/registration, thus differentiating QMS and its purpose from merely a conformance certification (Iso.org, 2016).

1.2. Problem statement

The objective of this thesis is to provide a roadmap for implementation of a QMS which supports both exploration of new opportunities and exploitation of existing resources in a company.

The proposed roadmap would provide management the support required to achieve traceability of established processes and a structured approach to pursue value adding opportunities. In order to fulfil this objective, there is a need of a well-planned QMS which is aligned with the business strategy of the company, and that supports the transition of startups from its informal management style.

To support the objective, the underlying problem statement in this research is divided into three sections. The first two sections describe different perspectives that are important when creating a roadmap and implementing a QMS. First, the industrial perspective explaining companies' narrow view on QMS and the importance of QMS certification in B2B scenarios. Second section considering the academic perspective, highlights that past research has majorly focused

on the benefits of a QMS for large corporations and therefore the gap in research on suitable implementation of QMS in start-ups. Finally, the resulting roadmap from considering both point of views is used to draft a proposal for the implementation of a QMS at a technology start-up, using ReVibe Energy as a test case. Being a start-up company without any prior experience of QMS, along with having limited research on this subject, is a big challenge. However, the proposal includes recommendations for having the QMS conformed to a widely accepted quality standard according to ReVibe Energy's needs.

1.2.1 Industrial Perspective

A clear majority of entrepreneurs' view QMS as an expensive investment which demands additional resources, added administration in an already scarce environment. Most pursue the implementation of a formalised QMS when their key customers demand for assurance that the products or services, they are looking for meet their requirements of quality (Iso.org, 2016). Due to this unfortunate short-sightedness of obtaining a quality certification, QMS is generally swept aside as another fad that failed to live up to expectations. In all fairness, popularly accepted QMS certifications such as the ISO 9000 standards have a history of being rigid and mainly used to just meet stated requirements, which are most often in some form of documentation or conformance report (Chen et al., 2016). Due to this, there is a clear misconception about the purpose of a QMS and its benefits, especially in a start-up environment.

Furthermore, having a certified QMS serves as a proof of trust in a B2B scenario, when a company is aiming to be a qualified supplier to its customers. Most entrepreneurs struggle to distinguish between product-based certifications and a certified QMS. Understanding the complex regulatory and policy requirements which are unique to every country, industry and even company is a challenge. The products and services produced by these start-ups are generally used as a part of an integrated system when developed for, or in collaboration with established original equipment manufacturers (OEMs). Due to the complex convergence of industries and market, which is a present phenomenon, a product has to be conformed with several industry and regulatory standards.

1.2.2 Academic Perspective

It has been noted that profound research has been conducted to understand the QMS from the context of large, established corporations. However, the issues underlying with its implementation in early-stage firms differ from those confronted by established firms. Apart from the obvious constraint on resources and knowledge, a formal management system introduced in an early-stage firms provides a basis for future development of the system; whereas the main concern in a mature firm is to integrate the QMS with the existing systems (Sandino, 2007). Despite the potential benefits promised by QMS, academic work in this area has been sparse and offer little to no guidance to practitioners.

The literature on the Total Quality Management (superset of QMS) has been very misleading in the sense that it has been advocated to be universally acceptable to all types of organisations and their activities. By ignoring the nature of uncertainty faced by the company, QMS has often been 'oversold' or inappropriately implemented as a system incoherent with the business strategy of the company (Sitkin et al., 1994). Although, literature from contingency theory field implies to adapt TQM principles and practices to the situational requirement, there has been no conceptual framework describing how this can be done (Sitkin et al., 1994). To summarize, from an academic perspective there is a gap in understanding QMS from the context of a scaling startup. There is limited literature focusing on needs and constraints of a scaling startup. Adding to the complexity is the fact that every startups focuses on different goals as they scale. However, there is a need to distinguish between control and decision-support systems in a QMS, to support different contingency factors affecting growth rate of a startup.

1.2.2 Challenge at ReVibe Energy

ReVibe Energy is a Sweden based B2B startup, operating in the energy harvesting technology field and in its early growth stage. Since its foundation in 2014 ReVibe Energy, has been focusing on developing a commercial proof of concept through external investments. They collaborate with their customers who are established OEMs to develop pilot products and consequently experience a long sales cycle of around two years. Recently, the focus has been shifted to commercialising their product and increasing the revenue through sales. The shift in focus has raised the need to introduce a customer focused and process-based thinking in the organisation. Similar to a majority of start-ups, ReVibe Energy operates through informal and close interactions among its employees, key customers, and suppliers. However, as they

continue to grow, gain more market interest, and consequently increase the number of employees and suppliers they have to introduce management practices which would lay foundation to the culture of the organisation. Being in the product development phase, the management practices introduced should assist the company in growth and innovation, thus supporting exploration of opportunities while not overlooking control and efficiency of operations to keep the company focused. For ReVibe Energy, who aim to be qualified suppliers to established OEMs, being certified to a quality standard is an imminent customer demand. However, like most start-ups, with only a few people involved ReVibe Energy use more direct communication to execute the overlapping tasks and responsibilities. At this stage, the team at ReVibe Energy chose to explore the benefits of implementing a QMS, beyond its certification value and thus initiated this project in collaboration with Chalmers University of Technology. As mentioned before, the research aims to provide a roadmap and establish an understanding on how to design a QMS which would support ReVibe Energy's growth strategy to become the world's largest supplier of energy harvesting systems.

1.3. Research questions

Recently, one of the most common terms used by entrepreneurs when forecasting growth in a startup is a hockey stick curve. According to this, the growth pattern that a company starts on is a linear trajectory, and then at a certain point, growth takes off astronomically. When charted, the pattern looks like a hockey stick (Digital-astronauts.com, 2018). However, the linear growth phase can take from days to years before the exponential growth kicks in. It becomes important to be cognizant of when this growth occurs and how it affects the startup internally (David Cummings on Startups, 2018). Although not all start-ups follow the same growth pattern, it is still important to understand the changes in the environmental context and associated change in the internal environment during the initial growth stage of the scaling B2B technology startup.

1. What are the characteristics of the primary growth stages of a B2B, technology startup?

QMS has mostly been viewed either as a universally applicable best practice or merely a jargon representing a conformance certificate. Also, its role in supporting the scaling of start-ups is unexplored. However, implementation of a management system in the early growth stages of a startup has promised benefits of supporting a startup overcome difficulties and limitations related to product and business development and enhance management skill levels (Sandino, 2007).

2. How can QMS be designed and implemented in fast growing start-ups focusing on technological innovation?

Also, introducing professional management practices in an informal and flexible startup environment would lay base to the forming culture and structure within the company. It then becomes crucial to ensure that the practices introduced through the implementation of QMS help in sustaining growth at the company.

3. How can QMS support the company on its continued growth?

1.4. Delimitations

This thesis is mostly concerned with developing a QMS framework for B2B technology start-ups and hence the study is focused on start-ups whose definition is specified in Section 1.1.

The research emphasises on relationships with OEMs who are one of the key customer types for these start-ups. However, the start-ups could have different customers (eg: SMEs, other start-ups etc) where the collaboration models would differ. Purchasing and R&D department were identified as the functions, start-ups mostly associate with.

Finally, for ReVibe Energy, the QMS and associated documents should be viewed as living system, subject to continuous improvement. Due to the 20-week time constraint on the research, certain aspects of QMS are presented in the form of proposals and recommendations. The recommendations include the approach to be considered while introducing new management practices and also a roadmap to achieve quality certification.

2
Theoretical framework

This chapter presents the theoretical framework relevant to this research. The first section introduces the literature on environmental uncertainty affecting organisational development, and subsequent organisational growth stages. It is done by presenting two growth models based on changing management practices and growing through collaboration with established coorporates. The second section focuses on the evolution of Operations Management (OM) over the years with emphasis on theory describing the relationship between valuable OM practices and contextual variables relevant to the organisation. It proceeds to the next section describing the QMS and its duality to support both control and learning in an organisation and concluding with a brief description of the latest ISO 9001:2015 quality standards and practical implications of its implementation at start-ups.

2.1 Organisational Development and the growth stages

Christensen (1997) describes two types of technological changes in the market. Sustained technology, and disruptive technology, each having different roles, and affecting the industry in their own ways. Sustained technology are technologies that can be continuous, profound in character and of incremental nature, but all of which comes down to the element of foster improved product performance. Whereas disruptive technologies often are unexplored solutions to underperformed established products that most often distinguish themselves by having the features of being either less expensive, simpler, smaller and/or more conveniently to use. What significantly distinguishes disruptive technologies is that it introduces an innovative technology to market that has an extremely different value proposition than what has been available beforehand, hence these technologies enable new markets to emerge. (Christensen, 1997).

Growth is a success element for an organisation. But growth can be defined differently depending on what kind of business objectives and strategies the organisation has. From a financial perspective, a company's existent value and growth in terms of revenue differs significantly depending on the size of the organisation. Large and successful corporations have

considerable higher revenue targets, making them hesitant from taking risks, thus also reluctant from entering disruptive markets and fulfilling the target in new sales. By strategically choosing to stay strong in existing markets where they can continuously grow, they most likely become followers rather than leaders. (Christensen, 1997). However, a central dynamic for businesses in highly competitive and quickly changing technological markets is the management of organisational development and continuous innovation (Steiber and Alänge, 2013). The ideal aspiration for all kinds of organisations is to create value, preferably exceed, customer needs and expectations. (Bergman and Klefsjö, 2010). This sometimes means entering disruptive markets. The challenge however, is to sustain innovation and growth despite the environmental uncertainty that is existent (Ng et al, 2015). Over the years, various researchers have tried to understand, define and categorize environmental uncertainty. Milliken (1987), clarifies that studies measuring only environmental volatility are not adequate rationalisations of environmental uncertainty, i.e, the change per se, or a fast rate of change does not create uncertainty; rather it is the unpredictability of the change that causes uncertainty. Furthermore, most of these studies measure uncertainty on certain scale and categorise it either into high or low category (Milliken, 1987; Child, 1972). However, for the purpose of this research, The Cynefin framework which is a sensemaking framework is used to understand the environmental uncertainty. In a sensemaking mode, the framework emerges from the data, rather than categorising data into pre-given model like in the categorisation type framework. The strength of using this model lies in understanding that uncertainty as an environmental context is constantly changing for start-ups and choosing a categorisation model would risk the danger of categorisation errors (Boone and Snowden, 2007).

The Cynefin framework sorts issues faced by organisational leaders into five contexts defined by the nature of relationship between their cause and effect. Four of these contexts: simple, complicated, complex and chaotic require management to diagnose the situations and act in contextually appropriate ways. The fifth context, disorder is applicable when it is unclear which of the four context is predominant (Boone and Snowden, 2007).

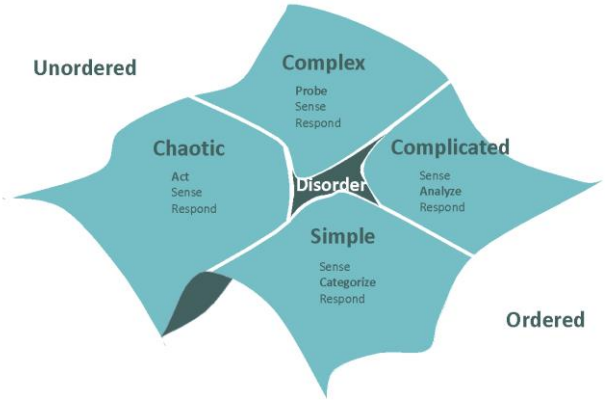


Figure 2.1. Cynefin framework of uncertainty (Boone and Snowden, 2007)

Simple contexts are those where the cause-and-effect relationships are understood, and the solution is self-evident and understood by all parties (Figure 2.1). Simple contexts are approached with a *sense-categorise-respond* attitude. Since managers and employees have access to the information needed to handle the situation, best practices or process reengineering has been suggested to be used in these situations. Challenges in the simple context include oversimplified thinking, entrained thinking (blind to new ways of thinking), complacency while reacting to changes.

Complicated contexts contain multiple right answers and although the relationship between the cause and effect is clear, it is not evident to everyone (Figure 2.1). Organisations must respond to these situations with *sense-analyse-respond* approach. Since issues in the context require investigating several options, good practice, as opposed to best practice is suitable. Challenges here include need of an expert, entrained thinking among experts, disagreement on solutions, and long decision cycles.

Complex contexts are situations where the cause and effect relationship of an issue is unknown then and understood only in retrospect (Figure 2.1). Instructive patterns can emerge if the organisation can create an environment to support experiments that are safe to fail in such situations. Hence, organisations must respond to such situations with *probe-sense-respond attitude*. Primary challenge here is a traditional command-control management style which prohibits organisations from experimenting and handling failure.

Chaotic Contexts are those where looking for an answer is pointless as relationships between cause and effect are impossible to determine as they do not display any manageable patterns

(Figure 2.1). An organisation must first focus on establishing stability before looking for patterns, and then try to transform the situation from chaotic to complex, where emerging patterns can prevent similar future crises. A top-down leadership is most suitable to handle such situations.

In summary, simple and complicated contexts assume an ordered universe where cause and effect relationships are obvious, and the right solution can be determined based on facts. However complex and chaotic contexts are unordered as there are no apparent relationships between cause and effect and the right solution is only known based on emerging patterns. In the fifth context: disorder, situations cannot be placed in any of the mentioned contexts and organisation must break down the situation and assign each of them into the four realms and undertake suitable actions. (Boone and Snowden, 2007).

It is important to be aware of these frameworks in terms of being prepared for environmental uncertainty. Businesses that are not prepared for environmental uncertainties and market changes risk to become unprofitable, lose key employees, or even cease to exist. By analysing critical development elements of the organisation, such as, past decisions, present events, market dynamics, and the potential future directions (Greiner, 1998), managers can understand the organisation as a whole and plan the needed business model and innovative framework of their new product development, covering the environmental uncertainties and ensuring an organisational development with a competitive edge (Steiber and Alänge, 2013).

2.1.1 Organisational growth stages

There are several models describing the growth stages of a company. The following presents two growth models/theories relevant for a startup. (Greiner, 1998; Larkin and O'Halloran, 2018). Greiner (1998) presents organisational development as businesses going through five different phases of growth, which is defined by five key dimensions, age, size, stages of evolution, stages of revolution and growth speed in industries. Between each growth phase (evolutionary stages) there is a barrier or a stage-gate (revolutionary stage) that the organisation has to work with internally in order to trail over to the next phase of growth. Larkin and O'Halloran (2018), on the other hand, presents organisational development as phases an organisation acquires different collaboration methods when working with product development (see chapter 2.1.3. Growing through Collaboration). The dimensions used in this are "*typical duration*" (time) and target. It emphasizes more on the fulfilment of each target within a time

frame, before emerging the next phase of growth. Greiner (1998) covers the general aspect of growth theory whereas, the latter concerns growth theory specifically on start-ups. (Greiner, 1998; Larkin and O'Halloran, 2018) Both theories are relevant for the research, in terms of being aware of the internal challenges a start-up will face when scaling and how the right type of collaboration is crucial.

2.1.2 Evolutionary phases and Revolutionary phases of the growth stages

The main dimensions of organisational growth include age- which is the lifespan of an organisation, size in terms of increase in number of employees and sales volume, and industry growth rate which refers to the external environmental and the speed of changing demands in the industry specific market. Based on the industry growth rate, Greiner (1998) classifies industries into slow growing and describes that they pass the first two to three phases over a long period of time, and moderate and fast-growing industries which encounter all of the phases, the only difference between these two being the speed of moving to the upcoming phases. (Greiner, 1998). He then presents five phases of growth- creativity, direction, delegation, coordination, and collaboration. These are represented as dominant management styles (stages of evolution) and are phases of constant growth. During the growth, every evolutionary phase will eventually face a dominant management problem (stages of revolution). These needs to be solved in order to continue to grow. (Greiner, 1998). The following will describe the characteristics of each evolutionary period and the significant problems organisations face, which can be their downfall if they don't coop with it.

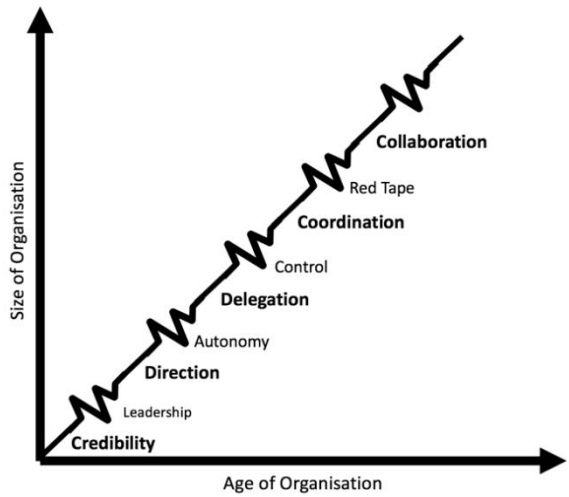


Figure 2.1.2.a The evolutionary (credibility, direction, delegation, coordination and collaboration) and revolutionary (leadership, autonomy, control, red tape) growth stages. (Greiner, 1998).

First phase is ***credibility*** and refers to creating a new product and a market at the birth stage of the organisation. At this point, the organisation works a lot with R&D and has no secure establishments, such as stable customer base and steady functions. There is a high level of customisation expected and they are very much dependent on the individual know-how and creativity. They are also sensitive to market. The strength of the organisation at this phase is the efficient informal communication, thus fast decision making. However, as the organisation grows, what once was a strength becomes a weakness. Moving towards commercialisation requires additional sets of knowledge and skills than when only focusing on R&D. The individualistic know-how must change into the concept of processes of knowledge transfer in order to proceed the process of growth. The increase of size, thus also increase of employees, creates a need of more formal communication. All of these required changes in the first phase of creativity constitutes a dominant management problem, which can be solved with the revolutionary phase of strong ***leadership***. The role of the leadership, not limited to the founders, is to clearly communicate the objectives and ensure that all of the employees are involved in the change of the desired goal(s) and culture. Numerous researches has described the importance of leadership and effects of different types of leadership in particular situations and reach a conclusion that the most appropriate type of leadership depends on the function of the leader, the followers and the situation. A majority of leaders at start-ups adopt a 'visionary entrepreneur' leadership style, with broad visions, lofty goals and an ambiguous work ethic model. And in the early growth stage of the company, this leadership style generally works (Hull, 2016). However, keeping this enthusiasm as the company grows is difficult, especially when the direct link between the founders and employees become less tangible and possible. To address this, leaders need to identify the intrinsic drivers that motivates employees such as autonomy (ability to have a sense of 'self-authoring' one's work), competency (sense of continued growth in skills and abilities) and relatedness (sense of connection, inclusion and belonging) and build an engaged, committed workforce (Hull, 2016).

The second evolutionary phase is ***direction***. At this point the organisation is more mature. It has moved away from the individual know-how, and have adopted work standards, incentives, and budgets. The organisational structure is characterised as functional with specialised knowledge and activities and it moves towards commercialised production, which creates a need for functions such as, accounting systems, inventory, and purchasing. Top managers at this phase maintain a lot of responsibilities and tend to be more controlling, thus allocating directives to lower-level supervisors. Communication is more impersonal, and formal.

Consequently, as the number of employees increase it initiates a culture of dependence and a strong hierarchical decision-making process, generating barriers for sustainable internal growth such as the individual creativity and letting everybody be committed. From this emerges the problem of ***autonomy*** which also is the second revolutionary phase. The solution for this challenge is delegation.

The third evolutionary phase, ***delegation*** is characterised as evolving towards an organisational structure of decentralisation. This allows the organisation to grow by creating incentives instead of control. The communication from the top-level managers are infrequent, establishing a more trustful environment, they instead focus on motivating their employees by assigning greater responsibility to lower-level managers, and organising profit centres and bonuses. The emphasis is put on measuring periodic reports and planning strategic decisions such as acquiring other businesses. The strength is decentralisation, it allows the organisation to grow by acquiescing the plants which can be run by the lower-level managers without top-level managers controlling them, thus being closer to the local market and responding faster to the customer needs when developing a new product. The challenge arises as the growth proceeds. Measurements such as periodic reports become inadequate, and top-level managers concern of losing to much control grows. The organisational structure is identified as not supporting communication of common language, i.e autonomous low-level managers in the diversified operational fields work variously without coherent coordination plans and technology.

The next level of revolutionary phase emerges, ***control***. Once again, top-level managers sense high level of diversification in their operations due to the autonomy, leading them to fall into the crisis of control. Some managers return to centralised organisation, which many times fail due to the large diversification of operations. Others understand the importance of ***coordinating***, which is the fourth evolutionary phase, and is characterised as using formal systems and procedures that is established and constantly reviewed. Eventually when growing the responsibility of low-level managers increases, at the same time the top-level manager monitors them. Hence, creating lack of trust between the hierarchical functions. Which represents the fourth revolutionary phase, ***"red tape"***. This phase of crisis is characterised by lack of trust within the organisation, leading to a cultural direction where for example line manager resent to take directions and criticises the bureaucratic system becoming a big issue. The consequences for this is lack of commitment. Which leads to the next evolutionary phase, ***collaboration***, emerging as a solution for this crisis. By replacing formal systems and controls

with social control and self-discipline problem solving process becomes more efficient and the organisational structure develops towards cross-functionality in terms of matrix-type structure ensuring better team collaborations.

This model describing the organisational growth stages in terms of changes in the internal environment as they go through periods of evolution and revolution provides a valid overview of the overall organisational development. It is also useful in order to understand the organisational practices which characterises the specific management actions in each growth phase. For a startup it is particularly useful to see the change in organisational practices as the organisation moves from phase one to phase three, which is relevant from the context of this research. Given that actions implemented as solutions to overcome a revolutionary period are the causes of the proceeding revolutionary period, it becomes useful to identify and analyse the risks in implementing specific practices. This model broadly considers the change in management practices required to cope with the environment as an organisation grows, without emphasising on the underlying performance which guides the organisation. Majority of change projects undertaken by organisations fail because the associated ideas are not naturalised in as a part of processes leading to organisational improvement. The framework presented by Marmgren et al. (2016) highlights the relationship between explicit and tacit ideas and imply that for new explicit ideas to become effective, they have to become part of the tacit guiding ideas which is often a challenge to achieve (Appendix A2). Their framework could assist professionals in making explicit knowledge and developing tacit knowledge. For a startup, while transitioning from informal management practices, the practices introduced would form the foundation of explicit ideas and also initiate a culture in the organisation. It is therefore crucial to ensure coherence (walking the talk) while developing both explicit and tacit ideas and consequently the organisational knowledge.

2.1.3 Growing through Collaboration

Steiber and Alänge (2013), highlights the importance of the capability to renew the organization by developing new products and business models. They refer to this matter as continuous innovation. However, they also mention that continuous innovation not always necessarily mean success in all market launches. Nevertheless, it is essential for a start-up, in the beginning of their journey to develop their product and ensure stability by meeting customer demand. However, it is difficult to ensure this stability when it is a new innovative product that has to be marketed B2B. Collaboration between technology start-ups and OEMs is not only key for

fostering innovation, but also beneficial for start-ups to develop their products and grow, and for corporations to enter new markets. (Larkin and O'Halloran, 2018).

For several B2B technology start-ups with OEMs as one of their primary target customers, motivations for collaboration with corporations and collaboration models change as the start-ups grows. Due to the current fast changing market, corporations need to process their innovativeness more intensively and many corporations choose to employ this in different ways (Steiber and Alänge, 2013a). While some work inhouse others choose to outsource parts or the whole R&D in order to bring innovation into to the corporate business processes. A central concept in Steiber and Alänge's (2013) research is the study of factors they call 'organizational characteristics' to support continuous innovation. Their study on Google's corporate setup in a fast changing business environment helps understand how Google works with collaboration or external interaction to actively create new products and enter new business areas. According to an interview with the employees at Google, external interaction ranked of low importance in their list of factors supporting continuous innovation. However, the acquisition team at Google highlighted the importance of cooperation with leading universities, venture capitals and spin-off process. The researchers concluded that Google's future growth will continue to equally depend on both their internally and externally generated innovations. The research only proves the growing interest in corporations to collaborate with external organisations such as startups to develop their capabilities and venture into new businesses. Larkin and O'Halloran (2018) presents the significant growth stages and suitable collaboration models for each stage.

Considering the organisation as a system and broadly seeing the different periods of growth stages, the Greiner's model helps identify the triggers for organisational change, changes in management practices associated with each stage identifying projected measures for organisational development. The collaboration model by Larkin and O'Halloran, (2018) considers growth of start-ups through collaboration with corporations which is very specific for B2B technology start-ups. Taking into account both growth models helps get an overall perspective of growth stages (both external and internal point of view) for B2B technology start-ups. A combination of both models would be a starting point to understand the internal and external factors that change in the different growth stages of startups. However, it is critical to understand that the resulting analysis would only apply to startups exposed to similar business environments. In other words, B2B technology startups.

From a startup perspective, the growth stages are divided into three different phases, each representing various collaboration methodologies that can be beneficial to startups, but also have challenges along the way. Larkin and O'Hallorans research presents three phases of growth in the development of a new product for start-ups with identified targets between the growth phases that needs to be checked in order to grow. These phases are, stand-up phase, start-up phase and scale-up phase. Also, from a corporate's perspective suitable collaboration models for each phase is presented (Larkin and O'Halloran, 2018).

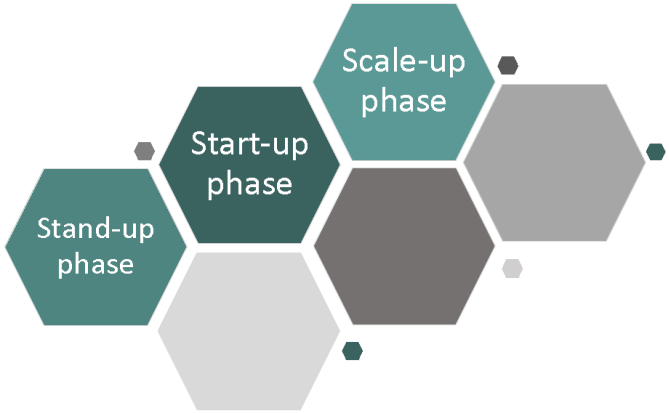


Figure 2.1.2.b The three growth stages of a start-up (Larkin and O'Halloran, 2018).

Stand-up phase represents the phase where the entrepreneurs start their companies (Figure 2.1.2.b). At this stage, it is important to have support systems such as, accelerators or incubators, leveraging advise and incitements for the development of the new product. This phase is divided into three collaboration approaches these are, direct sales, accelerator program, and incubator program. And the cycle time of the methodologies differs but can take up to a year to accomplish. Start-ups are dependent on the investment from these collaborating parties and could vary depending on the deal with the corporations in collaboration. (Larkin and O'Halloran, 2018). The corporate incubator model and the Entrepreneurial Co-creation model are the commonly adopted collaboration model from a corporate's perspective.

Corporate Incubator Model: (Figure 2.1.2.c) The corporation invests in establishment of a corporate incubator as a separate entity. The incubators invite start-ups working with new technologies aligned with the corporate strategy. In this case, the corporations also on many occasions provide resources needed for the start-up, such as, office space, computing resources,

mentoring and funding. Thereafter, when a valuable innovation is developed by the start-up, the corporate becomes a customer or an investor. Hence, the process of integration of the innovation into existing and future business activities starts. (Larkin and O'Halloran, 2018).

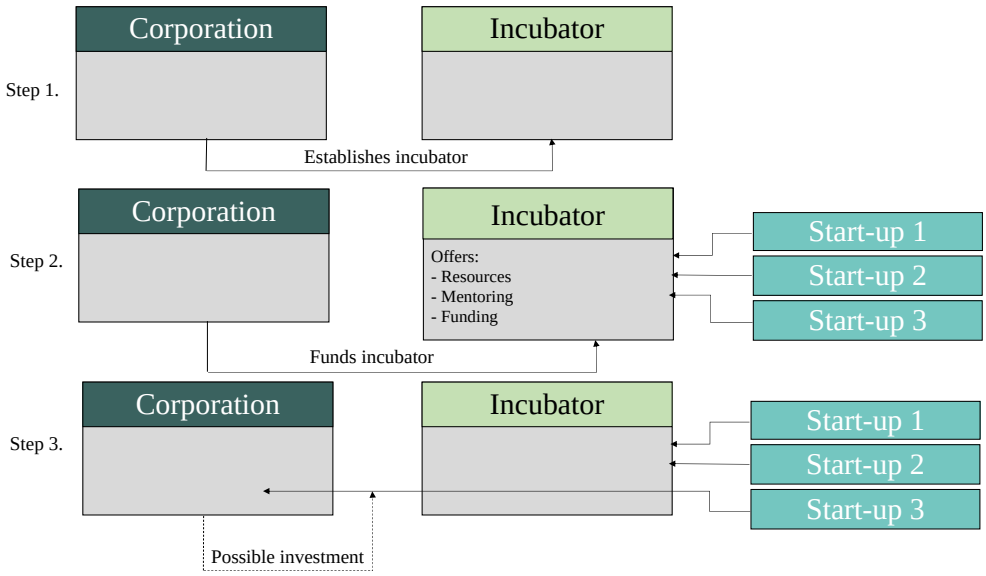


Figure 2.1.2.c. Corporations separate entity of incubators (Larkin and O'Halloran, 2018)

Entrepreneurial Co-creation model: (Figure 2.1.2.d) The corporation assembles a co-creation board, combining corporate board representatives, internal innovators and external entrepreneurs. By conducting a smaller SWOT-analysis the board identifies the gaps between current "as-is" position from an innovative technological standpoint and starts to plan a future "should-be" state. Next is the evaluation of the viability of the business model, strategic relevance, capital requirements of each innovation, the technical feasibility and the early customer interest in the innovation. Based on these inputs the decision of, whether the innovation should be utilized or not, is made. In the entrepreneurial co-creation types of processes, the corporation most often becomes an investor, by setting up a new legal entity together with the previous involved parties (the co-creation board) and delegating the task of bringing the innovation to market. The co-creation board takes on the role as a support system for the founding team, and functions as an advisor and creates an active board. However, after the decision of the utilisation of the innovation is settled, the objective is to find the product-fit to market. Hence, the entrepreneurs focus on the product development with the emphasis continuous customer testing by utilizing high agility. (Larkin and O'Halloran, 2018) By involving the customer, the innovation becomes stable in terms of valuing product-fit according to customer needs and requirements. (Bergman and Klefsjö, 2010). Thus, leading to a strong

customer traction. The identified valuable innovative technologies with a stable customer traction will then be merged into the corporation's business model and operations. Hence, by approaching start-ups this way, corporations scale into markets that has a great potential however, these types of co-creation innovation require a lot of financial resources and is therefore only applicable for corporations that have the resources to support this and large annual earnings. (Larkin and O'Halloran, 2018).

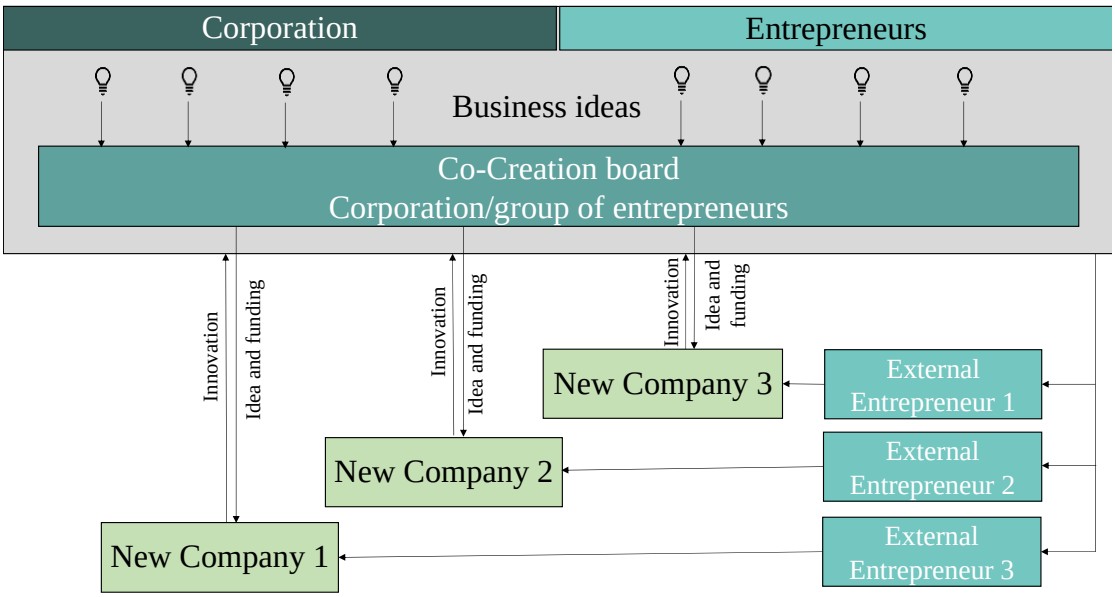


Figure 2.1.2.d Co-creation corporations and external entrepreneurs (Larkin and O'Halloran, 2018)

Start-up phase is in the early phase of development (Figure 2.1.2.b). In these cases, corporations prefer to try out the existing innovative technology and offer short term collaborations in order to test the products. In these cases, it is common that it takes long time to receive a long-term contract. This phase consists of partnership co-innovation, corporate venture, technology partner model ad sales partner model. (Larkin and O'Halloran, 2018). Common collaboration models employed by corporations include the internal innovation unit model or external subsidiary model.

Internal innovation unit: (Figure 2.1.2.e) The corporation has its own unit focusing on innovation with the objective of coordinating all innovation activities. In this concept the innovative department is centralised, hence there is a high level of cross-functionality between divisions and also with the startups. In this case, the innovation unit might use numerous channels in order to attract the relevant start-ups to collaborate with. The identified channels

are, reference-based contacts, interfaces with independent third party established accelerators (i.e incubators), industry events and fairs, gathered knowledge through venture setups, and enabling a technical integration (with a business unit) of a co-developed prototype. (Larkin and O'Halloran, 2018).

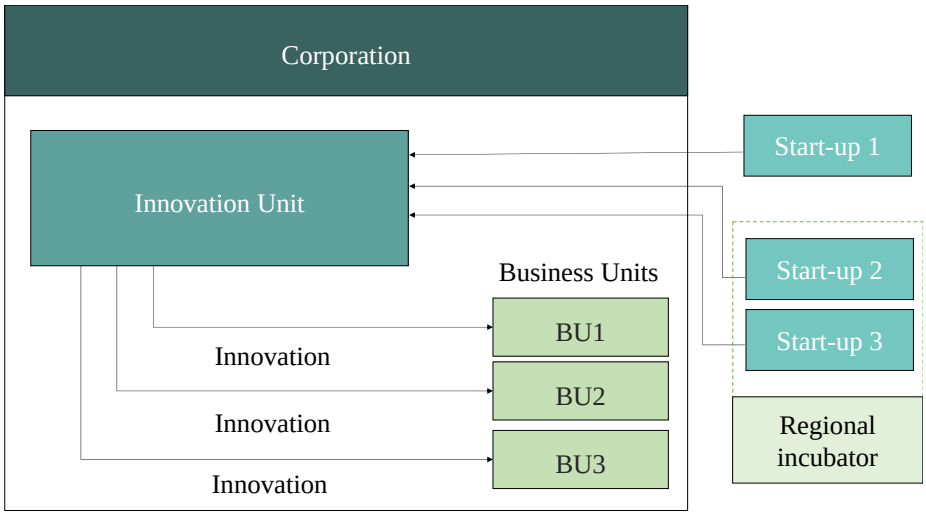


Figure 2.1.2.e Corporations Internal Innovation Unit collaborating with startups (Larkin and O'Halloran., 2018)

External Subsidiary: (Figure 2.1.2.f**)** The corporation invests in establishment of a subsidiary as a separate entity. The objectives of the subsidiary are to develop innovative technologies. The corporate identifies and validates potential business models that cannot be developed due to limited internal technological resources, hence sending it to the subsidiary for fast prototyping. The subsidiary works as an external supplier of product development and finishes the demanded minimum viable product or prototype (MVP) within the limited timeline that is set. The subsidiary in this case can chose how to utilise the available resources when developing the prototype/product. In this case, the subsidiary identifies external start-ups with an innovative product that fits within the framework corporations demanded MVP. If the end-results of the MVP proves to be viable, then it gets becomes a part of the corporation's operations.

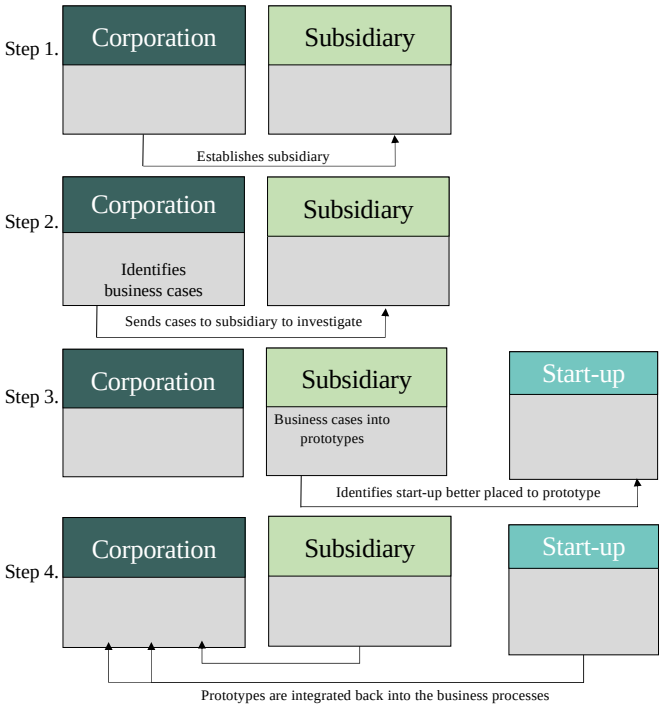


Figure 2.1.2.f Subsidiaries finding the relevant resources for potential markets (Larkin and O'Halloran, 2018)

Scale-up phase (Figure 2.1.2.b) is affected by factors such as sales, innovation, technology and venture partners. In this phase there are more established collaborations with corporations, and therefore also more stabilized sales processes with B2B direct sales, Partnership with Original Equipment Manufacturers (OEM) or white label partnerships. (Larkin and O'Halloran, 2018) Direct sourcing model of collaboration is the most commonly used in this phase.

Direct sourcing: (Figure 2.1.2.g). Direct sourcing refers to start-ups and corporations interacting as a reliable business partner. The process in this case involves the start-up approaching a business unit, (or the other way around) communicating an innovative proposal. Both parties form a partnership focusing on creating a value proposition out of the innovation. Thus, the role of the start-up being developing the innovation, whereas the corporate benefitting from it and reselling the product. The critical factors in direct sourcing form a corporate perspective exists in the managers' incentives, willingness to take risks and the technological knowledge they possess. (Larkin and O'Halloran, 2018).

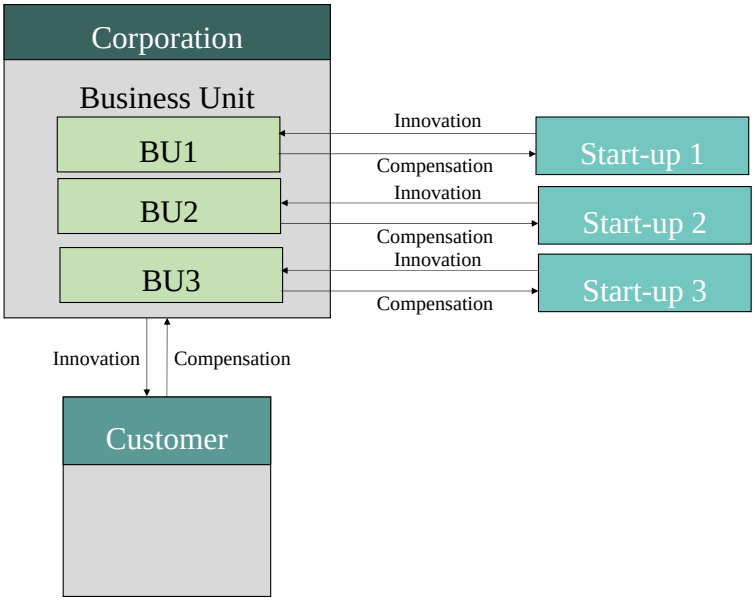


Figure 2.1.2.g. Direct Sourcing between corporations and start-ups, (Larkin and O'Halloran, 2018)

2.2 Evolution of operations management: Theory and Practices

Managing operations within organisations has tremendously evolved over the years with the change in market need and available technology. Historically, although Operational Management (OM) was mostly focused only on manufacturing production, the evolving definition of OM has blurred the limits of this field. The focus has moved from just managing manufacturing production to understanding that OM involves the interconnectedness of every functional area such as marketing, accounting, purchasing & supply chain, engineering, human resource etc (Bayraktar et al., 2007).

2.2.1 Universal Best Practices

In the field of OM, three stages of development are often proposed: craft production (before industrialisation), early to later mass production (Western high volume industrial production) and lean production (based on the techniques of Toyota and Japanese post-mass production ideas) (Piercy, 2012). Bayraktar et al., (2007) describes that the era of industrialisation, witnessed a relatively new manufacturing strategy of combining standardised parts with an assembly line. This forged the rise of vast number of such "best practices", each trying to find effective means to improve organisational performance. Since then, OM has shifted from mass production to mass customization. After the success of producing standardized products in large

volumes, customers began expecting high-quality products for a lesser price (Gunasekaran and Ngai, 2011). Thereafter, with Dr Juran's visit to Japan in 1954, Japan's quality control activities witnessed a transition from a focus primarily on technology in factors to an overall concern of the entire management. However, in the US the same quality control concept had a more limited connotation which gave rise to use of term Total Quality Management (TQM) in late 1980s (Steiber and Alänge, 2013a). The following years saw the emergence of several statistical tools such as JIT, Kanban, etc as best practices aimed to improve manufacturing strategies, service operations, new product development and development of performance metrics to produce more for less. However, they had a limitation of being stand-alone tools which could not be used to integrate operations of the entire organisation (Bayraktar et al., 2007). The introduction of Material Resource Planning (MRP) systems in the 70s and commencement of the internet (www) in the 90s, led to the rise of new management tools such as Customer Relationship Management (CRM), Supplier Relationship Management (SRM), Enterprise Resource Management (ERP) and Knowledge Management (KM) as key models for operational success of an organisation. These databases and information systems have become indispensable tools in OM, crucial to maintain key performance objectives in a dynamic and global business environment (Gunasekaran and Ngai, 2011).

In conclusion, the last three decades have seen the rise of a plethora of management practices under various themes, popularly, TQM, lean or agile methods. Although they have been advocated as universally applicable best practices, several doubts have been raised as to their universal validity. Sousa and Voss (2008) are of the notion that this universal validity of management practices stems widely from anecdotal case studies of "world class manufacturing firms" which operate in a global, high-technology, dynamic business environment. Furthermore, since these studies trying to capture the practice-performance relationships are generally survey-based, hence fail to capture the contextual richness of each case. Moreover, several practice-performance studies have also shown that the "best practices" did not have any significant effect on performance.

2.2.2 Contingency Theory of Operations Management

Challenging the acceptance of certain OM practices as "off-the-shelf" universal best practices, independent of the environmental context, contingency theory emerged as a lens to link OM practices to associated contextual variables. With this, the focus shifted from the value of a practice to understanding contextual conditions under which they are effective (Sousa and Voss,

2008). Luthans & Stewart, (1977) define an organisation as a "social system consisting of subsystems of resource variables interrelated by various management policies, practices and techniques which interact with variables in the environmental parasystem to achieve a set of goals and objectives". This definition of an organisation provides the necessary constructs to describe the contingency theory of management. According to Donaldson (2001), contingency theory suggests that "*organisational effectiveness results from fitting characteristics of the organisation.. to contingencies that reflect the situation of the organisation*". The strength of this approach is that it helps overcome the lack of established framework to overcome inefficiencies, thus successfully challenging the belief that there is a single best way to organise the business.

Firstly, the systems perspective of viewing an organisation is conceptually viable to understand contingency theory. Per the systems approach, an organisation, as a system is comprised of interrelated subsystems internally and is in constant interaction and influenced by the external environment (Luthans and Stewart, 1977). Secondly, it is important to understand the various systems variables and their effect on each other in the context of a constantly evolving business. Various researchers have used different variables and classification schemes over the years (Luthans and Stewart, 1977). For the purpose of this research, extensive theoretical review by Sousa and Voss, (2008) on contingency theory for OM practices is used as a reference. Their research is focused on a study of three sets of variables (contingency variables, response variable, and performance variables), measurement issues across the variables and employed form of fit to understand the relationship between OM practices and the said variables. Along with a theoretical framework to understand the OM contingency theory, Sousa and Voss, (2008) also identifies the current shortcomings with this approach.

Contingency variables: These are factors that have an impact on the organisation but are beyond the direct control of management. There is a limited opportunity to manipulate these variables and the effects are only seen in the long-term. These variables are characterised by high inertia. Examples include legislation change etc. Luthans & Stewart, (1977) define them as 'environmental variables' and break it down further into external environment variables and internal environmental variables. They explain that when the organisation gains direct more control over a segment of its external environment, the segment is then annexed into its organisational system. In case of internal environmental variables, these are not under the direct

control for a manager but can be influenced by the organisation as a complete system. Examples of contingency variables could be federal legislation (external), organisation culture (internal).

Response variables: These represent the specific activities undertaken by the organisation in response to the anticipated contingency factor. Sousa and Voss, (2008) examine the effect of popular OM 'best practices' as response variables. However, Luthans & Stewart, (1977) use the term resource variable to describe these factors that are under the control of the organisation and can be modified for any desired change. They classify them into human resource variables, non-human resource variables and management variables.

Performance variables: These are dependent measures and represent specific aspects of effectiveness that are appropriate to evaluate fit between the contextual variables and response variables for the situation under consideration. There are numerous ways to measure organisational performance. Contingency models developed by researchers are directed to achieve certain kind of performance objectives, sometimes operational and sometimes overall business performance (Sousa and Voss, 2008).

Measurement of the variables: Several issues while measuring the three sets of variables from a research perspective have hindered the progress in developing a generalised framework for use of OM practices based on contingency theory. While considerable progress has been made in measuring degree of use of OM practices, or response variables, there is a paucity in measuring contingency variables and performance variables (Sousa and Voss, 2008). Researchers have examined various groups of contingency variables to suit their specific purpose. Popularly, there have been studies on national context and culture effects, firm size, strategic context and other loosely related factors. Sousa and Voss, (2008) conclude that the wide variety of contingency variables, which tend to be too specific to organisational contexts, limits the generalizability of the studies. The challenge is to identify contingency variables that explain the greatest variance in performance, while allowing for generalisability across organisations. They believe that developing empirical taxonomies of contingency variables would help identify a limited set of key, highly correlated variables.

Scales used to measure performance have been developed to suit the particular study, which has in turn caused the existence of several measures and scales to test the same performance variable. Using context specific performance measures have limited the broad of these measures

and their potential for reutilization, while increasing generalisability of a measures compromises with its validity (Sousa and Voss, 2008). The complexity in establishing a relationship between these variables in the context of an organisation is noticed in the research by Luthans and Stewart, (1977). They present a taxonomic hierarchy of primary, secondary and tertiary levels, with a set of variables in each level in his contingency model.

Employed form of fit: The final aspect of designing a contingency model is in the assessment of degree of fit between the contingency factor and adopted practice. Several approaches to access this fit have been taken, which are often treated independently. Sousa and Voss, (2008) consolidate them into selection, interaction and systems approach of determining fit. While the selection approach assumes compatibility between an adopted practice and the context, the interaction approach checks the impact of practice on performance in the presence of a context. These two approaches focus on a single contextual factor and a single, affected response variable. However, the researcher argues that it is important to simultaneous address several contingencies, response alternatives and performance criteria holistically from a systems perspective. From a system approach perspective, he defines fit as "internal consistency of multiple contingencies and multiple response variables which affects performance characteristics". This field has recently introduced the concept of equifinality, which states that there are multiple, equally effective ways through which an organisation can achieve fit. From a practitioner's' perspective, organisations try to cope with the changing external environment and improve their performance by improving fit and alignment with their defined set of contingency variables. There are equally effective ways of achieving this and the process of determining degree of fit is viewed as a dynamic process specially in uncertain or unstable environments. (Donaldson, 2001). Although this theory provides organisations advice on adoption of relevant OM practices, it fails to explain certain industrial patterns such as organisations with mature OM practices but long-term deviations from fit (Sousa and Voss, 2008). To explain this, they present the framework, summarized in Table (2.2.2) to check for the patterns of use of OM practices and their performance outcome in its organisational context. They classify them into four types: Best-in-class, misfit, panacea and promising.

Table 2.2.2 Organisational practices based on their degree of use and performance (Sousa and Voss, 2008)

Performance	Degree of use: Low	Degree of use: High
Low (inadequate fit)	**Misfit** Example: Kanban coordination in manufacturing processes with high product variety and complex routings. Suggested action: Practice should be discarded from the set of alternatives for the organization's context.	**Panacea** Example: Heavily bureaucratic ISO9001 certified quality management systems in small organizations. Suggested action: Practice is used for reasons other than its effectiveness (institutional pressures, managerial choice/slack resources). The organization should attempt to remove pressures for use, and then discard it.
High (good fit)	**Promising** Example: Total Productive Maintenance in machine intensive environments. Suggested action: Practice is less used due to lack of knowledge or reasons other than its effectiveness (institutional pressures, focus on sources of performance other than best practices). The organization should evaluate its use and/or remove the pressures against its use.	**Best-In-Class** Example: JIT manufacturing practices in high-volume, repetitive production. Suggested action: Practice is part of the basic set of practices for the organization to implement in its context.

Contingency theory functions on the primary assumption that practices are adopted to impact performance variables at an organisation. While it can explain best-in-class and misfits, it fails to provide an explanation for panacea and promising practices. Organisations face certain kind of pressures due to which they break the efficiency barrier and made a conscious decision to use a practice long-term which is perceived as non-effective in their context. This explains Panacea practices. Organisations also choose to ignore practices which exhibit promise due to reasons such as lack of knowledge or resources which explain Promising practices (Sousa and Voss, 2008). The fundamental belief in the contingency theory is that, eventually it is the contingencies that determine the organisational response. This belief has been criticized for the lack of scope to free managerial choice. The strategic choice theory, which allows for some degree of choice in addition to the contingency theory helps overcome this setback. The rationale behind this theory is that organisations can have a few inefficient processes as long as most of their OM practice programs are designed in accordance with the contingency factors (Sousa and Voss, 2008). It is important to consider the power-holders within organisations who decide courses of strategic action, such as the management team, the investment board depending on the decision-making setup in a startup. Their strategic choice includes both establishment of different structural forms and their trying to manipulate the external environmental features. This also affects their choice of relevant performance standards (Child, 1973).

2.3 Quality Management

Quality is a complex and multidimensional concept with varying definitions. Bergman and Klefsjö (2010) describes quality as the capability to satisfy and exceed the needs and expectations of those the organisation is producing value for, the customers. This terminology captures the central concept of quality; customer focus. Garvin (1984) goes deeper and presents five different approaches to define quality from areas of philosophy, economics, marketing and operations to define quality. His approaches help understand the underlying concept of quality and the optimal value that fulfils customer needs, hence can be used as a competitive platform. While these approaches can explain the often-contemplating view of quality perceived by the different organisational functions such as marketing and engineering, they also help understand the customer's perceived view of quality. His five approaches to define quality begins with **transcendent approach** where the understanding of quality is absolute and universally recognisable. Advocates of this approach claim that quality cannot be precisely defined; rather it is an unanalysable property learnt through experience. This is closely related to branding and how certain brands are perceived with uncompromised standards and high achievement. The second approach is **product-based approach** which takes an economic view where quality is perceived as a precise, measurable variable. Here, quality lies in the difference in quantity of a desired ingredient or attribute in the product and hence goods are ranked according to the amount of desired attribute they process. Traditionally, this definition is mostly focused on product durability. The **user-based approach** takes on a subjective view of quality where it is subject to the preference of the user. Quality is the precise combination of product attributes that provide the greatest customer value. The challenges faced to aggregate the varying preferences to define quality at a market level is solved by assuming that the quality is high when majority of customers are satisfied. In the **Manufacturing-based approach**, quality is defined as conformance to requirements and it is viewed from a purely manufacturing and engineering perspective. When a product deviates from its established specifications, it is considered to be poorly made and unreliable. From a design perspective, the emphasis is on reliability engineering and from a manufacturing perspective, its on quality control, both aimed to weed out deviations and focusing towards cost reduction. Lastly, from a **value-based approach** quality is defined in terms of costs and prices. High quality is when a product provides performance at an acceptable price or conformance at an acceptable rate and hence defined in terms of 'affordable excellence'. Understanding these varied perceptions of quality would help start-ups design solutions (for projects and products) tailored to the different types

of customers. It is easy to forget that type of customers in a B2B environment are profoundly different from B2C customers (Clark, 2018). They can be grouped in four types. **Price first** prospect: Due to tight budgets, frugal employees or any such reason this type of customers care primarily about cost. They begin the conversion with price and don't stray far from it. Second, is the **Quality first** prospect: This type is opposite to the price first type of customers and believe quality, when delivered pays for itself in the long run. They work on high margins and are used to the best. Third, **Service first** prospect: They emphasise on service after sales. They don't trust easily and considers factors such as time in business, accreditations, training and awards to eastablish trust. They also ask a lot of questions about product testing and service channels. Lastly, **Collaborator** prospect: These are the ideal type of customers in a B2B scenario. They want to be involved and a part of the process. They usually work in teams and expect to be updated with the progress (Clark, 2018). Thus, in a B2B scenario understanding customer requirements begins with identifying what motivates the customers in the buying process, which can broadly be classified as above.

From the context of a startup, a new principled way to approach new product development and defining quality of products is the lean startup (Ries, 2011). Minimum Viable Product (MVP) is one of the core philosophies of the lean startup movement. MVP is the *version of a new product which allows a team to collect the maximum amount of validated learning about customers with least effort.* (Ries, 2011). By shifting focus from a product driven approach to a customer driven approach, this philosophy helps founders avoid wasting resources on building a product that has no need or no customer interest. However, there is immense confusion surrounding the concept of MVP and founders fall into various traps in pursuit of it (Kataria, 2017). One such confusion is, the lack of validation of whether the product idea fits into the customers' needs and values or not. Instead founders fall into the trap of thinking that only having a good product idea, while developing prototypes for customers just to reduce development cycle time, is enough du succeed (Kataria, 2017). Sometimes, entrepreneurs miss a key opportunity to establish market differentiation by interpreting the "minimum" component of an MVP to mean "nothing challenging." (Aycan, 2012). Therefore, it is important to note that main objective of MVP is validation through learning and it is an experimental business process rather than just a minimal product development process (Kataria, 2017).

However, these varying perceptions of quality need to be associated with the fundamental activities within an organisation. These activities are the basis for the conventional practice of

Total Quality Management (TQM), which provides a holistic view of the terminology of quality and combines the concept of value, methodologies and tools with the central emphasis on fulfilling customer needs (Bergman and Klefsjö, 2010). TQM is the first management approach to embrace both western and eastern way of thinking. It also covers three key areas of management: process/operations management, human resource management and strategic management (Bergman and Klefsjö, 2010). A well-known model used as a platform in the development of TQM within organisations is the Cornerstone model (Figure 2.3.). It consists of six interrelated values, which are customer focus, base decisions on facts, focus on processes improve continuously, and committed leadership.

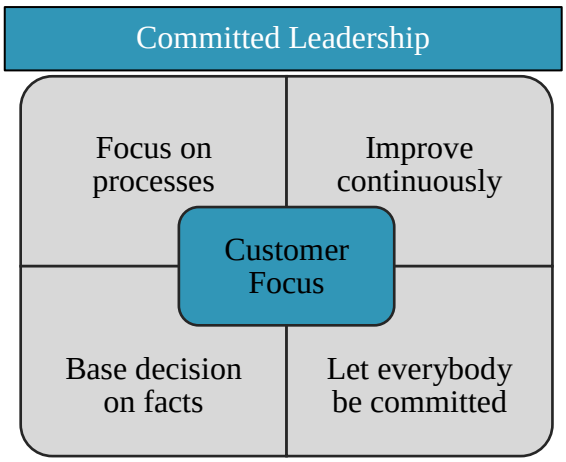


Figure 2.3. The Cornerstone model (Bergman and Klefsjö, 2010)

First, **customer focus** refers explicitly for whom the organisation is creating value for, it includes both external (the buyers/users of the provided services and products) and internal customers (the employees). Second, **base decisions on facts**, states the importance of not taking uncalculated risks by basing decisions on random facts or instincts, but rather have a stable decision-making process by collecting, structuring, and analysing valuable and relevant data. Third is **focus on processes**. Bergman and Klefsjö (2010) describes processes as *"interrelated activities that are repeated in time, whose objective is to create value to external or internal customers"*. The objective it to have input factors in a process using as little resources as possible, converting them into output factors such as, satisfactory results for customers. Fourth, **letting everybody be committed**. TQM, identifies communication, delegation and training as three factors influencing the degree of commitment of employees. It has a strong relation to culture and refers to involvement of the employees by giving them responsibilities and the feeling of being needed. (Bergman and Klefsjö, 2010). It is a balance of delegation and control

(Sitkin,S. et al., 1994),. Fifth, **continuous improvements**; in TQM, the PDCA (Plan-Do-Check-Act) acts as a central concept for improvement work, which emphasis that there is always a possibility to improve products, processes, or services to lower costs and increase quality. Finally, **committed leadership** is crucial to succeed in implementing in these values and emphasises on the importance of commitment from leaders in all levels in order to function as an organisation moving towards a common goal. (Bergman and Klefsjö, 2010).

TQM and the cornerstone model emphasise mostly on the variables that has an impact on the organisational structure, processes, and culture. It does not include much on variables external to the organisation that is beyond the limits of management control. Also, there have been research which have highlighted the risk that TQM could impede a firm's ability to innovate and rapidly adapt to changes in fast changing environments. While there is confirmed evidence that TQM supports organisations to improve continuously, question of whether it supports continuous innovation is unsettled. (Steiber and Alänge, 2013a). Therefore, there is a need to introduce a new management paradigm for TQM to contribute to both continuous improvement and continual learning and innovation.

2.3.1 QM to support control & learning

Following the declining support to accept certain QM practices as universally applicable best practices, there was a lack of an overreaching theoretical framework to address the role of QM practices in driving strategic alignment in companies. Various researches have tried to ground this business issue using a contingency based approach. Zhang, D. et al., (2012) argue that majority of the studies on effects of contingency factors on QM practices continue to treat it as a single set of universal best practices. However, some studies have noted the importance of customization of QM. Industries that start-ups operate in are constantly evolving; the market ill-defined and the infrastructure to deliver the still developing technology to the, as of yet, underdetermined market is non-existent. There is an uncertainty regarding the time to develop new technology, new market, for complementary technology to emerge (Cole, 2002). Compared to the conventional thinking about continuous improvement, the probe and learn process and rapid prototyping are better served to face uncertainty. In the context of PDCA, this approach underweights the "plan" and overweighs the "do". Conventional quality control supports learning from mistakes. For example, accelerated life testing of products under simulated field conditions is a popular product quality control practice. The information from the testing is used to control, reduce and subsequently prevent errors. However, to support

innovation, the quality practices would require supporting the organisation to generate errors intentionally and successively throughout the product development process and in interaction with downstream customers, from who they can learn. In this context, organisations would have to realise the distinction in errors: desirable errors (supports learning) and unnecessary errors (leads to no learning) (Cole, 2002). On the other hand, it is also crucial to consider that such practices supporting the probe and learn process would be expensive and thus must be evaluated against the risk for start-ups.

Zhang, D. et al., (2012)'s empirical study classified QM practices as two separate bundles to support both exploration of opportunities and exploitation of resources. They further explore the mediating effects of organisational structure (internal fit) and environmental uncertainty (external fit) on what they describe as Quality Exploration and Quality Exploitation. Their study investigates the QM practices associated with QM principles such as the TQM principles. They grouped common practices under dimensions of customer focus, process management, teamwork and training to present how practices vary under the constructs of Quality Exploration and Quality Exploitation. They conclude that, with low environmental uncertainty, Quality Exploitation influences performance to a greater degree than Quality Exploration; whereas the organisational structure has no significant effect. However, for high environment uncertainty Quality Exploration and an organic organisational structure influences performance when compared to a mechanistic structure. Sitkin,S. et al., (1994), also through their study, aim to surface the duality implicit in TQM, thus distinguishing control from learning in TQM practices. They suggest that TQM is not a panacea that can be unthinkingly used, but a clear understanding of the context, characterised by uncertainty, nonroutines, and/or instability must be present with the implementation. To maintain organisation effectiveness, it is crucial to balance conflicting goals of stability and reliability with those of exploration and innovation. They propose to achieve this by separating TQM into two conceptually distinct approaches: Total Quality Learning (TQL), focusing on exploration-oriented aspect of TQM and Total Quality Control (TQC), to effectively exploit familiar skills in addressing known problem. The operating practices associated with implementing these two approaches also diverge. They have classified common practices into: capability enhancing, information collection, analysis and dissemination and motivating employees to investigate the duality. Capability enhancing practices such as Statistical Process Control, aimed at quality control (QC) have proven benefits in eliminating defects. These practices have been developed in the industry to such an extent that it allows for failures to be proactively detected and root cause analysed. However, in

situations subject to rapidly evolving process engineering advances, QC practices to enhance capability cannot be applied as the processes never achieve stability. In such situations, the practices must aim to increase an organisation's ability to outlearn competition rather than maintain advantage through it products and processes. Also, resource training to enhance capability at conditions of low predictability must be focused on general human capital enhancement and autonomy rather than specific technical training and focus on teamwork. A technology push environment, sometimes necessities the organisation to disregard customer needs to find hard-to-imagine solutions which could also create a new market. But if the technology is mature and adaptations well established a customer driven approach is preferred. These scenarios require two distinct approaches to gather and disseminate information regarding to customers, suppliers and employees. Pre-established monitoring and feedback criteria would suit routine conditions but are not so straightforward in innovation processes such as R&D processes. Then, the TQ practices must aim to shift customer perception rather than find new ways to meet them. Rewards and incentives related to TQM practices are also contextual to the situation and the target of incentives vary according to the situation. In moderately stable environment, performance improvement is prioritised, and incentives focus on reduction of error and variances. Team rewards also prove beneficial under such situations. However, in uncertain environments, error-induced discoveries are prioritised which require incentives to foster a risk-based innovation environment. Furthermore, they too try to examine the mediating effect of organisation structure and environment uncertainty on tailoring TQM and reaches a similar conclusion as previously mentioned researcher. They propose that when the uncertainty is high, practices associated with the implementation of TQL will increase the outcome effectiveness and practices associated with implementation of TQC favours highly certain situations. They also believe tailoring TQM to subunit requirements is easier in traditional vertically integrated firm which is relatively centralised.

McAdam, R. et al., (2016) with a framework for SMEs to achieve strategic alignment leveraging their QM practices reaches a similar conclusion. Although their research focused on companies from the service industry, a number of comparisons can be made to product-based companies given the increasing service focus on operations management. According to McAdam, R. et al., (2016) it has been popularly suggested that the QM practices in the context of SMEs are often informal or customized versions of the QMS based on one of the popular QMS models such as ISO 9000, the frameworks based on the European Excellence Model, Malcolm Balridge Model. Since 2000, learning and innovation were gradually built into

models (Steiber and Alänge, 2013a). In their study, as a first step, they identify *strategy, culture, lifecycle stage and customer focus* as a set of appropriate contingency variables. Second, they represent each contingency variable by an appropriate typology. They go on to suggest any change in the contingency variable requires a change to be made in the typology with the use of a bundle of QM practices. This change is needed to achieve dynamic strategic alignment. They go on to provide a usable framework of eight propositions to shape QM practices to drive strategic alignment in complex and fast-moving business environments. They conclude that for an SME operating with a mechanistic structure and exposed to simple and stable environments tend to have QM practices which are simple and standardised; whereas when the business environment becomes complex and unstable the SMEs tends to move towards a more organic structure. The QM practices then tend to become advanced to ensure its adaptability to support this context. Finally, to keep up with the constantly changing environment SMEs necessitate a dynamic shift from a mechanistic to a more organic structure and thus need to ensure flexibility in the approach to QM practices.

The study by McAdam, R. et al., (2016) although focused on service-based SMEs provides the much-needed conceptual framework to explore the role of QM to achieve strategic alignment in a fast-moving business environment. Furthermore, it acts as an inspiration to develop a similar framework for a B2B, technology startup by altering the relevant set of contingency variables and QM practices. For this research, lifecycle stage is an invalid variable as the focus here is on start-ups and the customer focus typology used IS specific to service-based companies. Nevertheless, the typologies used for strategy and culture are valid for the scope of this research. McAdam, R. et al., (2016), use Handy's (1985) culture typology to classify culture into four elements: *Role, Power, Achievement and Support*. An organisation with focus on procedure, hierarchy and status display role culture. Power culture is one wherein a dominant leader is in charge and organisation follows informal rules. In an achievement culture the organisation is participatory and task and purpose oriented. Support culture is an empowered environment with high levels of intrinsic knowledge. They also mention that there have been several studies confirming that culture, interpreted as elements of this typology have a differential effect on the strategic alignment of QM practices. Miles and Snow (1978), postulate three strategy types: *prospectors, defenders, analysers,* that prove equally effective in an industry despite the market environment and *reactors* who are unable to respond to market changes. They classified them based on the organisation's adaptive decision patterns with respect to organisation's entrepreneurship problems (concerning product-market domain),

engineering problem (concerning technology and processes) and administrative problem (concerning structure, coordination and control of activities). Accordingly, prospectors primarily focus on product innovation and market opportunities, prioritising creativity and flexibility over efficiency. The organisation structure is usually informal and decentralised to support quick decision making. Correspondingly they adopt decentralised control systems and ad hoc measurements. Defenders seek market stability and aim to protect a limited product line for narrow segment of potential market. They compete on price, quality, delivery, service, operational efficiency, and tight control of costs. Supporting this, they have a more formalised and centralised structure. Analysers are hybrids, combining characteristics of both prospectors and analysers. They balance efficiency and cost control with innovation. They operate in at least two different product-market areas: one stable, in which they emphasise efficiency and one variable in which they emphasise innovation. The organisation structure is complex reflecting the diverse markets. It can be viewed as a combination of mechanistic and organic structures. Final group are reactors who lack a coherent strategy, react to environment changes, and make strategic changes only when forced to do so (Jabnoun et al., 2003).

Majority of these studies focusing on tailoring QM practices to achieve strategic alignment in a firm, make it clear that is no substitute of managerial analysis and judgement. The core implication from these studies indicate that the effectiveness of applying QM practices is enhanced, not by treating it as a single 'package' of prescribed practices but tailoring it to suit the context in which an organisation operates. Furthermore, the context and the relationship between them is complex. Implementing QMS as an overarching best practice will prove insufficient in driving strategic alignment for an evolving organisation (McAdam, R. et al., (2016). In conclusion, Quality management practices can broadly be classified into three categories: Quality assurance with a focus on conformance and reliance on rules, regulations and documentation in addition to supervision and inspection. This approach emphasises on controlling performance primarily through systems and documented processes and is suitable for organisations operating in low uncertainty and with a defender strategy. Total Quality Management with a focus on meeting customer requirements and continuous improvement through control. The TQM structure tends to be more mechanistic in low uncertainty conditions and organic in high uncertainty conditions, thus suitable for organisations with analyser strategy. Finally, Total Quality Learning with a focus on improving organisational learning capabilities to explore new opportunities and identify and pursue new solutions. This approach

is suitable for organisations in high uncertainty conditions and with a prospector strategy (Jabnoun et al., 2003).

2.3.2 ISO 9000 series

QMS is a useful tool for controlling and improving the quality of the company's processes and processes. This kind of approach for assuring great quality has existed for a long time. In the early 1930's the military worked with standardization and quality systems confirming good practices providing great value for those whom it concerned, hence leading to the creation of International Organisation for Standardisation, (ISO), which is defined by ISO as an element that;

"creates documents that provide requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products processes and services are fit for their purpose"

(https://www.iso.org/standards.html)

Nevertheless, there is an emerging global drive for quality recognition and certification, and today ISO is a well-known standard. The ISO 9000 certification can be viewed as a multi-tier governance system involves four groups of players: participating firms, certification bodies and their auditors, accreditation bodies and standard setters (Castka et al., 2015). While the objective of participating firms is to build a QMS for the organisation that conforms to good quality practices without controlling the approach (Boon Wan et al., 2003), the certification bodies perform non-financial audits to verify if the firm complies against the standard and issue a compliance certificate if they do. These certification bodies provide a wide range of services such as ISO 9000 for quality, ISO 14000 for environment. They use a 'pass/fail' type of assessment with the firms that apply for certification. The accreditation bodies determine if the certification bodies are capable of performing the audits and standard setters are responsible for the establishing and revising the standards (Castka et al., 2015). A QMS should not confused with product and service standards which give explicit requirements that specific products and services must confine to. QMS standards such as the ISO 9000 specify requirements for good management practices to achieve quality, but without referencing any particular product or service (Iso.org, 2016). The certification awarded by the ISO organisations helps set an industry wide standard to carry out businesses in a trustorthy manner. According to Boon Wan et al. (2003), the benefits of an ISO 9000-certificate is that it increases productivity, access to

overseas market, increase in overall sales, better documentation processes, yield better quality solutions, customer satisfaction, and have a competitive advantage by working with operational efficiency. On the other hand, Boon Wan et al. (2003) highlights the lack of impact on financial performance and that various certified companies do not experience increased market share, increased quality or lower waste as assured in the ISO9000-certificate. The inconsistency of this experience is referred to not including the calculation of firm size and industrial environment when evaluating the results of the ISO-certificate in companies. In addition, there is also a conclusion saying that SMEs perform better than larger companies in terms of utilizing ISO9000 in the optimal way for the organisation. One of the most commonly reported sources for this heterogeneity is the motivation for firms to get certified; some firms seek it to gain market share and others to bid to products that require ISO 9000 certificate to be a qualified supplier. A few seek certification to improve processes and communication (Castka et al., 2015). Commonly encountered problems most companies face when aligning the ISO9000 with the company values include, relevant and sufficient control over documentation, failure in defining responsibility for the employees, poor training, committed employees and misinterpretation of the standard. (Boon Wan et al., 2003). There is no "best-practice", however it is important to have system thinking in terms of having a transparent organisation, continuously working with procedures and processes, in order to scale and have the operations aligned when the capacity is needed, in which ISO 9000 can support. (Bergman and Klefsjö, 2010; Boon Wan et al., 2003). Furthermore, the selection of certification body is critical. Reputable certification bodies are more likely to be armed with a team of knowledgeable auditors that deliver value to the customer. However, bodies that aim for symbolic application of the standard might not be desirable as they might demand the firm into undesirable actions-leading to their dissatisfaction with the certification (Castka et al., 2015).

The latest version of ISO 9001:2015 is aimed at benefiting small businesses. The standard is based on the PDCA cycle Figure (2.3.2a) and contains ten clauses Table (2.3.2). The implementation of QMS begins from clause 4 which emphasis on defining the context of organisation. Per the standard context of organisation refers to the "*combination of internal and external factors that can have an effect on purpose, objectives, performance, and sustainability of the organization. Internal factors include values, culture, knowledge, and performance of the organization. External factors include legal, technological, competitive, market, cultural, social, and economic environment*" (Newiso9001.files.wordpress.com, 2016). Representing the Plan phase: Clause 5 – Leadership and Clause 6 – Planning stress on the importance of top

management involvement in planning and addressing of all risks and opportunities associated with the processes at the organisation. Per the Do phase: Clause 7 – Support and Clause 8- Operation guide the organisation to determine the necessary resources to execute plan and focus on customer requirements. Representing the Check phase- Clause 9- Performance Evaluation defines requirements for monitoring, measurement and evaluation of processes. It also provides requirements for Internal Audit and Management Review. Lastly, Act phase: Clause 10- Improvement emphasises on preventive actions into practice and continual improvement or processes (LAI, 2017).

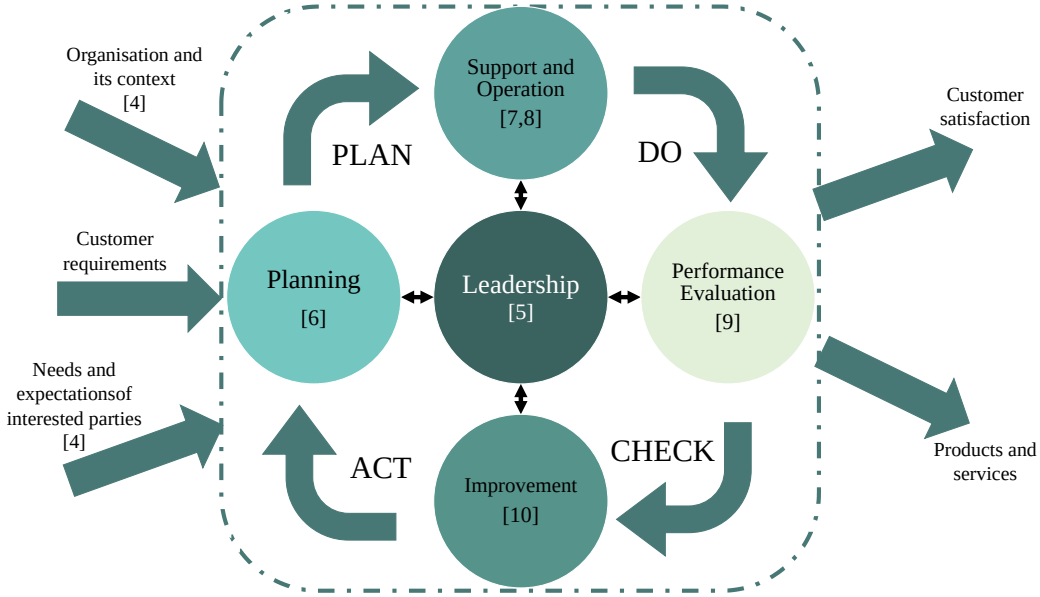


Figure 2.3.2a Quality Management System model (ISO 9001:2015)

Table 2.3.2 Key clauses of ISO 9001:2015 quality standard

Clauses of ISO 9001:2015

1. Scope

2. Normative References

3. Terms and Definition

4. Context of Organisation
- ❑ Understanding the organization and its context
- ❑ Needs and expectations of interested parties
- ❑ Determining the scope
- ❑ Management System

5. Leadership
- ❑ Leadership and commitment, Policy
- ❑ Roles, responsibility and authority

6. Planning
- ❑ Actions to address risks & opportunities
- ❑ Objectives and plans to achieve them

7. Support
- ❑ Resources
- ❑ Competence
- ❑ Awareness
- ❑ Communication
- ❑ Documented information

8. Operations
- ❑ Operations planning and control

9. Performance Evaluation
- ❑ Monitoring, measurement, analysis and evaluation
- ❑ Internal audit
- ❑ Management review

10. Improvement

.

The latest revision of the ISO series has been made with the objective to develop a simplified set of standards, equally applicable to organisations of all size. Also, that the amount and detail of documentation required to be compatible with the desired results of the organization's process activities (Iso.org, 2018). From the context of a startup this would mean no excess administration costs to maintain a standard compliant QMS. According to ISO 9000 clause 3.8 "Documented information can be used to communicate a message, provide evidence to support that what was planned has actually been done, or knowledge sharing." Furthermore, according to clause 7.5.3 on Control of documented information requirements, documents could be of any type of medium which includes paper, magnetic, electronic or optical computer disk, photograph, master sample. The standard provides the organisations the flexibility in maintaining its documentation considering the size of the organisation, complexity of processes and competence of persons (Iso.org, 2018). The flexibility provided to organizations to determine the correct amount and method of documented information needed to demonstrate effective planning, operation and control of processes provides additional motivation to align the QMS with the strategy of the organization.

A management system is composed for several core and supporting processes working together towards business objectives. Each process in turn is composed of several activities working towards quality objectives. Ideally, the PDCA cycle must work on all functions and levels of the organisation and not just on the senior management levels. The management system

documentation can be viewed to be composed of operating procedures. This includes process plan documents subject to improvement via application of the DCA phases of the PDCA cycle (Basics: Documenting a Real QMS, 2014). To support this in practice, the three-tier model of QMS documentation is used Figure (2.3.2b). Per the model, the first level is often referred to as the Quality Manual and provides an overview of the organisation system. The documents here help clarify the context in which the organisations operate. It also describes the processes needed for the organisation to create customer value. It contains policies that are implemented in the next stage. The second level of document is often referred to as Operating Procedures and this tie the policies to the office floor. They describe the management's plan to execute the processes by describing their sequence and interaction (9000 Store, 2018). These documents describe how a process is conducted and not activities. The third level of QMS documentation is referred to as Work instructions as they contain supporting instructions to perform an activity. The level of detail required in the instruction depends on the risk and complexity of the activity. (9000 Store, 2018)

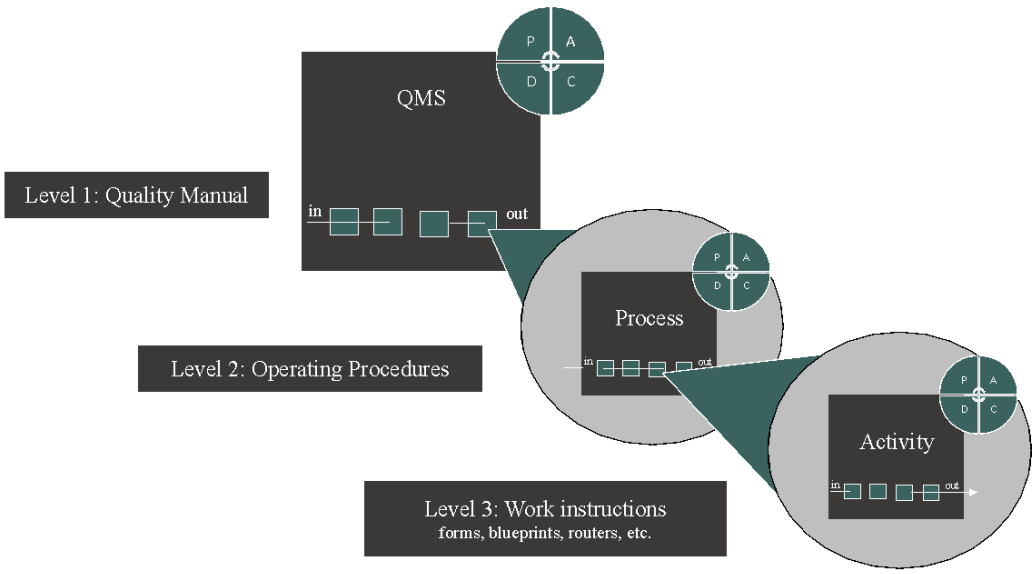


Figure 2.3.2b Graphical representation of QMS documentation system. (Basics: Documenting a Real QMS, 2014)

Most companies generally adopt a new management system with the single goal to get certified to a standard. This often results in the system only responding to a specific ISO requirement, while ignoring the existing processes and their operating conditions of the company (Basics: Documenting a Real QMS, 2014). For start-ups investing in a system for such short-term goals could prove to be a deadly setback. In majority of the start-ups communication internally and with partners is fragmented across channels such as email, phone calls and file share. In such

cases, audits are the primary method to gain visibility of processes (Veeva.com, 2018). With growth, it is important to incorporate partners into quality processes and maintain continuous access to real time information. At this stage, augmenting real time processes with periodic audits enables a holistic view of the state of operations internally, supplier performance and awareness of potential issues (Veeva.com, 2018). To maintain this information system start-ups move to an ERP system or other available independent software to maintain their data and documentation as they grow. When organisations decide to adopt a mature ERP system (software packages that integrate information flow across business functions and unit boundaries, and even among business partners) such as SAP, Salesforce they are expected to standardise their processes to reflect what is designed in the ERP system (Morton and Hu, 2008). From the context of a startup, this is a challenge as no such processes exist or are immature to be standardised. Also, simple processes in a start-up would not utilize these systems to the full extent and hence would be a waste. Another solution is choosing the several SaaS (software as a service) tools available from immature (startup) vendors. (eg: Pipedrive for a CRM system, Monday.com for Project Management). Although, these offer the solution that suits the budget and flexibility of using desired processes, they are developed by fairly newly inexperienced companies in a volatile business environment. Risk in terms of stability, compliance and security, reliability and responsiveness must be considered before investing (Shacklett, 2018). A third solution is to develop a customized documentation system in house to support the documentation. This is ideal considering the documentation system will be tailored made for the company. However, this requires expertise within the company and outsourcing this would be an expensive decision for the startup.

3
Methodology

This chapter presents the research methodology, providing a guidance on how the data collection has been validated and processed. It is divided into research strategy, research design and research methodology, each describing the theory behind the approach and how this is aligned with the empirical data collection.

3.1 Research Strategy

Research strategy defines the overall scope and strategy of the research process in order provide an understanding of how the objectives is fulfilled. (Bryman and Bell, 2011). The underlying objective of the research is to understand the nature of a start-up in order to provide a roadmap on how to work with QMS when scaling. As start-ups grow, a need for improvement of the organisational performance and innovation along with capacity is identified. Theory is limited in this subject directing towards a need of combining it with empirical data from case studies, hence being more of an exploratory research. Thus, the research strategy is of two strategies, an abductive and a qualitative approach, (Bryman and Bell, 2011).

Dubois and Gadde, (2002) refers to abductive approach as a systematic combining (Figure 3.1.a). More specifically, it is a process of a simultaneous evolvement between the theoretical framework along with the empirical fieldwork, in this case matching theory and reality. (Dubois and Gadde, 2002). QMS includes endless variables such as, focus on processes and continuous improvements of an organisation, all of which incorporates contingency into the research, when planning an implementation of the best QMS practices. Hence, leading to a need of understanding the reality and complementing it with theory, back and forth. Dubois and Gadde, (2002) describes abductive approach of this kind as matching between identified empirical activities continued from reviewed theoretical framework. The direction and redirection in the systematic combining model is referred to due to data collection being based on various sources, may lead to new discovery and also redirection of the research's original direction.

Figure 3.1.a Systematic Combining

Second relevant strategy is a qualitative approach, which emphasizes on words and interpretations. (Bryman and Bell, 2011). QMS highlight, leadership, employee commitment, and culture which is difficult to measure by numbers. In relation to this research, the qualitative strategy is more of an inductive methodology, where the theory is an outcome built from observations (Bryman and Bell, 2011). There is still a structure needed of gathering and analysing data, Bryman and Bell (2011) presents a good structured process in the practices of gathering data, that consists of the following key activities;

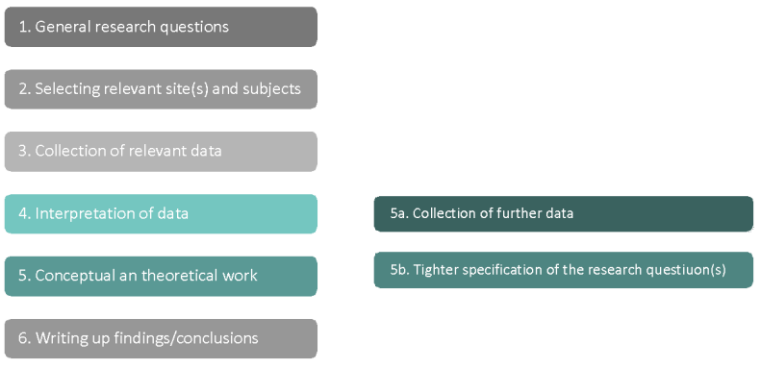


Figure 3.1.b. Quality research (Bryman and Bell, 2011)

3.2 Research Design

Research design accommodates a framework of the data collection and analysis that reflects the decided priorities in relation to three key indicators in business research such as, reliability,

replication, and validation. Reliability concerns the consistency of the obtained results. Replicability is somewhat connected toe reliability, but it refers to whether the study is repeatable, meaning the outcome would be the same if the study was repeated. According to Bryman and Bell (2011), a replicable business research would be highly valued, however it is not common nor is it always rewarding for the researcher seeking for originality. Finally, validity, simply means, measuring the right thing. (Bryman and Bell, 2011).

3.2.1 Data collection

There are various ways of attaining research results, however the strategy for this research is of an abductive approach and therefore the most suitable design is a case study. Bryman and Bell (2011) defines case study as provider of both theory generation and theory testing. However, in this context it is directed towards a process of singular variables (i.e case study of a single organization, single location, single person, single event), which is difficult to limit to in reference to the chosen strategy. Because of startups having limited resources and the organisation is not as complex as large corporations. A more suitable research design is of the one that rely on analytical inference and provides a broader knowledge of the best practice scenarios in implementation of a QMS in a start-up (Dubois and Gadde, 2002). In this paradigm a multiple-case study in a more comparative design is relevant. It emphasizes on the individual case and its unique context, and entails the research using similar methods of two or more contrasting cases or situations. The aim of this design is to gain a better awareness and deeper understanding of the social reality in various communal contexts which also is the objective of this research. (Bryman and Bell, 2012).

In order to gain the optimal results of the QMS implementation, the case study is complemented by three additional frameworks of data collection. The total of four frameworks of data collection are, case studies, internal auditing, customer focus, stakeholders and (ISO-certification) auditors, is designed the following way, built by;

- *Start-up Case study*, the goal is to implement a QMS in ReVibe Energy however there are gaps in the operations that need to be evaluated for best practices. Therefore, case studies of seven companies referred to as start-ups or SME's was conducted in order to identify the challenges to avoid when scaling and the optimal practices of a start-up in the growth phases.

- *ReVibe Energy Case Study*, regards observations, workshops and interviews internally within the company at ReVibe Energy. The objective is to understand the organizational context, leadership commitment, procedures and processes, the openness to change and development of organizational culture towards what is best for the organization. The goal is to understand the *"as-is"* operations and identify the gaps for *"should-be"* improvement(s).

- *Customer focus*, QMS highlights the importance of customer needs and requirements that has to be fulfilled. In order to understand the customer requirements for a start-up company such as ReVibe Energy and due to the limited resources, that is in hand, it is important to identify the characteristics and the actual needs of the customer in terms of innovative (disruptive) products (Chapter 2.1). Currently most important customers are identified as OEMs, therefore several case-studies for the empirical data will be based on that. The objective is to identify demands and requirements in order to provide the solutions the customers actually need. Customers in this case are identified as stakeholders in the OEMs that decides whether or not to include external innovative solutions into their own processes, such as R&D and/or purchasing. But due to the constraint on time only one interview representing each the R&D and one purchasing function could be arranged. The functions were chosen considering that they are the ones most commonly associated as customers to the technology start-ups. Considering, the diversity in corporations while organising internally, the requirements from purchasing and R&D should only be viewed as an overview of customer needs and cannot be generalised to support all cases.

- *contract-manufacturers,* concerns interviews with stakeholders in the organisation, and observations of their processes. It is a priority for ReVibe Energy at the current state because the objective is to be ready for high volume delivery, also referred to as commercialization. Hence, it is important to have an established agreement with an experienced contract-manufacturer in order to have a capacity ready when a customer orders high volume. In terms of QMS, it is important to understand what is needed and should be prepared before starting production.

- *Auditors*, ReVibe Energy wants to get an ISO-certification, it is therefore important to collect data from experts so that resources do not get waisted. Hence the objective is to get deeper knowledge of QMS and the requirements of getting an ISO-certification.

This is the research design, however a more detailed description of the different methodologies and practices in data collection will be presented further down.

3.2.2 Reliability

Reliability focuses on the consistency of the gathered data, it is connected to replicability, meaning the measures should be repeatable with very little variation over time. The less stable measures the less reliable are the results according to this theory. This research has a low stability if referred to this type of measurement, because the consistency is high level of qualitative data. (Bryman and Bell, 2011). However, the strategy is abductive, and therefore the results are somewhat expected to be contingent, thus not necessarily unreliable. Dubois and Gadde (2002) instead divides the measures into passive data, (what is set out to be searched for and found) and active data, (measures that are less stable because it is discovered and relatively new). The stability instead emerges from complementing the data with supportive theoretical research and/or additional empirical research. (Dubois and Gadde, 2002). The stability of this research is supported by the theoretical study and the different methodologies in the gathering of the data (in reference to Chapter 3, data collection framework).

Throughout the research, it was noted by the research team that the view on QMS, associated purpose and practices are very subjective. Although, seven companies were chosen for multiple case studies, the role of QMS in supporting growth was analysed by comparing only the two companies that identified these management practices under the label of QMS. Given the exploratory nature of study, added to subjective definitions of QMS, exact replication of the results would be difficult. Rather the study should be viewed as a basis to conceptually shape further studies (both research and practice based) involving contingency theory and role of QMS in supporting growth of start-ups.

3.2.3 Validity

The most important factor of research is validity. It presumes reliability, concerning the evaluation of whether or not an indicator (a qualitative gauge), really measures what it is

supposed to. In other words, if the measurements of the collected data are not reliable, then it cannot be valid. There are several views from which validity can be evaluated. Bryman and Bell (2011) presents several ways of ensuring different types of validity. Trustworthiness and authenticity is the one referred to for a qualitative research of this kind. Trustworthiness is divided into four criteria's such as, credibility, transferability, dependability, confirmability, and authenticity. Each representing different aspects of the validity of the research.

First, ***credibility*** is the correlation between the researcher's observation and the development of the theoretical ideas. This criterion is a strength for a qualitative research, thus it ensures that the research is aligned with the good practices and findings of the social context. (Bryman and Bell, 2011). The credibility of the research was ensured in several ways, first of all, there were two researchers systematically, critically viewing the research. In order to sustain in the "right" path, a supervisor frequently monitored and got updated during meetings. Second, this study being a qualitative research, based on the case study of ReVibe Energy, it has been important to entail depth of this study. Therefore, ***transferability*** of the findings has been important to highlight with a thick description. Third, ***dependability***, which can be a problem for a qualitative research if not handled correctly, is about establishing a merit. Everything that is recorded, such as, problem formulations, field work notes, interview transcripts, all types of audits used during the research period. (Bryman and Bell, 2011). Due to the abductive strategy it was important to have standardized documentation procedures such as, regularly taking notes of meetings and action plans. Furthermore, small summaries of the progress were presented to the supervisor. The interview transcripts were typed in an excel sheet, accessible to the researchers, and all brainstorming sessions and discussions (with usage of the whiteboard) were taken pictures of in order to not miss on any kind of data. It was important to establish trust and allowing the participants to be genuine and honest during their interviews. This is very important according to the third criteria in trustworthiness, confirmation. Fourth, ***confirmability***, refers to being objective and not allowing personal values interfere in the research. It was very important have a good reliable research by acting in good faith by basing information on facts. Finally, ***authenticity***. It was important to be objective and represent the different viewpoints that exists, hence get a better understanding of the research context in reference to the social settings. By working close with the ReVibe Energy case study employees with the emphasis on empowering but not direction the team, the researcher tried to stay authentic and reliable in their work.

3.3 Research Methodology

Research Methodology is a procedure for collecting data. This study consists of various methodologies in terms of data collection, however there are several variables that needs to be taken into consideration for the reliability of the research. These variables are such as, literature review, empirical data collection in terms of sampling, the framework of the data collection.

Sampling is related to the quantitative research in relation to statistical processes that is encountered. However, there is also a qualitative viewpoint that from the abductive strategy suits this research, and that is theoretical sampling. This type of qualitative sampling moves away from probability sampling and is an alternative strategy. It is practiced discovering categories and their properties in order to identify and evaluate the correlation into a theory. Theoretical sampling collecting data by observing, interviewing, collecting documents are processed until theoretical saturation, which means that creation of category and conformance exists. This approach does not only include people but also events and contexts. (Bryman and Bell, 2011).

The research methodology of collecting data was together with literature review, done through interviews and observations.

3.3.1 Literature review

The objective of the literature review is to enable and identify previous research in an area along with discovering new areas and gaps with potential solutions. Since the empirical fieldwork parallels the theoretical conceptualisation, there is a constant need to update the knowledge with underlying valid research, which is very difficult. In order for the research to be reliable, a systematic review is conducted. (Dubois and Gadde, 2002). This type of review adopts explicit procedures into the research. It is an evidence-based approach ensuring a more reliable theoretical framework. For instance, the researcher in these cases sets to find out the effects of a particular variable based on previous research. The main steps in a systematic review process are, specify questions and planning the review, conducting the review, and reporting and dissemination. It is considered to be a reliable approach because it covers a more comprehensive understanding of the subject. (Bryman and Bell, 2011).

The searching for this study was based on relevant theory related to the topic of; QMS in start-ups. The utilized platforms in order to find information about the correlation between QMS and start-ups were in Google Scholar and various library databases. The articles were carefully selected and evaluated on their validity and reliability based on authors and references. The abductive approach ensured the theory supported by empirical data and also the other way around.

3.3.2 Interview context

The interviews are divided into two scopes in this qualitative research, unstructured and semi-structured interviews. (Bryman and Bell 2011).

Unstructured interview is characterised as a conversation. (Bryman and Bell 2011). It includes a topic, and starting point of one question, leading into varied questions. In this study, the unstructured questions were conducted toward ISO-auditors, identified as experts in their field of auditing ISO-certifications. The objective was to understand the processes of certifications and the needed resources in order to get certified.

Semi-structured interviews are defined as more interview guide, or a formal list of topics that needs to be analysed. Unlike structured interviews, semi-structured interviews allow a little more space for the researcher to ask questions not included in the formal list, covering a large variety of instances. (Bryman and Bell 2011). The topics of the formal list in this study was based on the literature study and also on previous interviews from auditors.

The general and open questions was based on literature but also feedback from auditors interviewed early in the research. The objective with the open questions was to understand the context of how the start-ups work with their processes and quality in their own way. Having closed questions might have missed the essence of what was interpreted as QMS by the researchers. The open questions allowed the interviewees to answer in their own way. Also acknowledging the researchers to explore new areas and understand the knowledge the interviewee had about QMS. It provided some kind of depth to the research. However, due to ethical issues, the interviews were not recorded, only written down, therefore also limiting the input to what is interpreted at the time of the interview. (Bryman and Bell, 2011). Thus, in order for the data collection of this type to be reliable, the researchers made sure that the meetings

were face-to-face and two interviewees were present. This ensured a better understanding of the company culture and also allowed the research to go deeper into the subject.

The unstructured interviews were performed with four auditors from different backgrounds. The questions were mostly based on the QMS Figure.(2.3.2a). The semi-structured interviews were performed with seven start-ups (Appendix C), one contract-manufacturer (Appendix E) and two established corporations (Appendix D).

3.4 Ethics

The ethical issues of business and management research highlights five important principles to take into consideration when conducting a research. First, *whether there is harm to participants"*, harm can have a number of implications, physical harm, stress, simply actions that results in negative side effects on individuals. Second, *"whether there a lack of informal consent"*, includes aspects of disguise or covert observation. The principle means that the it should be up to the participants to participate in a study based on given information. This can sometimes also make the research invalid depending on the framework of the research. Third, "*Whether there is an invasion of privacy"*, the purpose with this principle is for the researcher to understand that there is no special right for the researcher to intrude the participants privacy without consent. Finally, "*Whether deception is involved"*, it is important not to misuse trust and represent the research other than what it actually is. (Bryman and Bell, 2011)

Having these in mind along with other ethical and legal considerations such as data management, copyright, affiliation and conflict of interest amongst other things, the study has been thorough in being transparent and clear with the purpose and that no harm is done in any kind of way. For safe guarding of the interviewees they have only been referred to within their function and responsibilities. Transparency has been important in the interviews, therefore all interviewees have all been informed of the purpose the interviews, of this study and asked for whether or not it is allowed to use certain tools, such as recorder amongst other things. All sensitive information given to the researchers has been evaluated and documented with caution. And if asked for the interviewees have been allowed to read the information before release in order to determine of any sensitive information has been released or not.

4
Empirical Data

This chapter contains data from case studies for two different purposes. The first was to understand in detail the phases of the initial growth stage in B2B technology start-ups and the impact of management practices introduced at this stage. Second, considering established OEMs belonging different industries are key customers to these start-ups, the purpose was to understand how customer needs and requirements change during this initial growth stage of a B2B technology startup.

4.1 Case Study

Supporting the first purpose, the data for the case studies was collected from seven Sweden based companies, younger than 20 years old experiencing fast growth in their chosen industries. The content is based on company reports and press articles and interviews with senior management and professionals involved in quality management of these companies. ReVibe Energy is also considered as a case to be able to compare the conditions among companies that share some context. The companies include: Simplex Motion, Nimbell, PowerCell AB, LumenRadio, Amparo Solutions, Vehco and Qamcom Technology.

To support the second purpose, professionals representing the purchasing and R&D functions in established OEMs were interviewed. These functions were particularly chosen as majority of these start-ups work with both the R&D department and the purchasing department of OEMs in their early stages and both have distinct needs and requirements from the start-ups. Therefore, a supplier quality manager from SKF and a product development manager from Volvo Cars were interviewed.

Table 4.1. Summary of case studies

Company	Year	Industry	Employees	Certified QMS
ReVibe Energy	2014	Energy harvesting	4	No
Simplex Motion	2013	Motion control/Servo motors	2	No
Nimbell	2009	Automotive	9	No
Lumen Radio	2008	Wireless Technology	35	No
Powercell	2008	Fuel cell technology	28	Yes
Amparo Solutions	2007	Intelligent Transport System	11	No
Vehco	2001	Telematics	93	No
Qamcom Technology	2001	Communication	130	Yes

4.1.1 ReVibe Energy

ReVibe Energy was founded 2014 as a joint venture between the founding team, SAAB Ventures and Chalmers Ventures. The company offers its customers a mobile and wireless power source that never runs out of power with the purpose of charging wireless sensor- and monitoring systems. Through a unique and patented energy harvesting technology, the products of ReVibe Energy powers Industrial Internet of Things (IIoT) applications and eliminates the need for batteries and/or cables as the main power source. The solution allows for a significantly higher return on investment compared to conventional power sources. Their long-term goal is to have their proprietary technology replace use of expensive and non-durable options such as batteries and cables that are currently used. With a vision to be world's leading company in vibration energy harvesting, ReVibe Energy has initiated important customer projects with leading OEMs. The projects are currently in the development phase and ReVibe Energy, along with its key customers are hopeful to begin serial production in 2019 (Börjesson, 2018).

Currently there are four permanent employees and two part time employees working at ReVibe Energy. While the CEO and COO handle sales, business development and management, Chief Product Engineer and Lead Product engineer are responsible for technology and product development. The CTO and another enginner work part time in product development as well. ReVibe Energy has maintained a linear growth rate since its inception in 2014. The team attended several venture competitions and fairs to capture interests of potential customers. In 2014, they received their first round of investment of SEK3.7 mil to parallelly focus on

technology and business development by putting the technology in industrial environments to prove its customer value. They successfully initiated this by launching their first customer project with a leading OEM, the same year. Supporting their growth, in 2016 they successfully completed another round of investments of 2M SEK to support their expansion strategy of attracting new customer and linking with strategic partners. In the same year, ReVibe Energy successfully completed a project with German based Deutsche Bahn where units were field tested in Berlin. To further improve sales and strategically invest in product development, they raised 7.5 MSEK from Lindebald Technology and previous strategic partners in 2017 (Börjesson, 2018).

The projects with leading OEMs, initiated in 2015 have undergone several design iterations and prototyping. The company is currently hoping to reach a frozen design with their key customers which will be commercialised in serial production in the fall of 2019. To successfully ensure capacity and capability required to establish this scaling, the team at ReVibe Energy identified a need to ensure traceability and repeatability of processes. The team also forecast a demand to be certified to a quality standard to be approved as a qualified supplier to the OEMs. To fulfil this purpose, they decided to plan the implementation of a Quality Management System. However, being a startup they had financial constraints with hiring expensive consultancy hours to fulfil this need and hence decided to collaborate with Chalmers University to initiate a Master Thesis project around the topic.

ReVibe Energy uses informal means to operate and communicate in the organisation. This is supported with simple IT tools. With its competent workforce, ReVibe Energy has managed to maintain efficiency and flexibility in its working. They have recently begun investing in the development of awareness creating or marketing channels. Currently, the outbound challenges are managed in house and include sales personnel making cold calls and attending fairs. This has a customer conversion rate of 2%. Recently, they have been focusing on developing their inbound marketing channels by outsourcing the development of website and related data analytics. They believe this channel is most efficient to find international markets and for interested parties to find them and with the recent improvements it has a conversion rate of 10%. To manage customer relationships, ReVibe Energy is testing a CRM system called Pipedrive which is a fairly new CRM SaaS. For project management, they have begun working with a platform called Monday.com to decide project timeline and task delegation. The two IT platforms are semi integrated and they are currently working to improve the integration between

the two. The challenge with using these platforms is that currently for R&D related tasks the company works based on facts 80% of the time and for the remaining 20% it is based on gut. While for sales related tasks they work 100% based on gut and rely on social skills and a personal network. This implies that the tasks vary distinctly to have them standardised. However, they believe that as they move closer to a deal with customers, patterns emerge, and some tasks can be standardised to move towards repeatability and traceability.

With increasing number of customers, demand to acquire capacity for serial production and consequent addition of resources, there is a need to document the knowledge the company has gained through the years to analyse, improve and disseminate this knowledge. The team has also recognised that their way of working can be improved if they do a task several times repeatedly, which requires reemphasises the importance of traceability of processes. A quality management system, with its emphasis on process thinking, customer focus and continuous improvement seems to be the solution to their need. To ensure the benefit of this investment, it is essential that their QMS in is line with their business strategy and allow sustained growth of the company. The management team had a clear vision that while it was important to be certified to quality standard, they were unwilling to add to the administrative costs to maintain the QMS. It was also a challenge for the team to differentiate between the product certifications and process certifications which varied with every project and customer and their target customers operated in different industries and geographical location. But the most basic problem while designing the QMS is ensuring that the practices and formalisation introduced would be coherent with the culture that would be initiated at the company. In the sense, it is crucial that the management practices introduced to support the company in their vision to be a leading, qualified supplier of energy harvesting systems but do not impact the flexibility or adaptability of organisations to react environmental changes.

4.1.2 Simplex Motion

Simplex Motion was founded in the year 2013 when inventor Johan Linder incubated the Simplex Motion project at Chalmers Encubator AB. As an experienced engineer he discovered a sensor technology that could not only achieve high precision control but allow for the compact integration of the servo motor system. The resulting motor system solution with distinct advantage of high torque to size ratio proved to be a cost-effective solution which would lower the development and maintenance cost from before. He began selling his patented, sensor integrated servo solution to the Swedish market which could be used in computer guided

drilling, milling, engraving, plasmas cutting, etc. His motivation to partner with Chalmers Encubator AB was so he could find a dedicated business development team that could continue building his project. Now Simplex Motion offers its solutions to customers by partly selling its own products, but also by developing customer unique solutions built on their platform. They also license their technology or offer their technical expertise services to customers. Simplex Motion made a turnover of 200KSEK in 2017 and is managed by two full time employees and Johan as a consultant (Simplexmotion.com, 2018). For this research, the CEO and CTO of Simplex Motion were interviewed.

Over the years, Simplex Motion has been developing their technology into products suitable for various customer needs. Currently they have developed 3 series of servo motors supporting different ranges of power output ranging from 25W up to 300W. Along with these, they also offer complementary accessories such as SIMPLEXMOTIONHUB which is a complete control box for 24V motors. Beyond these standard products, they offer customizations ranging from software adaptations on their standard servomotors to a unique solution specially designed for the customer application. The market conditions and requirements are different for different products and services, which they are hoping to explore and develop in the near future. The robotics industry is one of their target market segment and their servomotors can be used to power smaller robots. These, along with the complementary accessories are attractive to the electronic hobbies market where there is a demand for small motors. However, this market is characterised by need for low priced motors. The motors are sold via trusted resellers in Sweden and Europe, but it is currently a challenge to find resellers in Asia, who have a good knowledge of the market. The automation industry is another potential market segment which is vast and often imply OEMs as customers. They have identified certain industrial resellers who sell large amount of components to bigger companies. However, they are of the opinion that the large industries do not use such resellers, due to which they have a need to establish direct contact with the companies. They currently attend fairs to market their product but would soon start to make cold sales calls to attract large companies as customers. Simplex motion has focused on developing the commercial proof of concept all these years. They have come to realise that the market needs differ and developing solutions which are of most value to the customer is crucial. To better understand this customer need, they have decided to employ a Chief Marketing Officer in the near future. They have a few customization projects with other companies currently running. The CEO is of the opinion that working with other start-ups and SMEs on projects is easier than larger customers right now as it is easy to track the SMEs progress and

receive time feedback from them. In case of large companies as customers, it is harder to receive feedback and match their long development times with the resources at hand.

Since the team consists of only two people they use simple tools such as Microsoft Excel, Dropbox to support their operations. Customer requirements are tracked via the email conversions with them. Simplex Motion has a strategy to move towards establishing a portfolio of standardised products. They are working towards this goal by developing motors of different specifications and sizes and simultaneously expand their market reach. Prototypes of smaller volume and assembled in house, whereas high volumes are achieved by partnership with contract manufacturer. Although, they don't have any KPIs established, they check for nonconformities in a batch of motors and communicate any faults with the supplier and try to rectify it. Currently they are working with one contract manufacturer but are scouting others to match their demand, capacity, and cost constraints. Simplex Motion is still in its infancy and a structure or culture has not been established at the company. What is crucial for the company now is to establish a market, generate sales revenue, and reduce their dependency on external investments.

The CTO mentioned that one of the administrative challenges in getting the product market ready is comprehending the different standards the products must confine with. He mentioned that the only crucial certification for them is the CE certification, which is a self-certification required to legally sell products in Europe. However, since their motors is used in integration with several types of parts, they have to fulfil different directives (eg: low voltage, machine directive) to get their products certified. Also, the electronics hobbies market and the customization projects will have different requirements which is also a forecasted challenge as they gain market traction. At this point, their biggest challenge is the need for additional manhours and investment to sustain their progress as they build a stable market.

4.1.3 Nimbell

Nimbell was founded in 2009 with a business concept to develop, produce and sell light and medium-sized electrical work vehicles to professional organizations. Two Chalmers Entrepreneur school students and a group of experts under the direction of Per Svantesson identified a need for electric vehicles specifically for professional work and cargo transport and formed Nimbell to satisfy this need. The development of the vehicles was conducted in close cooperation with the final customer. In 2011, the first test vehicles of the first Nimbell product,

Trigo was introduced and made available for customer tests. In 2012, Trigo was launched into a waiting market. However, it proved to be very capital intensive to produce the vehicles and find customers willing to invest, due to which the company was eventually sold off. For the purpose of this research, one of the founding members of Nimbell was interviewed.

The main objective for Nimbell was to develop and market their products with primary focus on the Swedish market but an intent to target the foreign market as well. To achieve this, they tried to get Trigo approved for international market by implementing a QMS. Being in the automotive industry, this was crucial for Nimbell to be a qualified supplier of electric vehicles. Nimbell leveraged the QMS used by the contract manufacturers who produced the vehicle for the pilot test vehicles. However, they had a serious demand to be certified themselves for serial production. They planned for a QMS implementation project in collaboration with Chalmers University through a master thesis project. The student who worked on the project went on to manage the quality at the company on permanent basis. However, since the intention of implementing the QMS for purely to receive approval, they mostly focused on the formal compliance requirement, rather than trying to align it with the business strategy. During the course of implementation, they realised that certifying their processes was resource and capital intensive. Their QMS took on a quality assurance role with a focus on developing a process-based view, continuous improvement and ensuring employee commitment for the conformance of product. What lacked in their QMS design was the support to align the strategy of the company with its business environment. Furthermore, it was clarified during the interview that there are two distinct type of certifications were crucial to pursuit: product-based certifications and process certifications. To be a qualified supplier, they had to certify every vehicle certified per road safety regulations and their processes to ensure traceability and repeatability of processes.

Although they tried to improve their processes with a QMS; producing and testing the vehicles proved to be expensive without customer commitment to buy them. They faced several challenges during these times. Firstly, it was a challenge to design a structured way of working in a startup environment which is resource constraint with overlapping processing and responsibilities. Secondly, testing the vehicles proved to be expensive and they were unable to maintain the test lead time as it was a challenge to get slots for testing. Also, producing the vehicles proved to be a challenge as they needed expensive production tools to successfully

manage it. Given these reasons, Nimbell failed to certify their QMS and to create the market it hoped to.

4.1.4 LumenRadio

LumenRadio was founded in 2008 by founder and CTO Niclas Norlén with Chalmers Ventures and Almi Invest as major investors. In 2016, Latour Industries AB also joined the company's ownership. Leveraging their highly reliable and patented wireless technology, they offer radio modules and an operating system that can be integrated directly into the customers' products. Using state-of-the-art networked algorithms, ultra-low power, wireless FW updates, installation technology and large-scale networks, LumenRadio creates connected products which they believe is 'future-proof'. The core value they produce is in their patented cognitive coexistence technology, which like a weather forecaster, predicts how the frequency spectrum of communication channels will be utilized going forward on a millisecond basis. This prediction allows their products to adapt to the best available frequency, thus eliminating problems such as communication breakdown among wirelessly connected devices. LumenRadio has been strategically leveraging the increase usage of IoT and connected devices since the launch of the revolutionary CRMX system in 2009 to achieve a turnover of 52MSEK in 2017 with its now 35 membered team (Lenander and Westman, 2018). For the purpose of this research, the Purchasing and Supply Chain Manager was interviewed.

LumenRadio began with collaboration with engineers from Entertainment and Telcom industry and the CRMX system was designed to suit the requirements of the Entertainment industry. Currently they have the identified professional lighting and HVAC (heat, ventilation and air conditioning) system providers as their main customer segments. For the professional lighting segment, they are either in direct contact with the end user or use distributors to reach their customers. The HVAC systems for indoors include houses, supermarkets and office spaces as their target customers. Sometimes, they also have large OEMs as customers who integrate the product from LumenRadio into their system. They actively scout potential customers by attending fairs, cold sales calls and referring to reports from companies actively working in the IoT field. Their sales cycle is long and could take over a year to complete. Hence it is important to monitor activities with the customer as they move through the process. To achieve this, their CRM system uses a sales funnel where the customer value is monitored as they move close to the deal. Through this, division of activities at each stage of the process is decided and also project costs are checked against the budget. The sales funnel is monitored per customer and

per project. The results from analysing the sales funnel are reported to a steering group every month. The interviewee believes that their sales team is skilled at their job and always include a technician or engineer during meetings with customers when required.

LumenRadio has followed the typical hockey stick growth curve, which is popularly used to describe the growth of start-ups. To achieve this growth, they have used the blue ocean strategy, which refers to the creation of a new, uncontested market space by a company that makes competitors irrelevant and creates new consumer value. LumenRadio appointed a new CEO and with the change in leadership they began to look into not only new customers but also new business areas. To support this, the R&D team is expected to dedicate 15-20% of their time on internal R&D projects, where they check for gaps in the market they can fill with their technology. They actively patent all new findings and believe that their patent portfolio is crucial to position the company. To support its growing market, LumenRadio has developed its operations incrementally. Initially all activities were conducted based on gut but as they grew they recognised the need to base decisions on facts. To accommodate this, they introduced measurements within processes to check if it matches the forecast and make the required adjustments. Furthermore, as the number of customers grew it was challenging to accommodate the varying customer needs. Therefore, they aimed towards producing standard products which would also help them economies of scale. Currently, their portfolio includes product modules to support mass customization.

LumenRadio operates in a very cross functional manner internally. They work on managing the quality of their operations, albeit not having or calling it a QMS. Communication is through face to face meetings and the culture promotes such communication among employees, even if they belong to different functions. Although this structure and culture have just begun to take shape, LumenRadio tries to be coherent with what is explicitly developed and the tacit guiding of the organisation through involvement of all employees. Despite having executed several customer projects, they do not have a standardized process for new product development. They develop the prototype in house based on customer requirements and send it to the customer for testing. Most often a project undergoes two-three rounds of prototyping before design freeze for serial production. They have a checklist for critical quality elements of products defined. If a development project is successful and approved for serial production, they clarify steps required for production in the list. Recently, they have introduced an initial approval procedure where a copy of the final sample is saved with the customer, manufacturer and LumenRadio.

This has helped reduce misunderstandings before moving to the next stage. The serial production is done with partnership with suppliers and contract manufacturers. Scope of control differs for each project (eg: sometimes programming is done in-house and sometimes outsourced). The partners are strategically chosen, and they mostly use forecasts and informal controls to coordinate with them. LumenRadio uses a variety of IT systems to support their operations. Various technical programs are used for the development and since the last three years, GIRA is used to manage the operations. All the employees have access to the system and also relevant customers and partners. Customers can raise tickets with the development team when they face an issue with the products. In addition, Arena is used for to manage the product lifecycle and allows for technical communication with customers. They do not use email to communicate with their customers.

The purchasing manager mentioned that it was a challenge for them to move away from basing decision on instincts to basing them on facts. She believes small incremental steps can help a company with this. Their strength is in their workforce and culture fit is of utmost importance while recruiting. However, she also mentioned that finding software developers is currently a challenge. Another challenge was to ensure that they spend time on developing products that would sell. Engineers are always to trying to improve their design and are not content to introduce it to the market until they find it perfect. LumenRadio is now trying to introduce the concept of Minimum Viable Product (MVP) development technique to ensure that the right products are developed. Furthermore, with the diversified customer needs it is also a challenge to develop a portfolio that satisfies maximum needs and allow profitability for the company.

4.1.5 PowerCell AB

PowerCell began its journey twenty years ago as a development project within the Volvo Group. PowerCell AB was then founded as an industrial spinout in 2008 with a vision to become the world's leading innovative fuel cell company by offering efficient and, environmentally friendly power products and systems with their proprietary leading fuel cell and reformer technology. They are guided by the core values for Quality, Safety and Environmental Care. PowerCell AB has grown tremendously during the years, since the introduction of its first product PowerPac. They are publicly traded with Nasdaq First North Stockholm since 2014.In the year 2017, PowerCell AB achieved net sales of over 37000 TSEK and an operating profit of -67000 TSEK which clearly indicates their high operating costs

(Powercell.se, 2018). For the purpose of this research, COO and Purchasing Manager were interviewed.

PowerCell AB can be classified to be working within the high-technology industry and in a highly regulated external environment. They develop and produce fuel cell stacks and systems with high power density, for stationary and mobile applications. By designing the fuel stacks to be compact, modular and scalable, they are adjusted to the varying customer needs. Due to the complex underlying technology, coupled with expensive and long development cycles, the interviewees identified the market as 'niche' which is built on personal relationship. Based on the maximum power that could be produced using the technology, the company identified the telecom industry as the first market for PowerPac. They also identified other industries such as marine, military etc. which require the same range of power. Moreover, they identified applications such as powering the propulsion system of buses, trucks, cars which could be potential customers by developing their technology to achieve the required higher power output. The company which is strategically placed in the start of the technology development curve has its own set of advantages and setbacks with regard to the market condition. While globally widespread movements, aimed to lower the environmental impact from energy generation and consumption has caused PowerCell AB to experience a continued interest from customers, the capital-intensive development and dated government policies hinder the company's pace of progress. Due to this, they are heavily dependent on investments from customers as well as subsidized solution from the government. PowerCell AB has a special focus on the Chinese market as they believe it could be of great potential. However, since their customers are dependent on government subsidies to cover the high development cost, PowerCell AB has chosen to improve their technology to accommodate requirements needed to receive such subsidy.

PowerCell AB, with its roots from Volvo Group sought out an unchartered market with its strong proprietary, patented technology. Until 2014, the company focused on developing the technology into a workable proof of concept and delivered its first product PowerPac to the customer. In 2015, the company was believed to be in the starting point of the technology development curve and focused on developing capability to deliver prototypes for customer testing. With growing interest from customers, the company adopted a strategy to help them transition into a customer oriented commercial pioneer company. To achieve this, they planned to be ready with capacity for serial production in 2017. Per Wassén, CEO at PowerCell

describes the market strategy with, "*Our market strategy is firm, with full focus on developing the segments that we have prioritised, while at the same time we continue to devote particular attention to the growing Chinese demand. We are building brand, delivering high-performance stacks with premium quality, and we have a solid reputation, which is confirmed by the many requests and repeat customers*".

The purchasing manager mentioned that the employees are passionate about the technology and the culture at PowerCell further promotes this passion. Recruitment process is key in ensuring that new resources fit into the culture and have the required expertise. They believe that as a pioneer in this technology it is important to maintain the technical expertise. PowerCell works as a functional organisation with increased integration of processes higher up in the hierarchy. The projects are very process oriented and interface between processes is managed by process owners. Generally, the products are designed and assembled in house, but this is heavily dependent on the investment as the equipment required is expensive. Thus, if the customer demands for local manufacturing that is accommodated by PowerCell as they believe that the value they bring is in the 'know-how'. The components needed for the product are either very specific in nature and must be sourced strategically from very few trusted suppliers or standard components which can be easily purchased. The IT system used in PowerCell mirrors their organisation structure, with the use of required technical tools within functions but allowing for integration of their processes through their ERP systems such Microsoft SharePoint and Microsoft Dynamics.

Furthermore, PowerCell is ISO 9001:2008 and 9001:14000 certified. According to the interviewees the QMS contributed to a better understanding of customer requirements, and thus it assisted in the transition of the company from a development focused to a customer focused commercial company. The motivation behind the implementation of the QMS was: emphasis on safety in the industry, law regulations for working in this field demands to follow a controlled way of working and become more customer focused. The QMS at PowerCell provides details necessary to execute processes and check of validity of documents. Communication within the organisation is achieved through frequent meetings. Supporting this are the KPIs which helps keep the processes on track. These KPIs are derived from the business plan and are created by process owners. The COO believes that this level of detail or control of processes is necessary given the complex technology and high safety and compliance requirements. PowerCell has a dedicated and experienced Quality Manager to ensure

compliance and the continuous improvement of the system. It is available as a catalogue for all employees. They believe it is beneficial to implement a QMS as soon as possible, once the vision, and strategy to achieve that vision is defined.

However, the purchasing manager mentioned that it was a challenge to train new employees given the complex technology and detailed processes at the company. But the greatest challenges for PowerCell AB are the government policies and allowance of subsidies to companies working with fuel cell technology, limiting their innovative work. This adds to their problems of long and investment heavy development cycles. Being a company, whose strength is in its technical intensity, establishing a culture of customer focus is crucial at this stage for PowerCell.

4.1.6 Amparo Solutions

Amparo Solution, a spinoff from Qamcom Technology was founded in 2007 to work in the Intelligent Transport System (ITS) industry. Leveraging the growing hype in smart infrastructure, they recognized that increased road safety and better utilization of existing infrastructure require real-time information monitoring of their use. Amparo Solutions develop and sell products, systems and services to make today's infrastructure better and truly smart. The company is now a part of the Qamcom Group and believe that being part of such a technology-intensive and innovative business group creates unique opportunities for product development or system adaptations. They work closely with the team from Qamcom Technology on projects for product customization, development of new products and web applications to digitalization projects in the field of IoT and Smart infrastructure. Amparo now has a subsidiary company in Norway and is an 11 membered team. They achieved a turnover of 52 MSEK in 2017. The business idea is based on offering both public and private operators technical tools for increased road safety and improved traffic and visitor data. Their solutions are comprehensive and automated that are easy to install, require minimal operation and maintenance, and generate high quality and verified results. For this research, CEO of Amparo Solutions was interviewed.

Amparo Solutions has identified three business areas. First is Road, where traffic counting, speed adjustment and road safety tools are central of safety of users. Amparo Solutions provides automated solutions to access the right information at the right time, which increases security. They have been active in this segment since 2007 and are currently a market leader in areas

such as cycle counting, radar-based vehicle billing and road safety for unprotected road users. Second, is Railway where they believe their solutions provide the required security and life cycle costs to manage the increasing traffic and after-sales maintenance activities which has tremendously increased the cost of operating and managing a rail network. They have partnered with Schweizer Electronic AG to develop solutions for this segment. Third, is Industry where Amparo Solutions has helped several small and large industries increase their traffic safety or improve their traffic flow. With their solution, they aim to reduce waiting times and accidents at workplaces, which in turn would create conditions for reduced costs or increased profitability to its customers. They also provide services to industrial companies in to develop their own products in the ITS area. They cater to their customers in these business areas by either developing a solution for them or they act as distributors or resellers of products that are developed by their partners from around the world.

Amparo Solution began with the goal to develop, produce and sell their own products to their customers and started by focusing on the Railway industry. Soon it became clear to them that this strategy of doing everything in house was not feasible and hence adopted the Bootstrap strategy (Appendix A), which helped them gain revenue purely from sales rather than depend on external investments. Hence instead of focusing on a single product, their strategy was to offer a portfolio of products and services to its customers. With a combination of projects focused on in-house development and acting as distributors to other partners, they have successfully begun this journey. This strategy cleverly helped turn some competition into collaboration. In 2011, Amparo Solution signed a development project with a leading OEM manufacturer. After co-developing the product with this customer, they are currently in the serial-production phase with a demand to produce 600-800 units per year.

With regard to working with a certified QMS, the CEO believes that while QMS certification would be beneficial for a startup to attract customers such OEMs, it is customer focus and strong personal relationships that help in successfully retaining the customers. Although Amparo solutions has been following the Quality Management principles while working with customers, they haven't been certified to a QMS standard. They tried to leverage the QMS used by their parent company Qamcom Technology but realised the vast difference in processes made that unfeasible. However, Amparo solution still works with process-based thinking. For example, their company intranet describes the stages in their sales process. The expected input and output of each stage is available to the employees. The CEO describes that they have a high

opportunity transformation with prospective customers. Since the customer base involves public authorities such as Municipalities and national road and industry, the market is niche and dependent on building strong relationships. Internally they are organised as a teal organisation, which is a paradigm that views the organization as an independent force with its own purpose, and not merely as a vehicle for achieving management's objectives. Given that, every employee takes on responsibility of their tasks and work independently, the CEO believes this is a culture they are inherited from their parent company Qamcom Technology. In this sense, although they have explicit ideas in place to support them, they mostly rely on the tacit guiding while operating.

Their main challenge now is to maintain the lead time to deliver products to customers. Their customers apply a time pressure on delivery of products which is hard to withstand sometimes. Another challenge is that they use several interdependent IT systems which cannot be integrated. They share some of the resources with Qamcom Technology but have come to realise that as they grow, their processes do not match that of Qamcom Technology and integration of IT systems is crucial to maintain performance. Finding an IT solution which supports their growth is crucial at this stage for them.

4.1.7 Vehco

Vehco is a Sweden based pan-European telematics provider to heavy and light commercial vehicles. Vehco Sweden was founded in 2001 by Anders Tingström and three students from Chalmers Entreprenørskola. With the launch of Co-driver in Sweden in 2002, Vehco began its journey as a Fleet Management System provider for a Gothenburg based fishing company with about 20 trucks. Since then, Swedish Vehco has grown to merge with two other companies: the French ELOmobile, the Danish Comlog A/S, to form the Vehco Group. Today, Vehco offers an ‘à la carte’ of solutions for handling vehicles, drivers, trailers and transportation missions. Customers have the choice for using these services via either vehicle computers and screens from Vehco or on the customers’ own tablets / phones. They have over 800 customers in Europe, with 42.000 connected vehicles and generated a turnover of 160MSEK in 2017. For the purpose of this research, a Quality Manager and Product Developer were interviewed.

Broadly, Vehco identifies people who use heavy vehicles as users of their solution. They assist road transport companies in the management of fleets of heavy commercial vehicles. Although majority of their customers are logistics and freight transport service providers, Vehco also

provides solutions dedicated to passenger transport companies. They have built specific solutions adapted to the needs of different transport businesses such as the cold transport sector, agriculture or building works sectors. Vehco's applications support the daily working of drivers, transport managers and company managers. It is evident that customer needs are very diverse and most often they require very specific solutions. Vehco supports this by offering them a wide range of choices through their portfolio which they have recently introduced.

Vehco do not work with a Quality Management System but has chosen to work very closely with the customers which is a core principle in QMS. Their feedback is vital for R&D development. They organise several mingle sessions with customers and conduct customer contests (eg: for drivers) to keep them engaged and their products attractive. To further promote this culture of customer involvement, Vehco has strategically chosen to expand its development with offices in France and Denmark and sales offices in all major markets including Italy, Norway. To support this, Vehco identifies sales, R&D, supply chain, administration as its core processes, executed by its 90 employees. Internally, however the organisational structure is functional and there is no provision for communication between the sales and R&D team which has caused some problems. The development team work with Agile methodology, which is supported by the Gira software allows them to overcome the limitations of not being collocated. Project selection and prioritisation is conducted by a product council, who release the 'to-do' list to the sales team and product owner. The product owner then hands it over to the R&D team who break it down into development steps per the agile methodology. The decision making is done at the senior management level and communicated with the employees. The role of the quality manager is limited to ensuring product quality and conformance of products to requirements and standards. As there are no particular standards for the solution they provide, the measure quality mostly with the number of bugs reported and server downtime. Therefore, quality management takes on a role of quality assurance. However, the dependence on documentation is overcome by using agile methodology which replaces need for documentation with collaboration and communication. What seems to guide the company tacitly, is the customer focus and the involvement of customers in cocreation is emphasised at all levels of the organisations. The hardware of the solution is assembled by contract manufacturers and relevant purchasing and supplier relationships is handled by the purchasing department, which came into existence as a function in 2006. Any new hardware is first tested inhouse before serial production. Every product is then tested in-house at the company before shipping it for installation with the customer.

Vehco has managed to gain a strong market presence by strong involvement with its customers. However, a few challenges concerning their operations management were identified during the interviews. The interviewees identified lack of alignment with the sales and R&D team as one of their primary challenges. According to them, sales team promise a new solution to the customer which the R&D team is compelled to develop. Also, within R&D there is a lack of alignment in executing the process checklists such as when to decide on a code freeze or when to release it to the market. Vehco introduced a change program concerning the upgrade of IT, where they introduced SharePoint in the company after pilot testing. The interviewees believe that the system is not used to the full extent as the employees use only a fragment of the system and do not know about the features available in it. Better planning of the change program with a trial period for employees with an expert would have helped with a better use of the system. Based on the description of the challenges, it is evident that Vehco has not embraced principles of TQM such as the total approach, which states that quality is the responsibility of everyone in the company and also leadership is lacking in providing a unified vision to all employees.

4.1.8 Qamcom Technology

Qamcom Technology has an interesting history dated back to its founding in 2001, by current VD Jonas Killian. Qamcom Technology operate as product development and specialist service providers in the areas of signal processing, communication systems, radar systems, automotive systems and functional safety. Qamcom has been on a constant growth since its founding in terms of number of customers as well as revenue generated from the various projects. Qamcom Technology is an innovative R&D company with a unique approach to be successful in a constantly evolving market environment without accepting any external funding but generating revenue by offering more value. They are domain specialists within a holistic system view and as system experts, they create robust, scalable solutions within their domains: Advanced Signal Processing, Advanced Embedded Systems, High Frequency Electronics (e.g. microwave, radar), Wireless Communication Systems, Augmented Reality, Functional- and System Safety, AI, Vision. The current number of 130 employees is constantly increasing per the company culture 50% of the employees offer consulting services to corporations and 50% employees focus on in-house R&D and product development and are periodically rotated into different projects. For the purpose of this interview, a developer who is currently managing the QMS at Qamcom Technology was interviewed.

Qamcom Technology has had a unique approach to remain updated with the market conditions, problems and opportunities. It started with the founders' idea to develop products for a major corporate. Working as PhD researchers at Chalmers, they came across an opportunity to develop a unique product for a corporate and presented the idea. The proposal was accepted by them and Qamcom Technology came up with more such ideas. For the next eight years, the company focused only on this customer. Soon after this initial success, they adopted the bootstrap strategy and began investing in start-ups with interesting technology, which are now a part of the Qamcom Group. The acquisition of these companies was not strategic from the point of view of Qamcom technology instead the main drivers for these decisions are to gain knowledge about the market environment and were treated as pure investment decisions. However, in 2009 Qamcom Technology experienced a change in market which caused them to realise that focusing on a single customer was risky. The company then began leveraging its internal knowledge by offering consultancy services. According to the interviewee "offering consultancy services is a great way to learn about the market and the problems. If everyone works only on in-house R&D, you are not exposed to the problems faced by the customer everyday. Offering consultancy services, in parallel to the in-house R&D helps us remain updated and relevant with the current issues and latest technology".

Qamcom Technology has organised itself as a flat organisation with no middle management. Employees are held completely responsible for all activities and decision from project selection to its execution and deployment. Employees have the opportunity to take on any role temporarily. Currently, the 130 employees at Qamcom Technology are highly qualified and experienced engineers managing all core processes within the company. Working as a flat organisation give them the opportunity to take on new responsibilities or projects and improve their skills. The necessary information to base decisions on facts and with a good motivation is provided in their company Intranet, developed and customized in-house per their requirements. The interviewee believes it is good to have a single tool which manages 80% of the work necessary for business-as-usual (BAU), rather than multiple, independent tools. The company works with 'gates' to achieve traceability of processes. Checklists are made and stored in the Intranet which allows employees to check of readiness before moving to the next phase of the process.

Qamcom Technology was certified with ISO 9001:2008 QMS standard in 2015. The motivation for this was demand from the customers but they believe it is important to write down how

things are done in the company to monitor and improve them. The QMS assists with this. In a flat organisation, the QMS also acts as tool to help employees achieve traceability and repeatability of certain processes. The QMS has two different flows supporting both consulting and in-house product development. With regard to the consultancy service, the QMS is straight forward and has information about one decision gate to help decide if a request from a potential customer is to be accepted or not. For product development, the current QMS is very generic, on a high level which makes it applicable for all kinds of projects. While most projects, require Qamcom Technology to adapt to the QMS of their customers, there are a few projects which follow process per their own QMS. Staying true to the characteristics of a flat organisation, any employee is allowed to make or comment changes or improvements to the QMS. According to the interviewee, appointing a Quality Manager disconnects the rest of the organisation from actively using the QMS and hence is treated as a collective responsibility.

Qamcom Technology has grown to achieve a reputation as one of the best high-technology companies. The flat organisation structure and bootstrap strategy combined with extremely passionate and motivated employees can helped them reach this state as employees feel empowered to take on innovations and responsibilities, very similar to the Google case (Steiber and Alänge, 2013). However, a few challenges were identified as they continue to grow in terms of number of customers and employees. First, working as a flat organisation, coordinating over 100 employees with no middle management is posing as a challenge as they grow. It is a challenge to get people to take on responsibilities in such an environment. Their recruitment policy which accepts experts with years of experience in the industry has helped them sustain this structure until now. However, getting employees to take on responsibilities of tasks which are beyond the technical scope, such as the ones related to maintaining the QMS is a challenge. They are planning to introduce incentives to help counter these challenges. A challenge that arises due to this is maintaining the integrity of the QMS. As the number of customer projects grow, it is important to implement a structure goal setting and update the QMS to reflect reality to suit all kinds of projects. This is a culture that they are currently trying to develop in the company. Reflecting on their feedback from the audits, the interviewee mentioned that they have identified a need to set performance measures and drivers to support strategic alignment and growth.

4.2 Established corporations/Potential customers

For a B2B technology startup, established corporations (or OEMs) are a vital group of customers. In the initial growth stages, when the resources are scarce, working on projects for OEMs would provide them with the much-needed benefits related to increasing revenue without dependence on external investment, a scalable customer base, references for future sales and market knowledge and mentorship to name a few (Larkin and O'Halloran, 2018). However, having OEMs as customers comes with its own challenges such as long sales cycles, the difference in establish trust without references and existence of a chasm between proof of concepts and real projects. To explore how this collaboration is viewed from the perspective of established OEMs, a Supplier Quality Manager belonging to Group Purchasing department at SKF and a Project Manager belonging to the Product development department at Volvo Cars were interviewed.

4.2.1 R&D

To understand the collaboration between start-ups and corporations from an R&D focused perspective, a project manager belonging to the Product development team at Volvo Cars was interviewed. She had years of experience working in R&D related projects in different departments and the projects included everything from new concept generation to solving quality issues in aftersales. All of the projects involve working with suppliers and evaluating them. From a startup perspective, when they work on a pilot projects with an OEM, they generally have the company's R&D department as its customer. Volvo Cars is aiming to strategically position itself with its current offerings and be market leader in such areas of strategic importance. According to the interviewee, with the recent change in leadership (change of R&D head) collaboration and open communication is promoted within Volvo, which has resulted in increased collaboration between the R&D and purchasing department. Both departments are collocated, and resources are divided based on car components. The interviewee mentioned that she continuously works with the Supplier Quality Manager while handling supplier relationships. Volvo Cars is characterised with long development cycles which usually last 3-4 years before product launch and involve several rounds of testing.

For a startup it would be beneficial to come in during the pre-study phase where deep technical knowledge is key for a successful collaboration. And during ongoing projects, completely new suppliers are rarely signed on as it is considered very risky. While the R&D department evaluates suppliers by prioritising innovation and the technical knowledge in the suppliers, the

purchasing department is more cost focused. Onboarding of suppliers to new projects involve the following steps.

Firstly, suppliers are asked to provide an RFI (request for information) which contains the general specifications and overview of requirements. The chosen suppliers are then invited to a day of workshop at Volvo. For the next step, Volvo expects an RFQ (Request for Quotation) with more detailed specifications and requirements. This is usually done 2-3 year before product launch given the long development cycles. If its a new supplier, the Supplier Quality Manager audits the supplier before moving them to evaluation stage. Once the timeline for the project is agreed upon, suppliers are expected to fill in the compliance matrices which is unique to Volvo Cars. Once approved, the suppliers are checked for technology feasibility and production capacity. During the development projects, Volvo conducts a thorough analysis of the risks by evaluating possible failure models and suitable alternatives. Suppliers are expected to conduct a similar risk analysis and submit it, before being signed on. The suppliers are monitored by expecting from them to coordinate their gates with that of Volvo's. For example, design freeze stage, tooling stage etc. The process is very controlled in this manner, details of which is presented to the suppliers in the compliance matrices. Their delivery time, cost control, process-based goals are monitored at these gates and the suppliers are paid only after they are signed off at a particular gate. Volvo Cars communicates any changes in designs or processes using Volvo Process Change (VPC) procedures, where the change details and production locations are communicated with the suppliers. The suppliers then come back with the time needed to implement this change and any information is expected to be submitted 2 weeks before the review. The interviewee mentioned that for suppliers incentives include payment at gates, repeat orders and new projects. For a startup, performing well on pre-study phase would ensure serial production orders when the solution is production ready.

However, there are certain challenges during this collaboration from the start-ups' perspective. Firstly, given the long development cycles it takes a long time for the suppliers to get paid which is a major challenge for a resource constrained startup. Second, approaching the corporate is challenging for a startup as most deals are made based on personal relationships and it could be hard to find the right person who understands the benefits of the technology provided by the startup. Third, if the startup has only one OEM as a customer, there is a risk of the startup getting engulfed in just one customer giving the detailed process control.

4.2.2 Purchasing

When the products produced by start-ups are mature enough to be integrated in active projects at the OEMs, it is the purchasing department of the companies that act as the point of contact and hence represent the face of the customer. Although, it is agreed that purchasing is handled differently in different companies and their degree of integration with the R&D function also varies, inputs from this interview at SKF serve to provide a general understanding of the priorities of the purchasing function and their requirements and preferences while evaluating a supplier. SKF is a leading OEM which has been in existence for over a hundred years and have achieved hands-on experience in over 40 industries. They provide value to customers under five technology platforms, where they are industry leaders in bearings and followers in seals, motion technologies, services and lubrication systems. They have around 46.000 employees serving 130 countries, with 103 manufacturing sites in 24 countries. To achieve benefits of bargaining, SKF introduced a change program to move towards centralisation in 2013.

Prior to this change program, innovation and R&D at SKF was conducted in a centre of excellence which existed as a cost centre. Here, there was little to no integration between this centre department and the purchasing department. Due to this, projects moved from conception to serial productions, differently each time and was dependant on the employee responsible. However, since the change program SKF has attempted to turn this into a profit centre and applied a policy to undertake only projects with a pre-recognized market. In this setup, there is also increased attempts of involving the purchasing department in the early stages of R&D development. Potential suppliers are evaluated via what they call the QT3 audit instructions, regardless of the age and size of suppliers. However, they have recognised a need to find new ways to work with start-ups and group purchasing is actively involved in this business transformation process. According to the interviewee, if start-ups work in the concept building projects with the R&D department, it is important that working with quality is reflected in the culture of the startup.

However, the purchasing policy requires them to be certified to a quality standard and if a promising startup is not certified, they must be capable of presenting a plan to move forward. For active projects, choice of suppliers also depends on industry of the customer. For example, the aerospace industry is always under a cost pressure and suppliers up to level of tier three are audited to ensure compliance. However, the automotive industry in comparison allows a greater choice of suppliers. To manage customer requirements, SKF uses AP/QP (Advanced Product

Process Quality) procedures which includes a decided space for supplier selection. It is also common to source 3 suppliers for a single component considering its criticality. SKF is structured as a complex matrix organisation, where purchasing is now divided into Strategic purchasing-focusing on long term goals and strategic pipeline projects and Operational purchasing-focusing on immediate needs and related short-term goals. The employees at SKF have access to a detailed procedure that needs to be followed but employee compliance to this procedure is not monitored. Due to this, employees mostly work in ways that suit them which means the process could look different each time. Also, the company is hierarchical with several reporting layers. From the interviewee's perspective there are six levels of reporting to reach the CEO, but cross reporting exists which is dependent on the individual employee's network and interest. The performance measures used by the purchasing department to evaluate themselves involves them first checking the market price change (for fuel, steel etc). They then set a purchasing index based on that and evaluate that against performance. There are no performance measures on an employee level and no form of incentives to keep them motivated. The purchasing departments use performance measures: cost, quality, delivery and innovation management (CQDIM) to evaluate suppliers. Figures are received from the factory and from other departments (eg: Supply chain department for delivery figures). Most of these measures are focused on cost saving and process development. SKF takes their customer's spoken needs into account, by measuring it and, tries to achieve customer satisfaction by constantly improving their performance figures.

From a startup's perspective collaborating with the purchasing department might seem like a complex maze of confirmatory procedures and standards to navigate through. Most established companies such as SKF would have similar and unique requirements from their suppliers (I.e start-ups). By strategically defining an MVP (Kataria, 2017) considering the B2B customer types and Garvin's perspectives of quality, a startup could enjoy benefits of developing products or services of true customer value in reduced development cycle time.

Data analysis

Building on the presented theoretical framework and empirical data, this chapter aims to explore the relationship between levels of environmental uncertainty, varying customer requirements and specific strategic orientations of the organisation as contextual variables that have an impact on the organisations. The analysis is exploratory in nature, placing in proximity the finding from literature and practice to examine the characteristics B2B technology startup display during their initial growth stage. Furthermore, the role of QM practices to achieve their dynamic strategic alignment is analysed to propose a fit model which would increase the chances of improved firm performance.

5.1 Contextual variables that have an impact on organisations

There are two particularly influential groups of variables relevant to explain the environmental variables that posit as critical constraints on the choice of adoption of effective structural forms and practices in organisations. To explore the environmental variables that have an impact on the B2B technology startup, firstly, Luthans & Stewart's, (1977) classification of environmental variables into external and internal environment variables is used, which have been defined in Chapter 2. (see table 2.2.2) summarizes the contextual variables and their typologies in relation to the empirical data that have an impact on a technology startup.

External environmental variables: External environmental variables are those that are beyond the control of the organisation system. Understanding the different environmental conditionals that influence the type of relationships with outside parties is of importance as it affects the organisation as a system. These variables are described under **Environmental Uncertainty and Customer requirements.**

The Cynefin framework explained in section 2.1, (see figure 2.1), is used to understand the implications of environmental uncertainty on technology start-ups. The typology for uncertainty based on this framework is presented in the section below.

5.1.1 Environmental Uncertainty as a contextual variable

B2B technology start-ups generally begin with a promising but immature technology and immature market. They start off in a **complex** context where patterns of adoption of the technology is only realised in retrospect. Since start-ups need to probe to find these emergent patterns, they need a risk-based investment planning to succeed in the initial stages or as they plan a new undertaking (eg: strategic sourcing of suppliers) for the first time. If they have the capability to learn from emergent patterns, they reduce the complexity of the situation or spiral into a chaotic environment. Simplex Motion, which is in the initial stages of developing its IP into usable products is facing complex market conditions where patterns of use and value creation are unknown. To develop the capacity to learn from emerging patterns they are planning to hiring a Chief Marketing Officer. This would help them reduce the complexity of the situation and establish a profitable market segment for their product. Similarly, ReVibe Energy which hopes to begin serial production of its products, face a complex situation while choosing contract manufacturers to partner with. Although the choice will be based on references and proof of trust from the partners, their capacity and capability to produce the products within forecasted KPIs can only be confirmed in retrospect. A possible solution here is to sign a pilot project with multiple partners and compare their performance before establishing a strategic relationship with one. However, this endeavour could be expensive, and the investment must be weighed against the risk. Therefore, from a startup perspective, no matter the industry every new endeavour is a complex situation. While it offers a possibility for start-ups to learn from these patterns, the probe and learn process could be expensive and resource consuming. It is important to have a risk-based thinking while signing on new customers, new suppliers, new technology or resources in the early growth stages of the company.

When technology start-ups focus on developing their technology to suit the customer requirement, the development cycles are often in collaboration with the customers and are long. Developing a technical solution is often **complicated** and could be done in several different ways. Start-ups need the technical expertise to develop their products to match customer needs. For example, instead of monitoring product performance and reacting to customer complaints, Vehco regularly meets the customers and the users of their products to reduce the complexity of the technology. This becomes crucial as complex technical solutions developed by experts are used every day by people without the same expertise. The sense-analyse-respond approach

suits while designing the process of new product development. A similar approach proves useful to control any quality issues that might arise from the products developed by the contract manufacturers in later stages. As in the cases of PowerCell, Amparo Solutions and Lumen the quality of the products produced by contract manufacturers is controlled with a mixture of informal means and regular audits. A complicated situation for ReVibe Energy is to establish strategic purchasing and supply chain relationships as they begin serial production. There are several ways to approach this situation, which is a challenge to analyse with the existing resources and their overlapping responsibilities. A suggestion here would be to hire a dedicated Purchasing Manager who would develop strategic relationships and control measures with these partners and ensure quality control of products. When start-ups develop their organisational knowledge to learn from complex situations, several solutions to complete a task emerge. This inevitably leads to the need to obtain the required resources through means such as recruiting people with the needed expertise.

As companies grow by successfully increasing the number of customers, projects and resources, several processes take shape and situations become **simple**. A new sale of an existing product could be an example of a simple process. For example, as emphasised in the interview with Nimbell, getting the product certified for the first time took much longer than having the second product certified. When they had a control of the process of getting their vehicle certified to be road legal, the same process was completed with much more ease for the proceeding vehicles. For ReVibe Energy, several processes have begun to take shape such as customer acquisition process, initial requirements gathering, employee onboarding etc. By documenting this knowledge ReVibe Energy can establish best practices tailored to fit the strategy and culture of the company. Benefits such as reduction in development cycles by standardising routine procedures; smooth recruitment, onboarding, and employee orientation to ensure culture fit can be achieved. Furthermore, from a startup perspective, unfortunately **chaotic** situations often prove fatal for the company. An example is the chaotic situation that lead to the crisis at Nimbell. Companies of all age and size are constantly facing situations with varying degrees of uncertainty. To combat complicated, complex and chaotic situations an organisation needs to be flexible and adapt. Start-ups must support their agility with a good mix of resources and practices. Practices defined as best practices to approach simple situations must not be the cause for bureaucracy in the organisation as it grows.

5.1.2 Customer requirements

In fundamental ways, a B2B company's customers and their buying patterns are more complex than those of B2C. Even though B2B purchases mostly stem from rational decisions, several factors such as overall cost of ownership, long standing relationships, and general reputations of suppliers come into picture (Maechler, Sahni and van Oostrum, 2016). A majority of the case study interviews with the start-ups revealed that for entrepreneurs navigating the maze of corporations to establish contact with the right person or unit was a challenge. This view was confirmed by the corporations that there was no one best or easy way for start-ups and corporate collaborations. Most projects stemmed out of professional references or personal contacts. It is evident that both parties must develop better channels to ease up the initiation of collaboration. However, it was noted that the R&D and purchasing departments of OEMs were the most common business units participating in the collaboration. In other words, R&D and purchasing departments were the most common customers for these start-ups.

It was evident from the interviews with people experienced in this, that the buying decisions and governing KPIs are different and sometimes contradictory for both departments. When compared with the customer type and customer perception of quality described in Section (2.3), it can be concluded that it is crucial to have both manufacturing user-based approach while conducting business with both customers groups. The user-based approach that claims quality "lies in the eye of the beholder" emphasises that every customer need and requirement is different and products that best satisfy these preferences are the ones with the best quality. This is very apt in case of these companies. ReVibe Energy, PowerCell with majority of projects in co-development stage with R&D departments of OEMs witness the effects of changing needs in form of long development cycles with several rounds of testing and prototyping. As the companies grow, to a stage such as Vehco and LumenRadio they realise that every accommodating customization in every customer project was a challenge, as indicated during the interviews. As pointed out by Garvin (1984), a challenge in using the user-based approach is to aggregate widely varying customer preferences to define quality at a market level. He further suggests that this issue is often resolved by assuming that high-quality products are those that best meet majority of the customer needs. This is the central thought when designing a product portfolio, which was also confirmed with the interview with LumenRadio. At the company, when they realised that saying yes to every customer need was a challenge, they introduce their modular platforms with options for customers to pick and choose solutions from their different modules. This type of user-based approach to quality is crucial for technology

start-ups. When dealing with R&D departments of corporations, collaboration is key. As identified by the project manager from Volvo Cars, in these projects innovation is prioritised and suppliers are evaluated on their technical knowledge rather than price. Therefore, a value-based approach is best suited in these situations. For these projects, overall quality of products and total cost of ownership in terms of the product's acceptance performance, at an acceptable cost or with acceptable costs is important for the customers. Therefore, the start-ups must design their solutions and pricing with this in mind.

However, the purchasing department is most cost and conformance focused. They fall into the category of customers prioritising price and service. As expressed by the Supplier quality manager from SKF, suppliers are evaluated with an audit process designed by SKF to match their requirements, according to their policy. At this stage, corporations (both Volvo Cars and SKF) demand for proof of trust and compliance to various regulatory, ethical and quality standards. Qamcom Technology, Amparo Solutions, ReVibe Energy and PowerCell confirmed that being certified was crucial to obtain businesses to commercialise the product. Furthermore, cost is a priority at this stage. Innovation and adaptive start-ups are expected to focus on performance efficiency of processes and control costs of production. In conclusion, it is evident that the plurality of stakeholders creates complex buying behaviours. To address all the groups and their preferences, startups must track the customer requirements and value throughout the sales cycle. For example, LumenRadio track value of the customer in their sales funnel as they move closer to the deal. They do this by constantly checking performance with the forecasted cost and price. A start point for ReVibe Energy would be to map out the stakeholders and their convergence by mapping the ReVibe Energy's sales team to the corporate's procurement team, ReVibe Energy's development team to that of the corporate's and the one responsible for production with the shop floor of the customer and supplier.

5.1.3 Internal environmental variables

As defined by Luthans & Stewart, (1977), internal environmental variables, though beyond the direct control of a manager in question, are still within the direct control of the organisation system. To explore these, strategy and culture are chosen as relevant internal environmental variables from the context of start-ups. The typology used by Sousa and Voss, (2008) in defining strategy and culture, explained in Section 2.2.2 is used. A summary is in the Figures (5.1.3a, 5.1.3b).

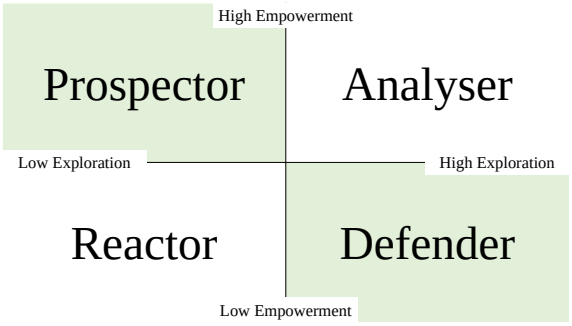


Figure 5.1.3a. Strategy typology in relation to exploration and exploitation

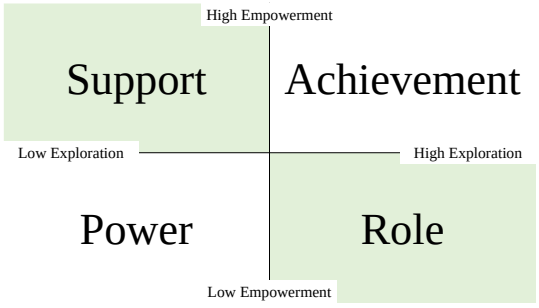


Figure. 5.1.3b Culture typology in relation to empowerment and task definition.

To understand the practical implications of the contextual factors, the literature is compared with the case data from the empirical research. A summarizing evidence table showing the contextual variables and corresponding typology placing for each of the cases is presented in Table 5.1.3.

Table 5.1.3. Case typology in relation to the literature.

Company	**Internal environmental factors**							
	Strategy				Culture			
	Defender	Analyser	Prospector	Reactor	Role	Power	Support	Achievement
ReVibe Energy	X					X		
Simplex Motion	X					X		
Nimbell				X	NA*			
Lumen Radio		X					X	
Powercell	X				X			
Amparo Solutions			X					X
Vehco		X			X			
Qamcom Technology			X				X	

*Since the team is no longer active, culture could not be categorised

5.1.4 Strategy as a contextual variable

Companies in the initial growth stage are bound to have an inherent number of characteristics supporting the Prospector category. Technology start-ups in particular undergo a phase where they need to develop the technology (or IP) into usable prototypes, as well as secure a market for the products. However, there are companies which focus primarily on developing use cases or business areas for their technology. These have been identified into the ***Prospector*** category. Amparo Solutions and Qamcom Technology can be classified into the Prospector category. Both companies have adopted the bootstrap technology which means focusing on new market opportunities to drive growth which is a characteristic of Prospectors. Qamcom Technology

works with in house product development and as a consultancy service. Similarly, Amparo Solutions develop products in house and act as distributors to partners in the same industry. The parent company Qamcom Group with its strategy to invest in technology start-ups supports the same exploration-focused strategy in Qamcom Technology and Amparo Solutions. Simplex, PowerCell and ReVibe Energy, on the other hand have defined their market segments and focus on improving their efficiency to maintain and grow in those segments. A valuable resource of these companies is their proprietary IP to an innovation and all of them are in the beginning of their technology development curve. This in turn means potential new entrants are rare which supports a ***Defender*** strategy. Lumen Radio and Vehco are classified as ***Analyser***. They maintain growth in their traditional market and increase growth in new markets. Although LumenRadio has its portfolio segmented on product functionality, it measures sales and growth in business areas. Vehco with its close interaction with customers and different users to focus on all business areas surrounding its technology. Both these companies manage the duality of exploration and exploitation, thus are classified as Analyser. Nimbell, however is currently highly reactive to the wishes of the market hence classified as ***Reactor***.

5.1.5 Culture as a contextual variable

Start-ups which most often start with one or two people start with an informal culture which is yet to develop to be classified into any category. However, they display characteristics of the ***Power*** category until they develop this culture as it is the leader or the leadership group which is dominant, and the roles are open among each other in these stages. From Greiner's (1998) growth model, ***Power*** culture is the one that exists until the point of the leadership crisis. ReVibe Energy and Simplex Motion can be classified into the Power culture category. Vehco and Powercell are classified to have a ***Role*** culture as they have a high task definition and centralised decision making. Vehco uses the Agile methodology to run its operation which is characterised with defined roles and a focus on procedure (eg: daily scrum meetings, iterative development cycles). Similarly, PowerCell with its procedures defined in its QMS has its process defined, high task definition too. In both cases, strategy devised by the management is transmitted downward and rely on training at all levels of the organisation. The Change implementation with rollouts after pilot testing at Vehco is an example of such a culture. Theory implies that with the Role culture there is a danger of implanting sub optimal practices. The Change program at Vehco which was rolled out after a few pilot tests is an example of such practices as only 20% of the system is being used due to lack of knowledge. ***Achievement*** culture is one that is characterised with a task and purpose approach and a can-do attitude among the employees.

Amparo Solutions exhibits an Achievement culture where they have open roles and a participatory attitude while defined processes such as sales process described on the intranet. This suits their operations as the product development in done in collaboration with Qamcom Technology and that is run according to the culture at Qamcom Technology. Amparo Solutions which mostly focuses on sales and business development has its critical processes defined. Qamcom Technology and LumenRadio have a ***Support*** culture which is consistent with an organic organisational characteristic. Qamcom Technology functions as a flat organisation which is focused on empowerment of employees and they work based on intrinsic motivation. Lumen Radio also relies on tacit knowledge, cross functionality and informal practices to explore new services in new and existing markets thus exhibiting a Support culture.

Interesting comparisons can be made here when comparing the corporations with the same strategy but different culture guiding them towards it. The three companies with Defender strategy have either Power or Role type culture. Both these culture types are associated with low empowerment of employees. The power culture in this context can describe companies, which are still too immature to have a defined culture since decisions are taken by a dominant leader/s and company follows informal rules. The role culture type may suit defenders given the focus on efficiency in a relatively stable environment. Prospector companies here have either Achievement or Support culture, thus making it evident that empowerment of employees is key while trying to develop explorative capabilities in the company. What is particularly interesting here is that the two companies with analyser strategy (see table 5.1.3) have contradictory support and role culture, which allows for interesting comparisons of LumenRadio and Vehco. The support culture at LumenRadio seems to be well suited for the analyser strategy at LumenRadio. Low task definitions and high empowerment of employees has allowed for an environment of cross functional working and easy communication. Leadership here is more supportive than dominant which has allowed for LumenRadio to grow through business areas and market share. Vehco on the other hand, have the same strategy but a contrasting culture within the company, characterised by high task definition and low empowerment. The challenges that surfaced during the case interview could very well be attributed to this culture. To succeed as analysers, high empowerment of employees and open roles seems to be crucial. Top down decision making at Vehco, when it comes to project planning is a reason of inefficient use of IT systems and lack of coordination between the different functions. Adding to this is the high task definition, which does not allow employees to view the organisation as a complete system. In conclusion, it can be summarized that high

empowerment of employees is more crucial to succeed for analysers and prospectors when compared to defenders. Degree of task definition is not as crucial if the employees feel empowered with the needed training or incentives.

5.2 Growth stage model

The growth stages highlight the significantly important stage-gates start-ups face and the alternatives they have when building a growth strategy. Organisational growth in Greiner's (1998) model is characterized as growth phases going through revolutionary crisis between each evolutionary phase when scaling. Even if Greiner's (1998) model is a good reflection it does not cover critical factors of growth concerning B2B technology start-ups. Based on this and data from case studies, three phases are identified as relevant phases representing the initial growth stage of a B2B technology start-up. Customer focus in such start-ups concerns, strategic choice of collaboration methods in each (stand-up, start-up, scale-up) phase. In terms of customer requirements of products, services and proof of trust, it is valid to reference to how the corporations work with their research and development and commercial production. (Larkin and O'Halloran,2018). Complementing Greiner's (1998) model with these variables provides a good picture of the growth stages for B2B technology start-ups and the challenges they will most likely face when growing.

The growth phases based on analysis of theory and data from the case studies and the model is conceptualised in the Figure 5.2. The phases in the in the initial growth stage are divided into three focus areas which are, sales, technology and processes. And from the combination of the variables three critical elements of the growth phases emerges: Development of portfolio, Development of network, Development of business objectives

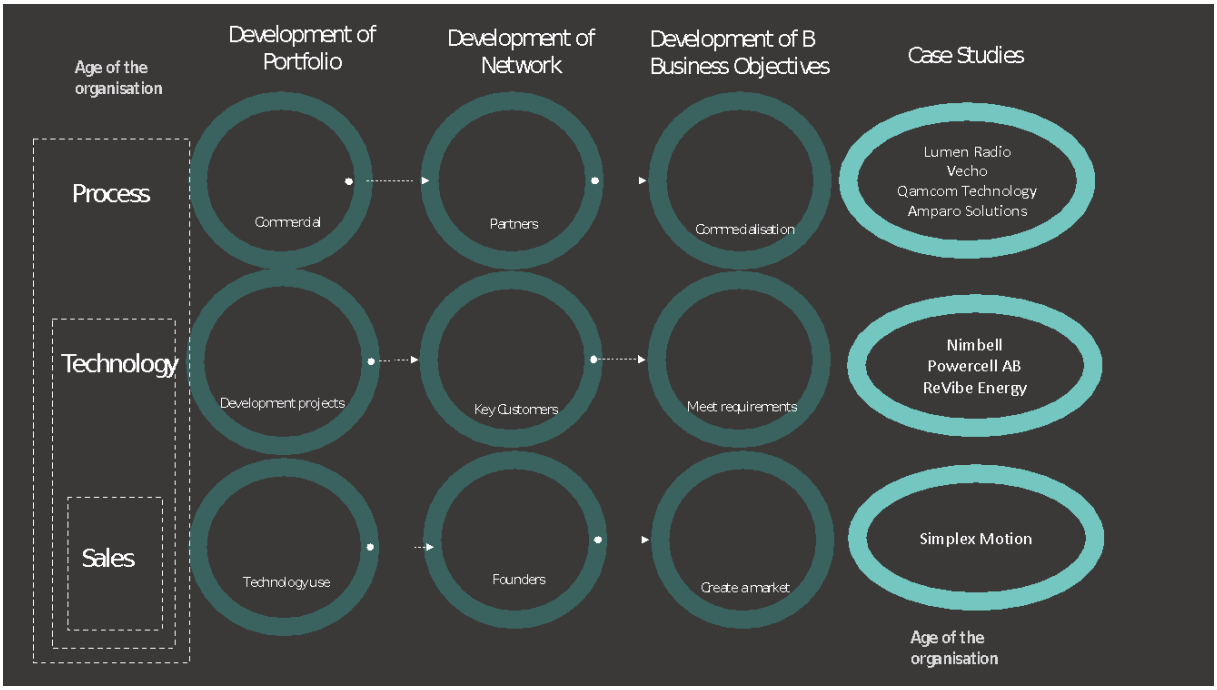


Figure 5.2. The growth stages of a start-up.

The first element, ***development of product portfolio***, represents the technological growth phases of a new, innovative or disruptive technology that needs to be presented to the market, with a goal to develop a stable customer base. The phases include developing technology use cases, development projects and commercialisation. An important notification is that this focus area of product and portfolio development is a loop that starts over every time a start-up develops a new product. At a certain point, the company cannot afford to keep up with customizing the product every time and develops a product portfolio for the customers to choose from (eg. Offering modular platforms). The second element, ***development of network*** refers to various types of stakeholders that have an impact on the company during this growth stage. These include founders, key customers and partners (i.e suppliers etc). This network keeps growing as the company grows. The third element, ***development of business objectives*** involves fulfilling the primary demands in each phase by constantly learning and adding organisational capabilities. In the first phase it is to create a market, then adapt to customer requirements and last, commercialisation of product.

All of these elements and factors put together in a diagram shows the processes, focus areas and required resources for each phase. To explain this in detail, each focus area in the initial growth stages will be analysed to identify the changes in demand and consequential change in the startup internally.

***Sales*.** As shown in the diagram, operations in a startup start with a focus on the core technology or single product, with key stakeholders here being the founders with an objective is to create a market. The startup team is primarily expected to develop their skills in marketing and sales to succeed in this phase. All of the companies in the case studies went through a similar situation in the initial period. Simplex Motion is a good example of a company in this phase. They have a core technology with products of different size to torque ratios. Their market is not established, and customer value and requirements vary depending on the choice of market they decide to focus on; hence their solution is to hire a resource decided to focus on the business development. All of the other companies in the case study have successfully passed this phase and did so by actively participating in technology/ industry fairs, competitions etc to spread awareness of their company and technology. What was crucial for most companies in this stage was external investments to operate in the absence of a stable market. However, Qamcom Technology and Amparo Solutions managed to grow through this phase without dependence on external investments by adopting the bootstrap technology.

***Technology*.** All of the companies analysed in the case studies consider established OEMs as one of their key customer type. The majority of them have identified a goal to be leading, qualified suppliers to OEMs. Given that, once the company encounters customer interest for their technology from an OEM and identify a need they can fulfil, they move over to the development project phase. This phase marks the start of collaboration between the start-up and corporations, and key customers are added to the network of the organisation. Startups can associate with corporations via numerous channels and it was established during the case study interviews that project deals in the initial stages are mostly made leveraging personal network or references from shareholders. However, it is expected from the startup at this stage, to identify customer requirements and develop their technology into products that would be of value to the customers. They would need to develop their engineering skills to turn their innovation into profitable use cases. PowerCell AB has most of their projects in this phase. It is characterised by long development cycles, multiple iterations and prototyping to match customer requirements. Nimbell faced significant challenges in this phase with their long and complex development and test cycles. The startups also face challenges with respect to generating revenues at this stage. As emphasised by the project manager from Volvo Cars, (section 4.2) if startups join in during the pre-study phase of a project, it takes a long time before they get paid. Startups generally end up losing money on a lot of administrative work required

to maintain constant collaboration with corporations that they cannot charge for. ReVibe Energy is currently in this phase with their strategic projects with key customers. They too experience challenges in aligning with their customers' long development cycle. However, development projects sponsored by the customers are a great way to develop the technology and improve any shortcomings in a capital constrained environment. ReVibe Energy have now begun to identify some patterns that cause a delay in their development cycle (example, clarify administrative expectations before hard, re-plan the evaluation kit package to allow the customers to better understand the value of the product). The challenge now is to agree on a design freeze with the customers and ensure capacity for the upcoming phase.

***Process*.** The third focus area in the initial growth stage of a startup is moving towards commercialisation. Ideally, when a startup successfully completes a development project in collaboration with customers, they reach a 'frozen product design' ready to be commercialised and introduced to market. Scope of responsibility to commercialise the product, could vary depending on the project and customer. For example, the products developed by Amparo Solutions are produced in high volumes solely by their customers; whereas in majority of our cases, as well as in the case of ReVibe Energy the strategy is to commercialise the product by strategically partnering up with suppliers and contract manufacturers and hence they are added to the network of the company at this stage. The business objective at this phase is to commercialise the products, which most often means serial production of the product in high volumes. The startup is expected to ensure their capability to commercialise by developing process-based thinking which is crucial while producing in large volumes. Here, the sales process is more stable when compared with that of development projects and follow a more routine B2B direct sales patterns. However, in some cases, although they produce the product to the same OEMs, their customer changes in the sense, purchasing department of the OEMs act as the primary customers in this stage. Here, the customer relationship cannot be based on personal network of the startup, they will require to present proof of trust documents such as QMS certification or references of successful use cases as this is the purchasing policy in most established OEMs. Moreover, the choice of strategic partners (suppliers) is crucial as this stage has to match quality against capacity and lead time and cost requirements. As emphasised in Section (4.2), most OEMs apply formal means of measuring and monitoring startups which would require them to institutionalise practices to prove conformance to customer requirements.

As companies go through this loop of three focus areas several times by acquiring new customers, they reach a point where customization and long development cycles become an inconvenience. As emphasised in the interview with LumenRadio, it is challenging to satisfy every customer need and be open to constant customization. It becomes important to group products into suitable product groups or plan a mass customization solution and hence design a relevant product portfolio. In case of LumenRadio, they developed a modular platform offering to accommodate for the varying customer needs while controlling the level of customization required internally. This not only speeds up the development project cycles, but also helps in controlling costs commercialising by reducing the number of customized components required. Failure to acknowledge this, could lead to miscommunication between the sales and engineering department as noted in the case of Vehco. At ReVibe Energy, it has been agreed that the first step towards developing a portfolio is to replace customized components with standard solutions. By improving this ratio of standard components in products, a step towards designing a product platform portfolio can be taken. When companies successfully design a portfolio and cross this phase, they can focus on developing each product group, thus moving to its next growth stage. Several external and internal environmental factors change during these phases and affect the growth of the organisation. In order to successfully grow, companies need management practices that support the company to react to uncertainties and meet customer requirements. Central to this is committed leadership who are assigned the task to design and choose management practices that support scaling in the organisation.

5.3 Quality Management Practices to achieve dynamic strategic alignment.

This section aims to explore the duality of quality management practices to support exploration and exploitation in organisation, thus allowing for a dynamic strategic fit as they evolve in a fast-growing environment. QM practices associated with the TQM principles, represented in the cornerstone model are captured and how the practices vary under constructs of Quality exploration and Quality exploitation is analysed compared the QM practices adopted at Qamcom Technology and PowerCell AB.

Qamcom Technology and PowerCell AB are two equally successful companies that have distinct organisation structure, culture and Quality Management System to support that. To simplify the difference in the management practices used in the companies, three approaches

to QM practices are considered: Quality Assurance, Total Quality control (TQC) and Total Quality learning (TQL). Accordingly, Quality Assurance with the focus on conformance of products and proceses to requirements and standards. Conformance is achieved through systems and documentation which offer required proof. Both companies use several technical platforms to prove technical compliance of products, designs and related quality. For general QMS documentation, Qamcom Technology use the intranet they have developed in house and PowerCell AB use ERP systems such as SharePoint and Microsoft Dynamics.

The following aims to explore management practices related to TQC and TQL. Qamcom Technology displays characteristics of Prospector strategy and a Support culture. They are focused on exploring new business areas to provide value to existing and future customers and do so with a flat organisation structure, with no middle management. Their QMS provides broad guidelines while executing non-routine processes and specific operating procedures for routine processes. Although the QMS provides the necessary transparency and all employees have a right to propose improvements, it fails to help them coordinate as they grow in number. However, operating in a constantly evolving business environment, their QMS combine practices to support both control and learning within the organisation. PowerCell AB, on the other hand, displays characteristics of a Defender strategy with a role culture and their QMS supports this structure. The QMS is mostly focused on achieving conformity and traceability of processes and hence helps control processes rather than focus on learning. Quality objectives and associated practices are designed by the top management and passed down in the organisation. Operating in a moderately stable business environment, their QMS exhibits exploitation features from a technology development perspective, but they are also adding exploration features from a market development perspective. To explore how practices, vary to support the two constructs of QM in detail, practices associated with the TQM principles of customer focus, process management, base decision on facts, employee commitment, continuous improvement under the direction of a committed leadership are analysed for both companies.

Customer Focus: Fairly new companies need to display certain amount of exploitation features when it comes to customer focus. To establish a market for the core technology offering, companies need to address the needs of the customers, understand their expectation and fulfil them. Qamcom Technology does it by dividing their QMS flow to support both in-house product development and consultancy services with its own guidelines and procedures. While

consulting for customers, they adapt their QMS to incorporate features of their customer's QMS so they are better aligned to their customer's needs. PowerCell however have a strong technological background and their QMS is aimed at understanding customer expectation so they develop products with most value. Since they have established a niche market for themselves, and their fuel cell technology is only it in its initial stages of development and market acceptance, their practices support customer exploitation rather than exploration. Qamcom Technology on the other hand, being a technology intensive company focuses on customer exploration by investing in interesting technology start-ups. As members of the board to these startups, this gives them a chance to identify new needs in the market and new technology available to fulfil those needs. Although they are not directly involved in the operations of the companies they invest in, this strategy allows for knowledge sharing between them. This is further supported by the flat, transparent organization at Qamcom Technology where employees constantly interact with each other.

Process management: With regard to process management, Qamcom Technology exhibits signs of quality exploration while PowerCell that of quality exploitation. This supports their respective Prospector and Defender strategies. The QMS at PowerCell, which is available as a catalogue to all employees focuses on performance reliability and achieving control of processes. Per the interviewees, as they operate in a investment-dependant, complex technology environment where safety is a primary concern, it is important that they do things right the first time, which requires practices that ensure process control. To support this, they use statistical process control measures and detailed description of activities in the processes to train the employees. However, given the relatively low empowerment of employees within the companies, training new employees proved to be challenge without the right incentives. In line with its prospector strategy, Qamcom Technology however have designed their QMS to ensure resilience in face of uncertainty within the company. Broad guidelines help the employees handle non-routine processes with a common, supporting vision. Their QMS which is available on their company intranet for all employees to refer and update, allows them to maintain this resilience and improve the learning capacity. However, given the open roles and low task definition at Qamcom Technology, a challenge is to keep the QMS updated to reflect the reality. Also, low task definitions suit the organisations as the employees are experts in their field who already understand the shared vision in the organisation.

***Base decision on facts*:** To explore the duality of Quality Management with respect to this principle, practices connected with collection, analysis and dissemination of information can be analysed. When it comes to handling information in connection with suppliers, PowerCell follows an exploitative approach to using formal audits and pre-defined monitoring measures to gather information. However, Qamcom Technology works in close collaboration with its key suppliers and uses innovation-based measures to monitor their relationship with suppliers. Also, information collected to capture customer needs or benchmark against competition are pretty straightforward for PowerCell as they are heavily dependent on such inputs, be it customer requirements or regulatory data. Their dependence on environment factors supports this exploitative information collection and feedback criteria rather than try to shift customer perception of the need. The support culture at Qamcom Technology allows for dissemination of information freely throughout the organisation. However, the challenge here is that information and knowledge is developed tacitly which poses risks of losing the knowledge with resources. The role culture at PowerCell, however means dissemination of information is documented and made available to all employees. Although this would mean that there is a greater possibility of the knowledge staying in the organisation, they cannot ensure if the documented information is utilized by the employees.

Keep everyone committed: Keeping everyone committed can be connected to the incentive system at the company which could be applied to enhance both exploration and exploitation practices. When analysed from an incentive perspective, PowerCell supports adoption of exploitative practices; whereas Qamcom Technology supports adoption of exploration practices. PowerCell has a Quality Manager to implement, maintain and continuously improve its QMS who is viewed as a mentor. Teamwork is emphasised in the organisation and employees receive feedback related to performance. The performance measures are focused on error reduction and performance improvements. These characteristics are consistent with Quality Exploitation. In Qamcom Technology, however, there is no Quality Manager. As all employees have a shared responsibility to implement and maintain quality. Leadership supports independent thinking and autonomy while working. Employees receive learning related feedback from each other and performance measures and general and based on judgement. These are consistent with Quality Exploration practices.

Continuous improvement: Both PowerCell and Qamcom Technology have employed measures to ensure continuous improvement in the companies. However, PowerCell focuses

on improving the existing skills and efficiency of existing resources. Internally, PowerCell is functionally defined and expertise is shared within the functions and any training provided is to enhance the specific skills. However, Qamcom Technology has a more explorative approach to improve continuously. Firstly, it is ensured at Qamcom Technology that there an equal division of workforce on both in-house and consultancy projects and resources are subject to constant job rotation. This helps them build a more general form of training. Also, Qamcom Technology does not hire new resources based on need, rather they hire a person with aligned competence and culture as and when they are available. They believe that good talent is hard to come by and continuous hiring allows availability of slack resources when required.

***Committed leadership*:** In TQM, the main roles associated with committed leadership is to set the vision, set a few but challenges goals, deploy goals to all levels of the organisation, coach people and create an environment in which the team players can develop and feel empowered (Steiber and Alänge, 2013a). This particular TQM principle takes on very different roles for both companies and could well be the differentiating factor in their QMS. PowerCell technology with its traditional organisational structure and leadership, follows a more top down approach in terms of leadership, in line with the roles specified under the TQM concept. Every process has a process owner who is given the autonomy to set process goals and improvement plans. The functional setting is well suited considering their complex technology and alignment of goals is achieved through strong integration in the higher levels of hierarchy. While PowerCell focuses on employee training to provide the necessary motivation, they need to develop new incentives to ensure a feeling of empowerment among its employees. Qamcom Technology, on the other hand, has no middle management which means leaders act as facilitators in innovation process, and as cultural ambassadors and connectors who quickly absorb information and diffuse it to other parts of the organisation. This is a challenge for flat organisations as they grow if the leaders do not have a clear vision and a strong incentive system to fall back on for support. Just as highlighted in the interview with Qamcom Technology, they are facing a challenge in getting people to take on responsibilities beyond their technical tasks with no middle management. They are trying to rectify the situation by developing an incentive system in the near future. Along with this, leaders will need to take initiatives to set a vision and direction to the teams and make expected roles and responsibilities clear in the company. From a QMS perspective, there might be a need for Qamcom to introduce practices supporting quality exploitation to focus on the efficiency development in the organisation.

The analysis above throws light on how quality management practices can be designed to influence the environmental factors which are not under direct control of the organisation. Furthermore, it provides an understanding on how Quality Management practices can be used to achieve dynamic strategic alignment in the fast-growing and constantly evolving business environment. A summary of the analysis is presented in figure 5.3, below.

Internal	Practice			External
1. Customer focus 2. Strategy 3. Culture	1. Quality assurance 2. Total Quality Learning (TQL) 3. Total Quality Control (TQC)			1. Environmental uncertainty 2. Customer type
1. Customer focus - Product-based - Transcendent - Value-based - User-based - Manufacturing-based **2. Strategy** **3. Culture**	**TQM principles**	**Quality Exploit**	**Quality Explore**	**1. Environmental uncertainty** - Complex - Chaotic - Complicated - Simple **2. Customer type** - Price - Service - Quality - Collaboration
	Leadership	• Set vision and goals and deploy to all levels or the organization • Empower & involve employees to improve operational efficiency	• Be facilitators of innovation process by supporting employees • Be cultural ambassadors emphasising on competency, relatedness and autonomy of employees	
	Customer focus	• Identify existing customer needs & respond	• Explore new customer needs & identify new customer	
	Process Management	• Increase process control & process reliability & efficiency	• Explore new improvements of products & processes	
	Decision on facts	• 1st order learning from cybernetic feedback • Participation enhancement	• 2nd hand learning • Diversity enhancement	
	Team commitment	• Focus on functional problem solving • Top down decision making	• Process on cross-functional teams • Participating decision -making	
	Continuous improvement	• Train existing skills • Increase control & reliability • Exploit existing skills & resources	• Train on multiple skills & resources • Increase learning & resilience • Explore new skills & resources	

Figure 5.3. Management practices for strategic alignment in technology start-ups.

The analysis provides interesting insights while designing a Quality Management System for a startup. From the context of ReVibe Energy, the strategy, and culture in the company are still informal and undefined and introducing management tools such as a QMS would define the strategy and culture through adopted principles and practices. It is important to ensure that the strategy and culture support the external environmental conditions and customer requirements; while practices introduced and formalised at the company support the strategy and culture. Any change in the environment or customer need, would necessitate a change in strategy or culture which would in turn require a change in practices.

Furthermore, on analysis of literature and case study data, it can be concluded that Quality Management practices can be classified into quality assurance, quality exploitation and quality

exploration. Quality assurance related practices can be understood by the QMS documentation model in Figure (5.3.) as it mostly deals with achieving conformance to requirements and standards. For ReVibe Energy, this dimension of QMS is designed to achieve conformance to the ISO 9001:2015 standard. Furthermore, by comparing management practices at Qamcom Technology and PowerCell AB, an understanding of how quality exploration and quality exploitation practices can help an organisation in growing could be made. For ReVibe Energy, this analysis would help while deciding how to organise the company for further growth and also how to achieve conformance to the ISO 9001:2015 standard, with a goal to balance between quality exploration and quality exploitation.

6
QMS for ReVibe Energy

This chapter describes the QMS that resulted from this research at ReVibe Energy. The result is described in six steps which formed a roadmap for ReVibe Energy to implement a QMS that supports their growth as well as acquire ISO 9001:2015 quality certificate. The steps include: knowledge transfer, data collection, visualisation of organisational context, defining quality objectives, identify gaps to achieve objectives and recommendations. The first five steps provide the necessary foundation to work with a QMS and the recommendations support the continuous improvement of QMS.

The action plan followed at ReVibe Energy to implement a Quality Management System is presented in the section below. Working with a QMS can be considered a cyclic process where the goal is to continuously improve the organisation system, the processes and activities. In that context, implementation of QMS was done in four phases.

Phase one involved planning of the process, which included transfer of knowledge among internal resources, researches and important stakeholders to determine the current context of the organisation and the desired future state. The documented information present in the company also served as input data during the planning phase. This phase was completed via workshops, interviews and constant communication among all involved and the focus was to clarify the purpose of implementing QMS, desired benefits, possible constraints and other risks and opportunities.

Second, was the 'Do' phase where the implementation was led by the company, supported by the researchers. This phase involved visualising and clarifying the gaps needed to achieve defined objectives. Supporting that, one of the potential contract manufacturer ReVibe Energy could partner up in the near future was interviewed. Along with that, several third-party auditors responsible for quality certification of the company were interviewed to clarify gaps needed to prove compliance to the ISO 9001:2015 standard. This phase was completed during the course of this research.

The remaining phases will be completed by the company with support from the recommendations and drafts presented in this research. The ‘Check’ phase focuses on analysing the implemented QMS in reality and check for discrepancies. The final ‘Act’ phase focuses on achieving compliance to a standard and continuously improving the QMS for dynamic strategic alignment.

6.1 Knowledge transfer

The knowledge transfer began with an introductory workshop with ReVibe Energy’s management team. During this workshop, the management team shared with the research team their purpose of implementing a QMS and their expectations from the system. They also shared the constraints that could affect the implementation of QMS. For ReVibe Energy while being certified to a quality standard is crucial to be a qualified supplier to OEMs, it was important that the implemented system would not increase administrative burden on the company. In the same workshop, researchers clarified the definition of QMS and the practical implications of planning its implementation. In this manner, the goals and expectations from a research perspective and practice perspective were clarified. An introduction of the types of QMS certificates available, their value and benefits were shared with the management team. A decision was made regarding the purpose or scope of the QMS and the ISO 9000:2015 standard was chosen as it is the most recognized standard. Table 6.1.a. summarizes the established conclusions of this topic.

Table 6.1.a. Summary, of the purpose of the QMS, expected benefits from QMS and constraints when implementing QMS both from ReVibe perspective and research perspective.

	ReVibe Energy perspective	Research perspective
Purpose of the QMS in ReVibe Energy	● To achieve repeatability and traceability of process. ● To be compliant with a recognised quality standard.	● Provide a framework of ReVibe Energy (other start-ups) to implement QMS. ● Motivate the benefits of strategic alignment of business plan and QM practices.
Expected benefits from QMS	Understand and document context of organisation, Proof of trust for potential customers, improve customer focus and satisfaction, develop process-based thinking, preparation for serial production phase, save consultant fee by implementing QMS in-house.	Introduce professional management tools in fast-growing start-ups, achieve the required amount of control of process without sacrificing agility of the startup, understand how contextual factors affect the BAU activities in the organisation.
Constraints in implementation	Lack of knowledge about process, lack of resources, budget constrained, threat of too much control.	Time constrained, different levels of commitment from employees, resources, action plan must be supported by a theoretical framework.

Table 6.1.b. Step 1: Knowledge Transfer

Knowledge Transfer
● Introduction to QMS from a theoretical perspective ● Presentation of choice of QMS standard certifications ● Clarification of purpose of QMS implementation ● Clarifications expectations and constraint in the implementation

6.2 Data collection

For the purpose of data collection, the research team received access to the company data. This was a good opportunity to understand the current degree of detail of documentation and ease of accessing them. At the company, information was stored on simple cloud platform in carefully labelled folders. To explore the organisational context in detail, a combination of observation, workshops and semi-structured interviews were used. The research team began with a workshop for the ReVibe Energy team. It began with an introduction to the PDCA cycle and explaining what is means to have a process-based view. After discussing the challenges in defining processes at this early stage, the ReVibe Energy team managed to broadly identify management process, basic & supporting process and outsourced process required for their operations. They also assigned the responsibilities for the execution of each process. The resulting organisational chart is presented in Appendix H. Following the workshop, exploratory interviews were conducted with the employees individually, to gather data on the activities required to execute processes, their interactions and time period. Personal interviews helped in receiving multiple views on process activities. A summary of interview questions is presented in the Appendix B. The research team then consolidated the interview data to understand the current processes in detail. Considering, ReVibe Energy would soon start serial production, a potential contract manufacturer who the company had sourced were interviewed. Through the interview data was collected on how they manage their processes, compliance requirements and relationships. A brief understanding of the expectations from the contract manufacturers was achieved through this process. However, an audit would be necessary to fully investigate this future state. But the interview with the contract manufacturers revealed the importance of a reliable Bill of Materials for the products and the assembly and test instructions are crucial documents for serial production.

Table 6.2. Step 2: Data collection to determine organization context

Data collection to determine organisation context
● Access and gather documented data ● Identify overall business processes supporting operations ● Identify responsibilities, stakeholders, activities and interactions to execute processes. ● Interview potential contract manufacturers.

6.3 Visualisation of organisation context

The research team, then analysed the data gathered from the workshop and subsequent interviews at ReVibe Energy to consolidate and visualise the processes graphically. Based on the data, business model canvas (Appendix G), the overall process flowchart (Appendix H) and swimlane process maps (Appendix I 1-7) were designed to visually represent the process activities and their interactions. These models helped understand and document the context in which ReVibe Energy operates. The business model canvas provides an holistic approach embracing elements of pricing, mechanisms, customer relationships, partnering and revenue sharing. It is a useful tool to understand stakeholders and their requirements. The process maps were then reviewed by the ReVibe Energy team, where they suggested multiple corrections to fit it to the reality. Appendix I (1-7) represent the iterations of the Swimlane process map, with Appendix I1 being the final version. The process map indicates the 'as-is' state for ReVibe Energy.

Table 6.3 Step 3: Visualisation of organisation context

Visualisation of organisation context
● Graphically map the as-is condition in the organisation. ● Clarify models with resources and make corrections based on feedback.

6.4 Determine Quality Objectives

After documenting the context of organisation, the next step was to determine measurable quality objectives. To be in line with the objective to align QMS to business strategy, this step began by analysing ReVibe Energy's business plan which included long term and short-term goals. The research team noted that the business plan was a good start to understand the business strategy of the company and was treated as an inspiration to identify critical quality objectives and an action plan moving forward. The balanced score card was identified as a suitable tool to break down broad business strategy into measurable objectives. This was completed via workshop with the members of ReVibe Energy team (both management and engineering functions were represented in the workshop). It was decided that the balanced score card would be reviewed every year to check actual progress against the estimated targets. Appendix J. By using a tool like the balanced score card, the company was able to establish an action plan to achieve these objectives. This could lay founding to the management practices and procedures

introduced at the company. For example, routine tasks such as initial customer requirement gathering can be standardised. In addition, it allows to identify crucial documentation such as the bill of materials and the assembly and testing instruction sheets. Furthermore, important ways of measurement to check against forecasted objectives could be identified. For example, it was realised during the workshop that there was a discrepancy in the way customers were moved to the different stages in the cycle. Misalignment in data entry would affect the data received to check if the objectives such as customer retention or satisfaction were reached.

Table 6.4 Step 4: Determine Quality Objectives

Determine Quality Objectives
● Define long term and short-term business objectives. ● Break down business objectives into measures quality objectives.

6.5 Identify gaps to reach quality objectives

To identify gaps in the company to reach the quality objectives, the balanced scorecard was revisited. The 'Action plan' identified in the balanced scorecard served as an input to identify the steps needed to reach the 'should be' state for the company. This was compared against the context of the organisation to identify suitable Operating procedures and work instructions necessary for sustained growth of the company. In addition to this, this was checked against the gap checklist for ISO 9000 compliance to ensure that the plans were exhaustive to reach the desired future state which also involved getting certified. To further support this, interviews were conducted with several third-party auditors with experience in quality certification of organisations. The interviews helped understand the following about quality certification:

- While designing a QMS to suit the organisational context might be difficult, having that QMS compliant to the ISO 9001:2015 is not as complex.
- The requirements stated in the clauses are logical and would be present in any well designed QMS. The clauses should be viewed as a checklist to ensure that the QMS is of value to the organisation.
- While working with QMS compliance, the first crucial step is to determine the scope of QMS. This includes a description of all the processes governed under the QMS. It is important as defining this scope would help an organisation decide a suitable time for

application of certification. The company must ensure that all of the core processes in the company are governed under the QMS.

- The audit happens in two stages. The first is when the documents submitted by the company are checked by the auditors. Commonly requested documents include those describing the context of the organisation, scope of QMS, internal audit reports, management review reports. The second stage is when the auditor visits the company for a day of audit. The duration of audit varies depending on the size of the company. For ReVibe Energy, it generally takes around a day. During the audit, records for proof of compliance is checked and validity of work instructions is checked against the reality.

Meeting with auditors helped the research team to determine the certification requirements and readiness according to ReVibe Energy. Considering certification, it is crucial to be a certified supplier to OEMs. ReVibe Energy could apply for certification for its current context. But it would require additional application for an extension once the production process is established and this would incur additional costs. Nonetheless, it is vital that the production process is under the scope of the QMS for ReVibe Energy. Currently, ReVibe Energy's strategy is to work with already certified contract manufacturers. However, it is important that ReVibe Energy's have control of their quality once mass production is released. This means retaining their own QMS, including details of quality control of products from production. Therefore, the recommendation is to apply for certification when strategic relationships a with chosen contract manufacturer is developed and the company has had a chance to audit the contract manufacturers internally.

Table 6.5: Step 5: Identify gaps to reach quality objectives

Identify gaps to reach quality objectives
● Review the quality objectives ● Identify gaps between the current context of organisation and desired should be state ● Identify gaps with respect to standard compliance (ISO 9000)

6.6 Recommendations

Through the previously mentioned steps, a startup like ReVibe Energy can understand the context in which it is operating, and the contingency factors that affect the organisation as a

system. It also helps define the purpose of implementing a QMS and the scope it would influence. By defining quality objectives, a desired future state is determined. The analysis of QMS for ReVibe Energy provides the needed roadmap to choose management practices as the organisation grows. For example, as the company grows in the number of employees, practices established should support capability enhancement, information collection, analysis and dissemination and motivating employee. (Sitkin,S. et al., 1994) The practices should have a balance to support both quality exploration and exploitation. Considering that ReVibe Energy would choose management practices with this knowledge in mind, the following recommendations would help ReVibe Energy in their goal towards certification to the ISO 9001:2015 standard.

- Considering the documentation model described in Figure 2.3.2b, document the operating procedures and work instructions that result from the action plan of the balanced scorecard.
- Check for inconsistencies with the reality and ISO standard by revisiting the gap analysis checklist developed during this research.
- Provide access of documents to relevant stakeholders and monitor the performance in real time using audits and management reviews. Document the results which will be the records proving conformance.
- When the company moves closer to serial production, create a process map for production and revise the balance scorecard to include the production process. Identify the control procedures and documents that arise from the action plan.
- When ready, plan for certification by carefully selecting a third-party auditor who understands the operating conditions of start-ups. Review the required documentation for pre-audit and audit purposes before applying for certification.
- Review management practices against the audit feedback.
- Continuously repeat the process for a dynamic alignment of the QMS with the evolving needs of the organisation, as they grow.

7
Conclusion

In this chapter, interesting ideas that have emerged from the data analysis and also those not directly supported by the data but useful to consider for further research is presented.

This research began with the purpose to investigate how QMS can be designed and implemented in technology start-ups to support their scaling strategy. It was evident from the start that there was no universal consensus on the definition of a startup or for how long a company could be considered a startup. This in turn meant that scaling of a startup could mean different things for different start-ups at different point in time, based on their strategy. For example, at ReVibe Energy, in the current context scaling meant to acquire the capacity to produce in large volumes. But for LumenRadio the priority is to explore new business areas with their technology. Therefore, scaling could mean anything from the ability to produce in large volumes or explore new business areas or new markets with existing products. Each situation required a different set of management practices; prioritising control, innovation, or a balance between both (Zhang, D. et al., 2012; Cole, 2002; Sitkin,S. et al., 1994; Steiber and Alänge, 2013a). With respect to designing a QMS to support scaling in technology start-ups, it was clear that there is no one single best way of doing it. The QMS had to be custom made, specific to the context of the company, its needs and resources which changed constantly as well.

Several attempts have been made over the years to standardise the content of total quality. Steiber and Alänge, (2013a), highlight the two development trajectories for the TQM concept, namely a broad and holistic concept of TQM and a narrow concept, focused primarily on measurements and use of statistical methods. They go on to mention that if the concept of continuous innovation is considered as important as continuous improvement, the broader version of TQM needs to be updated to accommodate practices to organise and manage people for both incremental and radical innovation. The suggestion is to start with classifying Quality Management practices into dimensions of;

- Quality Assurance: focusing on conformance of products and processes to given requirements and standards using systems and documentation,
- Total Quality Control: aimed at satisfying and delighting customers by focusing on performance efficiency and continuous improvement and
- Total Quality Learning: emphasising on continuous innovation by enhancing the learning capability of the organisation. By breaking down the broad concept of TQM and subsequently QMS, an organisation can adopt practices to remain adaptable in times of uncertainty and constant change.

Furthermore, the framework by Marmgren et al., (2016) describes the relationship between different manifestations of ideas and behaviour in an organisation. The framework presents several managerial implications to leaders working towards an organisation's sustained growth. Management models and communication in an organisation need to constantly adapt to the changing environmental factors that affect the organisation's growth. It is not until the behaviour is changed that results and effects sought after becoming a reality. Their framework highlights the relationship between explicit (documented and spoken) and tacit guiding ideas, and that it is the latter that largest controls action. The explicit ideas implemented as improvement initiatives (eg: implementation of a QMS) must become a part of the tacit guiding ideas to influence the behaviour. Crucial to achieve this is the awareness of the environmental variables that describe the context of the organisation. Any change (current or foreseen) in these variables will necessitate a dynamic change in management practices. The practices introduced bearing in mind the organisation's strategy, existing structure and culture as these factors have an impact on the behaviour of the organisation.

From a B2B context, examining the dimension of customer focus using collaboration models presented interesting implication. Firstly, it is evident that collaboration between corporations and start-ups can benefit both sides, helping corporations create and enter new markets and start-ups to develop their products and scale (Larkin and O'Halloran, 2018). However, there are several pitfalls to be overcome to ensure a successful collaboration. Success mostly demands on both sides learning and understanding the interests, expectations, incentives, culture of the other. It was evident during the course of this research that start-ups often found it challenging to establish the right contact in corporate organisations. Start-ups are expected to navigate through the maze of corporate organisations to speak with the right unit or person to initiate collaboration. Corporations should introduce proper communication channels that ease

up establishment of collaboration. Furthermore, once such a collaboration is established, startups often risk running out of capital towards the end of long sales cycle. While it is important for start-ups to address this issue with suitable sales approach, corporations should try to be more agile and develop means of communication to keep the startups updated. Start-ups can ease the collaboration by understanding their customer requirements and their perceived value of quality. Start-ups aiming to be qualified suppliers to OEMs are often expected to be certified to a quality standard and also match their stage gates with that of the corporations. Consequently, with more customers this would mean complying to multiple requirements for start-ups. A well designed QMS can help start-ups distinguish between routine or standardised tasks and non-routine tasks. They can then introduce suitable management practices to execute these tasks. Also, a QMS compliant with a quality standard such as the ISO 9001:2015 allows the start-ups produce the proof of trust which is sometimes crucial to acquire new customers. Thus, by recognising the multifaced concept of total quality and choosing practices that match the context of the organisation, start-ups can design and implement a QMS that would support them in their continued growth.

Finally, we have identified that the world is undergoing a transformation in how companies and industries have begun to collaborate. We argue that there is a need for further theoretical development to find synergies between QMS and business strategy of the company. Specially in case of B2B technology start-ups, where having a certified QMS is crucial for business there is a theoretical gap which guides practitioners through the complex decision-making process. However, an interesting outcome of this research has been the identification of QMS as tool to strengthen the collaboration with large corporations and start-ups. Although, various models have been suggested for successful collaboration, we suggest that further work is required in the area to design policies and standards as future research.

Appendix

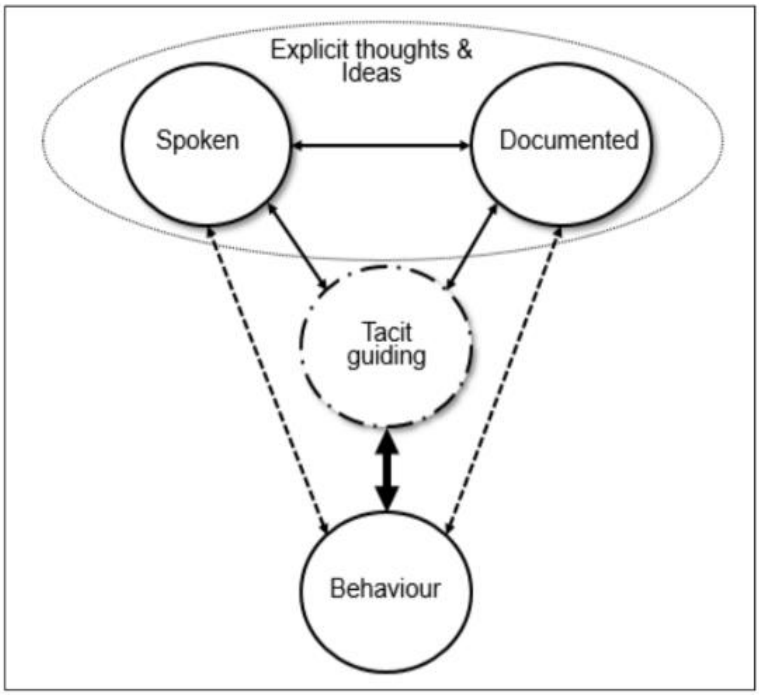
Appendix A

Bootstrap strategy: Bootstrap is a situation in which an entrepreneur starts a company with little capital. An individual is said to be bootstrapping when he or she attempts to found and build a company from personal finances or from the operating revenues of the new company.

Compared to using venture capital, boot strapping can be beneficial, as the entrepreneur is able to maintain control over all decisions. On the downside, however, this form of financing may place unnecessary financial risk on the entrepreneur. Furthermore, boot strapping may not provide enough investment for the company to become successful at a reasonable rate.

(source: Staff, I. (2018). Bootstrap. [online] Investopedia. Available at: https://www.investopedia.com/terms/b/bootstrap.asp [Accessed 12 Jun. 2018].)

Appendix A2: Marmgren et al.'s explicit and tacit knowledge model



Marmgren et al., (2016)

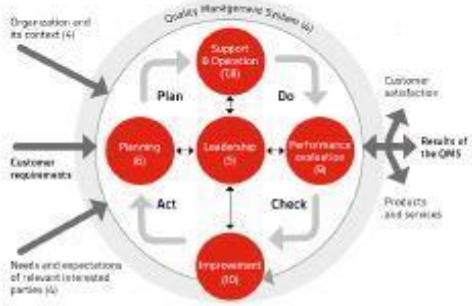
Appendix B: Interview at ReVibe Energy: Process mapping

REVIBE ENERGY WORKSHOP

The objectives of today is, for us to understand the company, and you. How you work, what your functions and responsibilities are in order for us to recognise important factors to look into.

QMS

Quality Management System (QMS) confirms that the organization is focused on meeting customer requirements ensuring them being satisfied with the products and services that they receive. ISO 9001 is an international standard that specifies requirements for a QMS. Organizations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements.



ORGANISATIONAL CHART

An organizational chart is to visualize the position and function for each employee. Internally it might be easy to know without documentation of what position an employee has and what their function is in the organisation. However, externally it is a professional representation of the company and the skilled people working at the company. In this case, one might also find out that there are functions that needs to be created and fulfilled in order to meet the customer requirements in a more accurate way.

The task is to identify what functions there are, and the individual employees responsibility area.

PROCESS MAP

Process mapping visually identifies and demonstrates the steps and complexity of a process. It shows, input variables and the resultant key output variables, value-added and non-value-added activities, and evidently classifies the process steps into different categories such as, noise, controllable factors, standard operating procedures (SOPs) and so on.

The task is to identify the different steps in the process without going too deep into details. Identify each "step" into one of the following three categories (agree in the group, and choose one colour of post-it for each category to write on);

- Action – what kind of action do we take?
- Deliverables – What do we "hand over"/deliver?
- Decision – Does one take decisions in this step? What is the decision-making factor?

Once this is done, entitle the employee that works and/or has responsibility over the certain step.

Appendix C: Case study interviews

Company Background	Customer relationship - New customer order + retain customers
Name and start year	Target customer segment
Industry	What are the different channels used?
Turnover	How are the offerings grouped ? Per customer/ product type etc.
Number of employees	Briefly describe the process of customer aquisitions
Certified? year of certification	Who is responsible for customer acqisition?
Scope of certification	How are the different channels monitored?
Benefits of certification	Are customers categorised as they move through phases? how?
Challenges faced in obtaining them	Any performance evaluation and feedback system to learn from each stage?
Core processes at company	Information flow from sales to engineering on requirements
Organisation chart/main business units	How are the products segmented? solution based, product-platform based
	Do you have seperate teams for customer aquisition and exisiting one?
	What tools are used to manage the process?
	How is the process documented? Database and compliance
	Key aspects for sales from QMS point of view

New Product Development	Supply Chain and logistics	Purchasing
Scope of new product development	Scope of supply chain and logistics	How is purchasing performed? - centralised or decentralised?
How are the different kind of NPD projects classified and managed	KPIs for logistics	Overview of purchasing process
Desribe the process of new product development	Plan for packaging	Approximate number of suppliers used
At what step are engineers involved in the lifecycle of the process?	Type of logistics used: incoming goods	Type of relationship/contract with suppliers
Activities for interaction between sales and engineering	Type of logistics used: outgoing goods	What are the criteria to choose a supplier? global/local sourcing
What are the KPIs in terms of product development	Benefits	Do you have any kind of forecasting? - volume and type
Tool used for project management/communication	Challenges	What are suppliers monitored?
What is documentation and what is the Documentation database ?	Communication with logistics team	How do you communicate with the suppliers? documents, type of contact?
Challenges faced	Type of contract with logistics partner	Method of inspection of incoming quality of components
Scope of QMS wrt NPD	Criteria for choosing logistics partner	Look at the purchasing policy?
QMS documentation required in terms of NPD	QMS wrt logistics	Differences in purchasing for NPD vs production
General average order size		

Production
Scope of production process - inhouse/ contract
Number of contract manufacturers, type of contract, scope of activities and level of control
Desbribe the production process.
Important KPIs for production
What are the work procedures used for production - instruction sheet?
Do you have a clear operations strategy? What is it? (plants close to the head office & R&D, cost efficient)
What is your targeted achievements in terms of plant and equipment?
- What is the span of process? - make or buy?
- What is the plant size? - one big plant or several smaller ones?
- Where do you want the plant location to be? - locate near markets or locate near materials?
- Investment decisions? - invest mainly in buildings or equipment or inventories or research?
- What are the choice of equipment? - general-purpose or special-purpose equipment?
- What kind of tooling? - temporary, minimum tooling or "production tooling"?
How do you choose your contract manifacturers? What is a good manifacturing plant?
Production planning and control?
- How frequently are you consider of inventory taking? - few or many breaks in production for buffer stocks?
- are you or you manufacturer going to handle the inventory? - if you, what should then the inventory size be? - high or low inventory? (JIT)
- What degree of inventory control are you going to have? - control in great deatil or lesser detail?
- What are you going to control? - controls designed to minimize machine downtime or labour cost or time process, or to maximize output of particular products or material usage?
- What will you quality control in the production be? - high reliability & quality or low costs?
- What kind of standards are you going to use? - formal or informal or none at all? (Will you set any kind of guidelines?)
Have you considered to create policies or audit the manufacturing wehen you have contract manufacturing? Any key elements that needs to be controlled?
Labour and staffing **(take into considerastion that some of the questions here might be more relevant to the plant owner)**
- What kind of "job specialization" is needed in terms of production personell? - highly specialized or not highly specialized?
- What are the expected criterias of the supoervision? - technically trained first-line supervisors or nontechnically trained supervisors?
- (Are you going to be involved in their wage system?) - What will the wage system be? - many job grades or few job grades; incentive wages or hourly wages?
- What kind of supervision are you going to have? - close supervision or loose supervision?
- How many industrial engineers do you think you need? - few or many engineers?
What kind of management organization are you going to have handling the production?

Appendix D: Interviews with OEMS

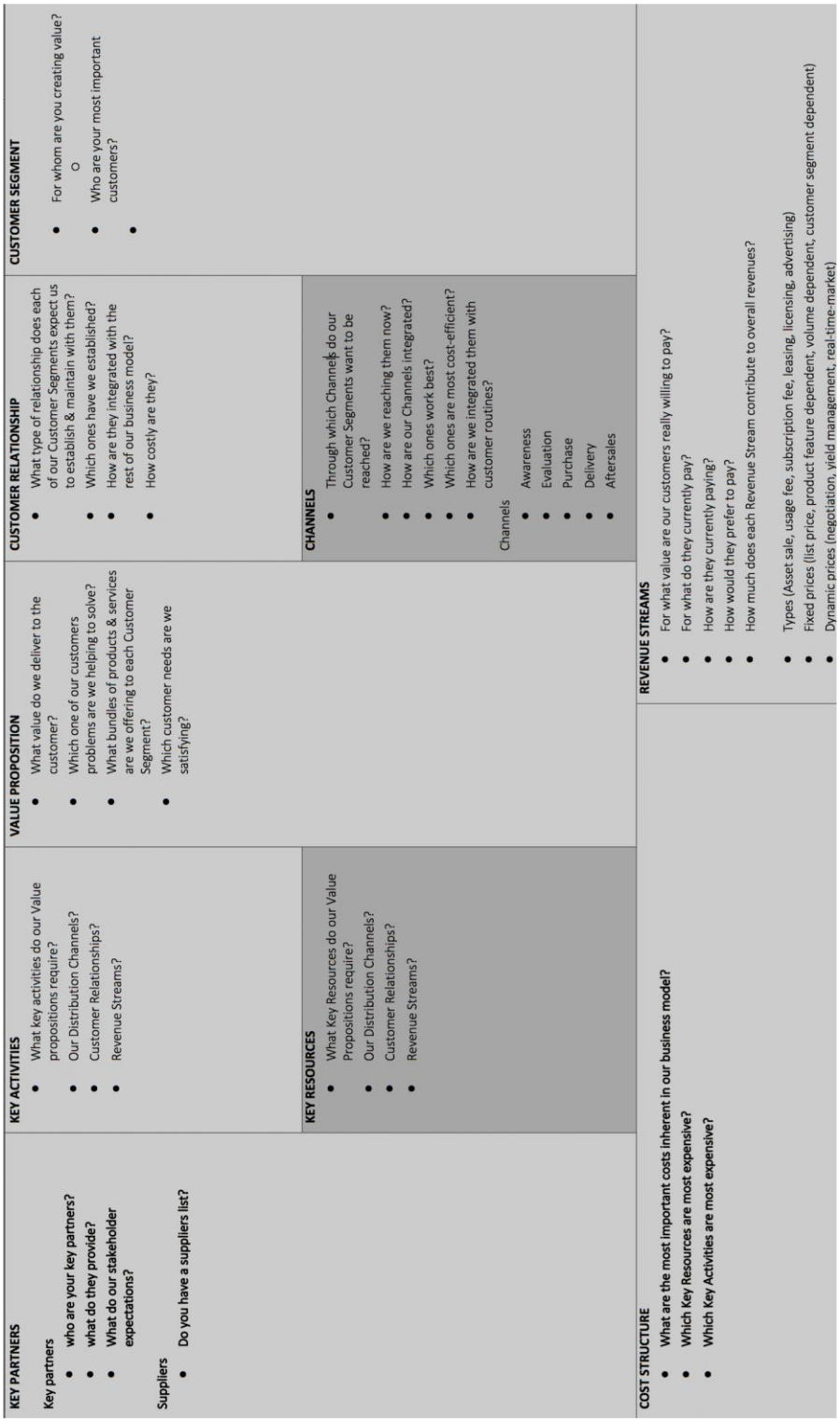
Customer focus
1. How can Revibe become a qualified supplier for your company?
2. What is your policy for supplier selection and approval?
3. What requirements changes when a supplier move from R&D phase to production.
4. How can the startups identify and be prepared for product-based and QMS certification requirements?
5. How do you audit the suppliers?
6. What kind of KPIs are used monitoring the suppliers?
Background
1. How can startups get investments from corporates?
2. Can you see the benefits from corporate point of view? - (What is your motivation for working with a startup/R&D department of a smaller company?)
3. In literature we read about corporate decision-makers most likely look for references before engaging in a collaboration (network effect) is this the case at this corporation?
a. If yes – What kind of references do you look for?
4. How would you describe your R&D decision process? – Long decision cycle or short decision cycle?
a. If long – Why is it long? How would you suggest shortening it?
5. Do you have a QMS?
a. How do you work with your QMS?
b. Are you ISO-certified?

Collaboration between start-ups and corporates for mutual understanding
Why does collaboration make sense for each party?
1. Where do you position yourself in terms of innovation?
a. What part of your function is linked to the R&D at your corporation?
b. What do you do internally and what is done externally/outsourced?
2. What do you evaluate when choosing the startup you want to collaborate with?
a. What are the decision factors when identifying potential collaboration opportunities with the startups (you choose to work with)?
3. How do you approach startups to collaborate with?
a. How do you make a startup as a part of your system?
4. How to agree on IP and ownership in dialogue with startup-companies?
5. Do you believe that external innovators have more freedom to develop truly disruptive solutions?
6. Theory supports the claim of corporates being slow in their decision making (in R&D, purchasing etc.) do you agree?
7. Do you believe that innovative start-up may give you a corporate edge?
1. What kind of risks are you company willing to take when collaborating with a startup/choosing a startup as a supplier? (Corporate choice of supplier)
a. What kind of policies do you company have when choosing a startup as a supplier?
b. How do you measure risks when choosing a startup as a supplier?
c. How much risk are you willing to take?
d. How do you perceive a startup as a supplier?
e. What would be the reason(s) of ending you collaboration with a startup?
2. How can you distinguish a relevant innovative "product development" supplier from one that you don't need?
a. What are the challenges in distinguishing "good" companies from "bad" ones?
3. How do you identify your customers' requirements?

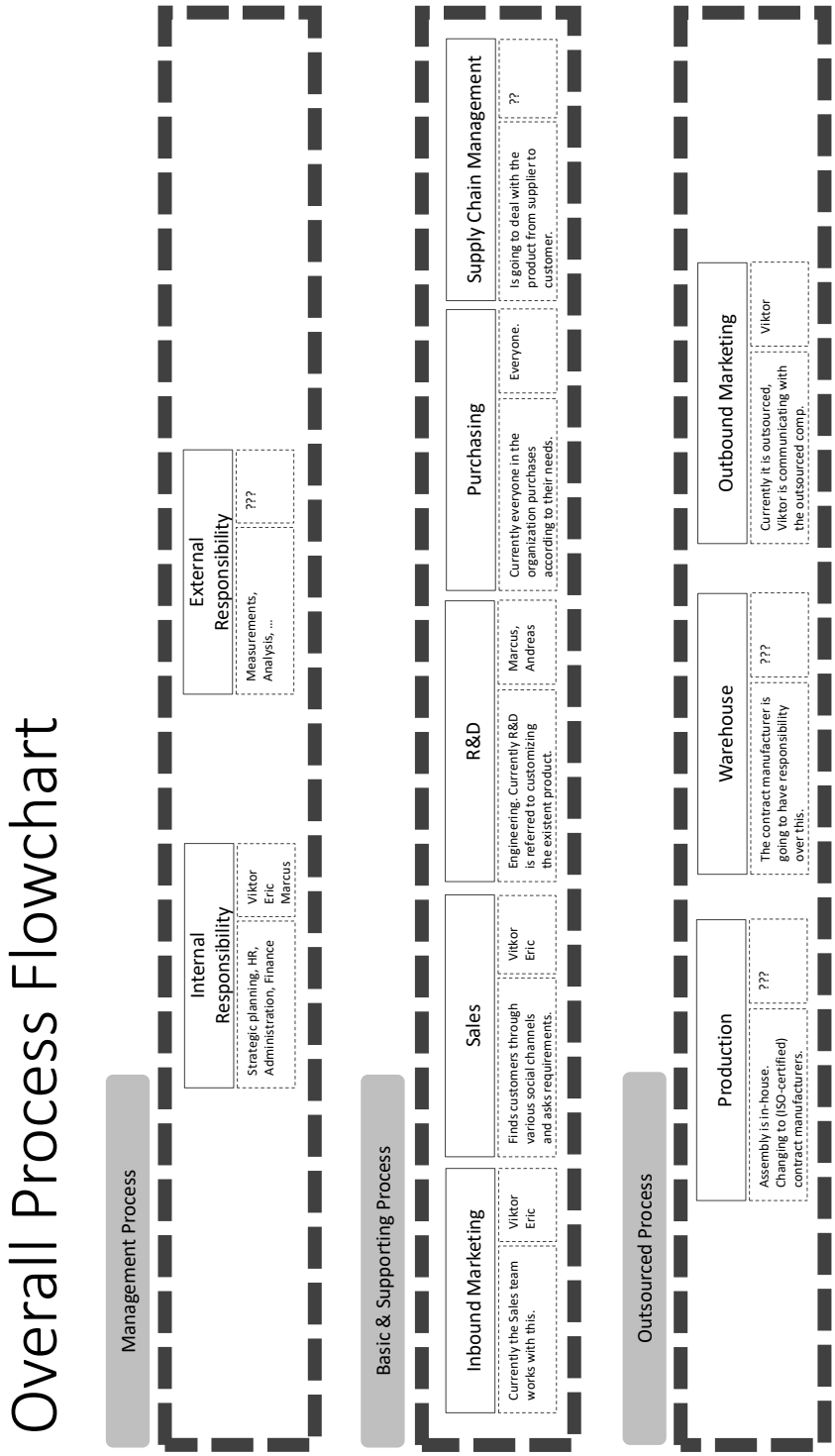
1. What are your challenges in collaboration with:
a. Suppliers?
b. R&D startups?
2. How do you manage:
a. your sale cycles?
b. your integration of innovative externally developed products into your own?
3. What are your short- and long-term objectives?
a. How do you manage your short- and long-term objectives?
4. Do you feel that you corporate culture sometimes hinders your creativity/your fully potential?
5. How can startups find the right people for collaboration in your corporation?
6. How do your company work with innovative products?
7. What would make a startup more reliable for you?
8. What would make you perceive a startup as a serious business? -top-down approach
9. How engaged is your supervisor in your work?
a. Purchasing?
b. Quality work?
c. R&D?
10. How would you describe your organisational culture as?
a. Do you perceive your senior manager as a curious & open-minded person?
b. Do you perceive your senior manager as a person that understands new technologies?

Operations
1. What is your targeted achievements in terms of plant & equipment?
a. What is span of process? -make or buy?
2. Where do you want the R&D startups facility to be located?
a. located near markets or near materials?
3. What degree of control do you have?
a. In great detail or lesser detail? - standards, "must-follow"rules-, guidelines
b.What do you control?
c. What kind of standards do you use?
4. What level of stability are you considering?
a. frozen designs or many engineering changes?
5. What are your technological risks?
a. use new processes unproven by competitors or follow-the-leader policy?
b. (Product strategy) How are your engineers working? - complete packaged design or design-as-you-go approach?
6. What is the digital platform that you communicate in?
7. What kind of organisation do you have? - functional, geographical or other
8. How is the executive use of thime planned to be?
a. Involvement - much or little in detail? - authoritarian or nondirective style, much or little contact with the organisation?
b. High involvement - in investments, production planing or cost control or quality control or other activities?
9. What is the assumed degree of risk? - decision based on much or little information?

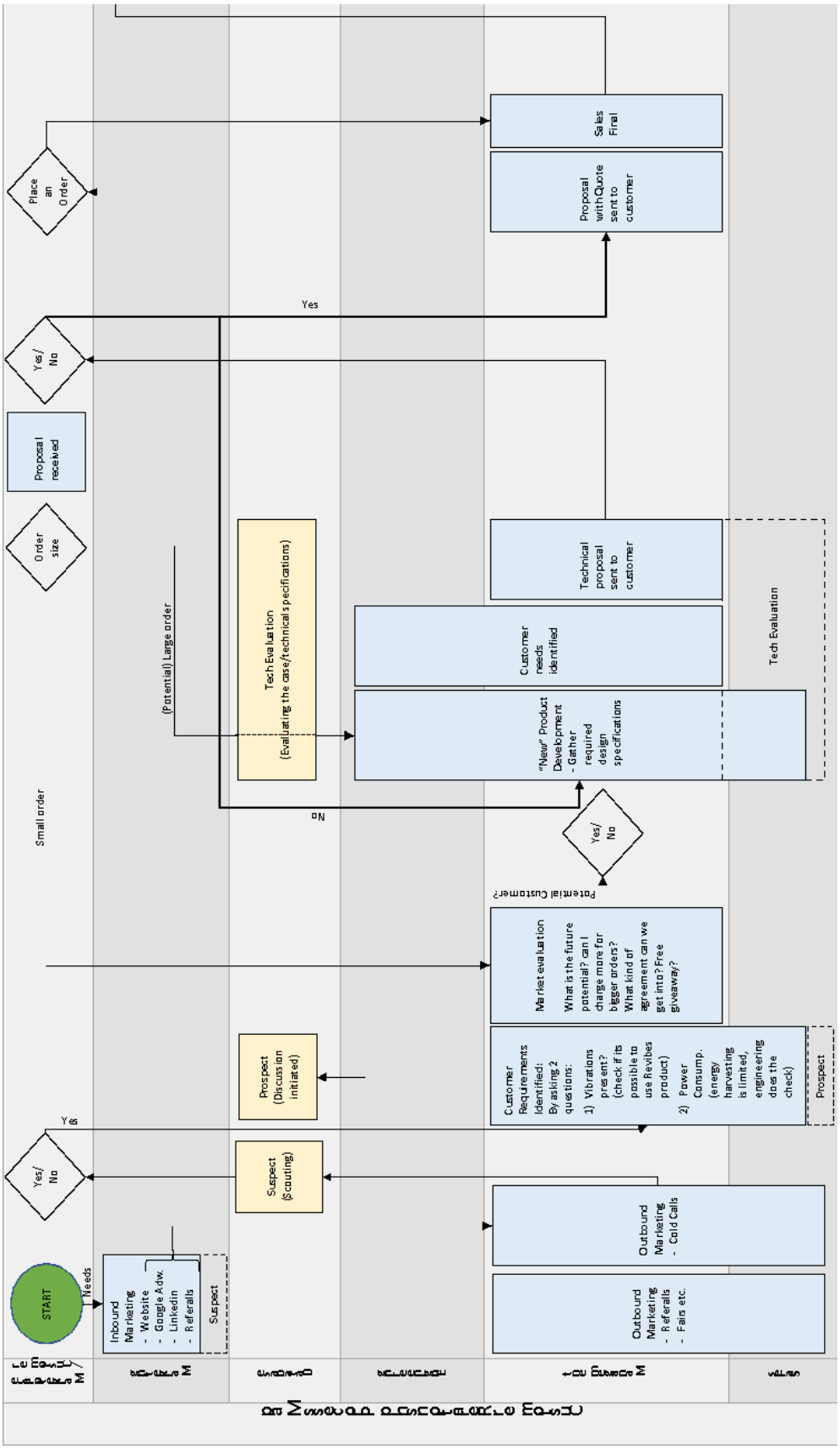
Appendix G: ReVibe Energy: Business model canvas



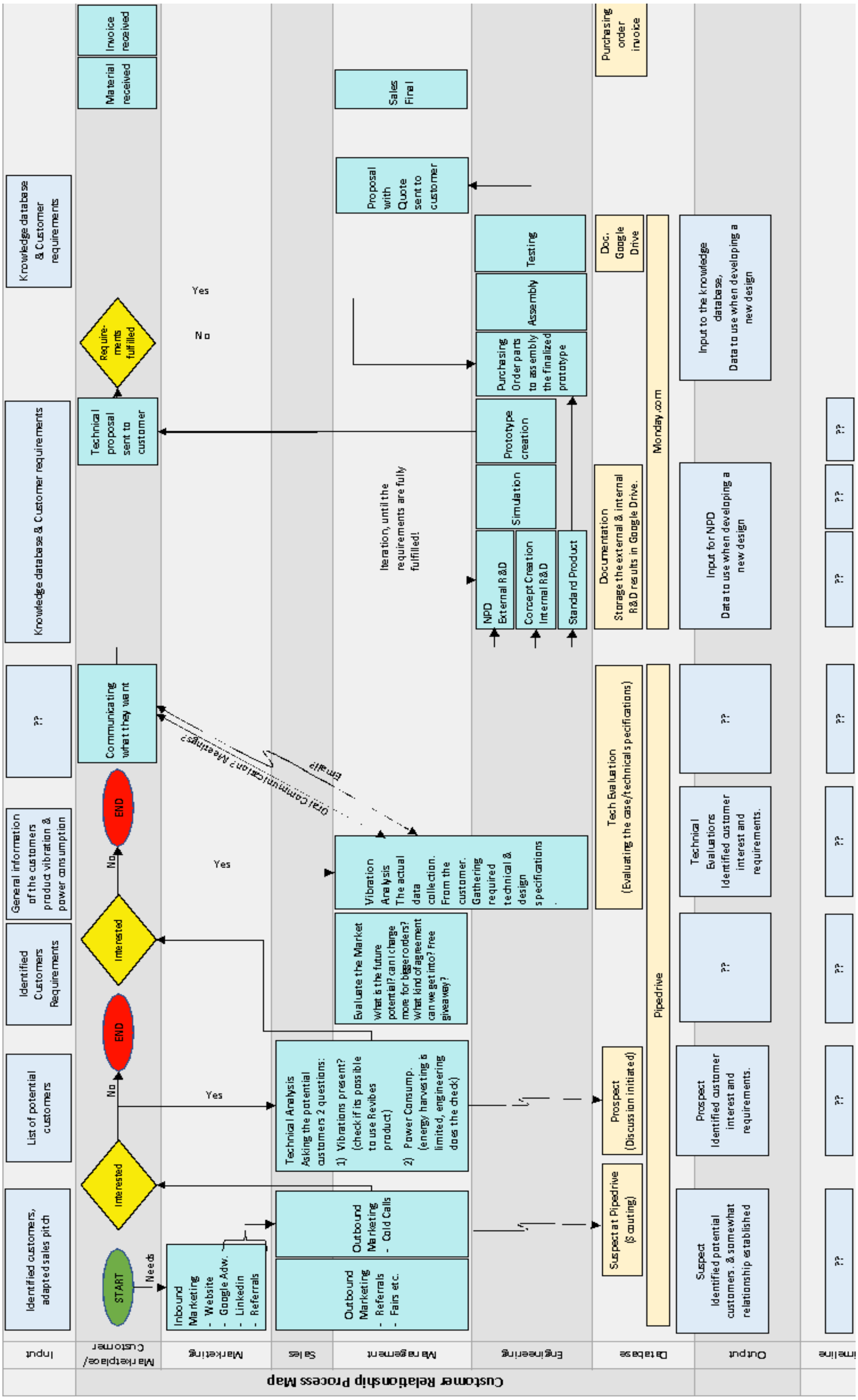
Appendix H: ReVibe Energy: Organisation chart/Overall Flowchart



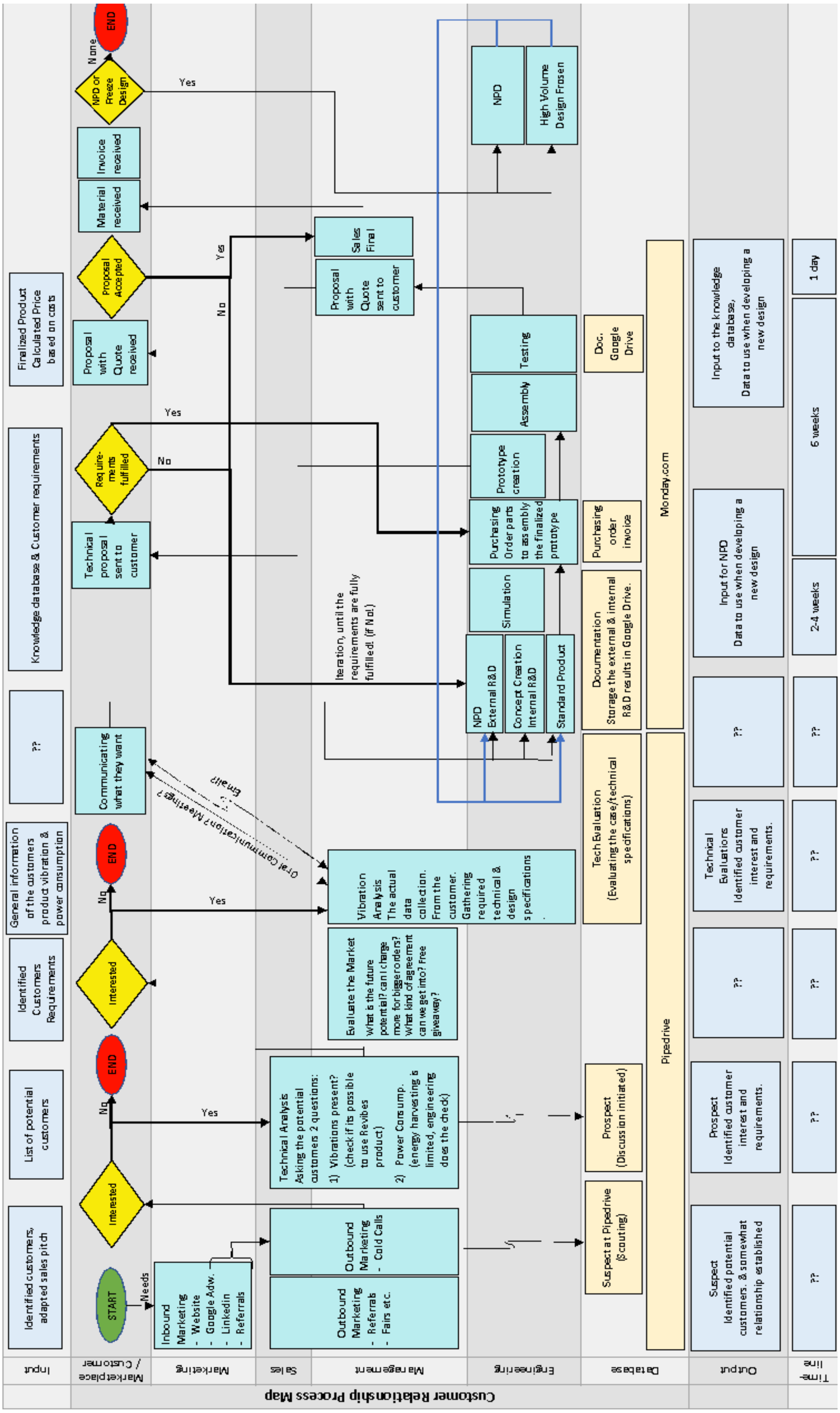
Appendix I1: ReVibe Energy: Versions 1 of Swimlane process map



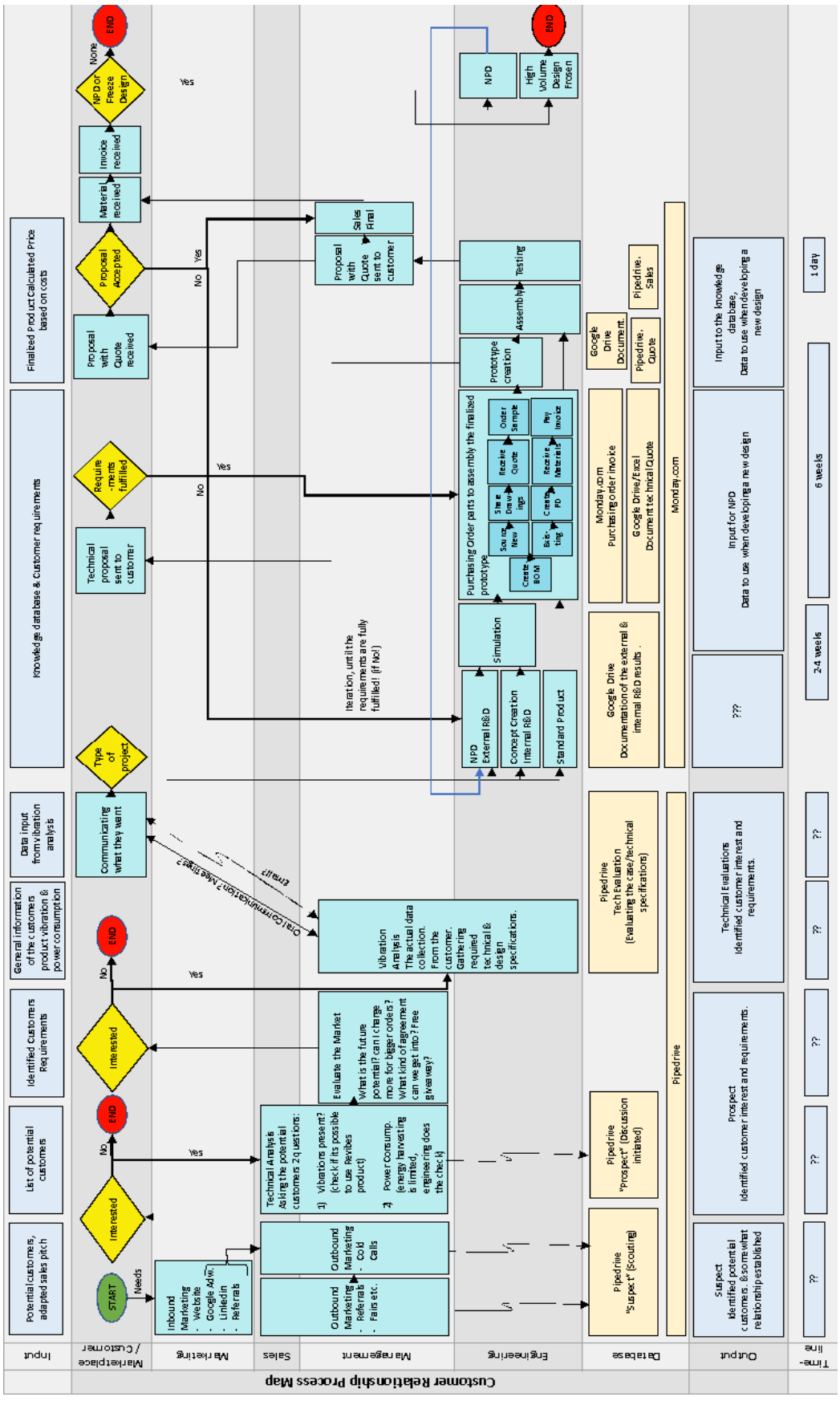
Appendix I2: ReVibe Energy: Versions 2 of Swimlane process map



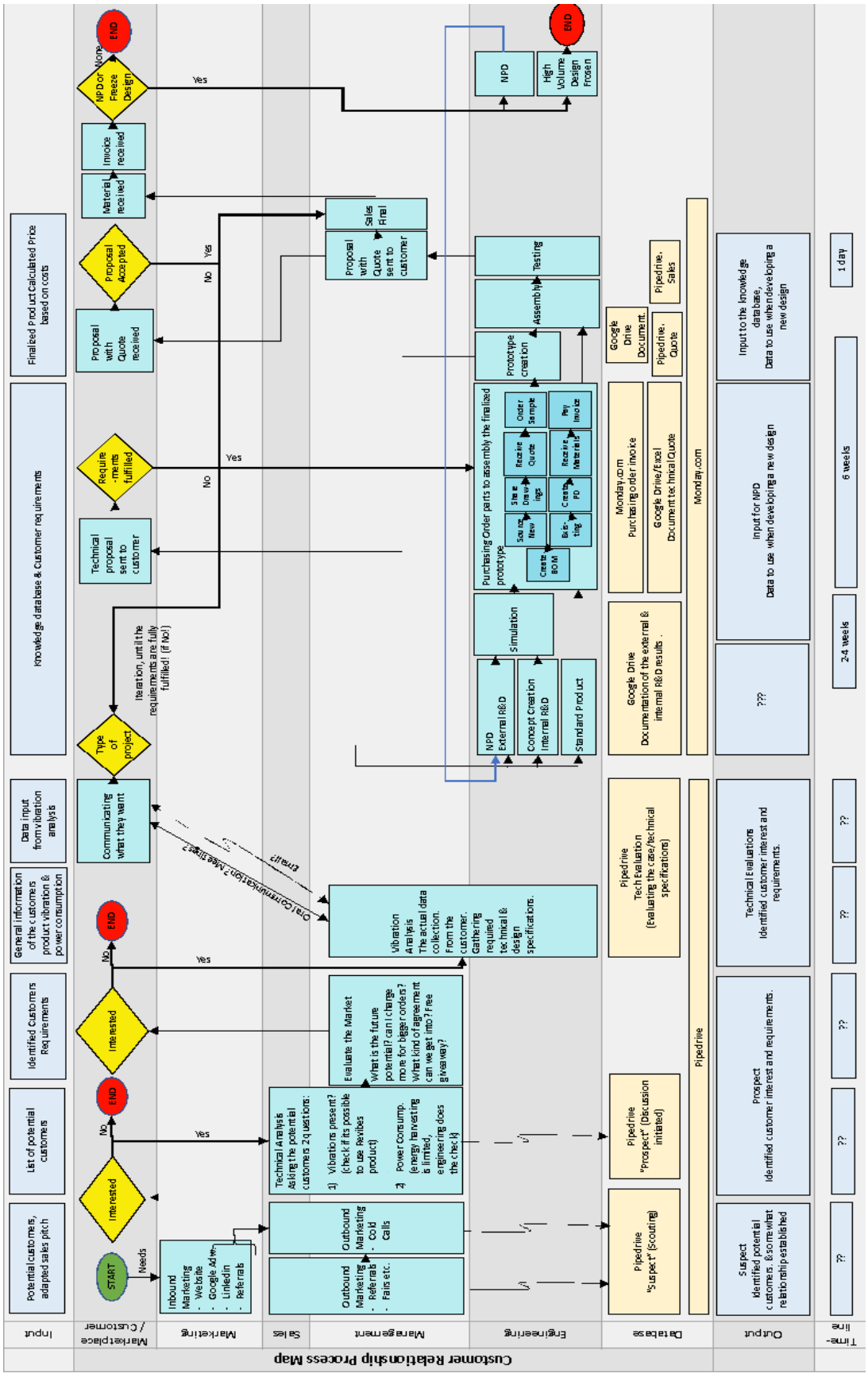
Appendix I3: ReVibe Energy: Versions 3 of Swimlane process map



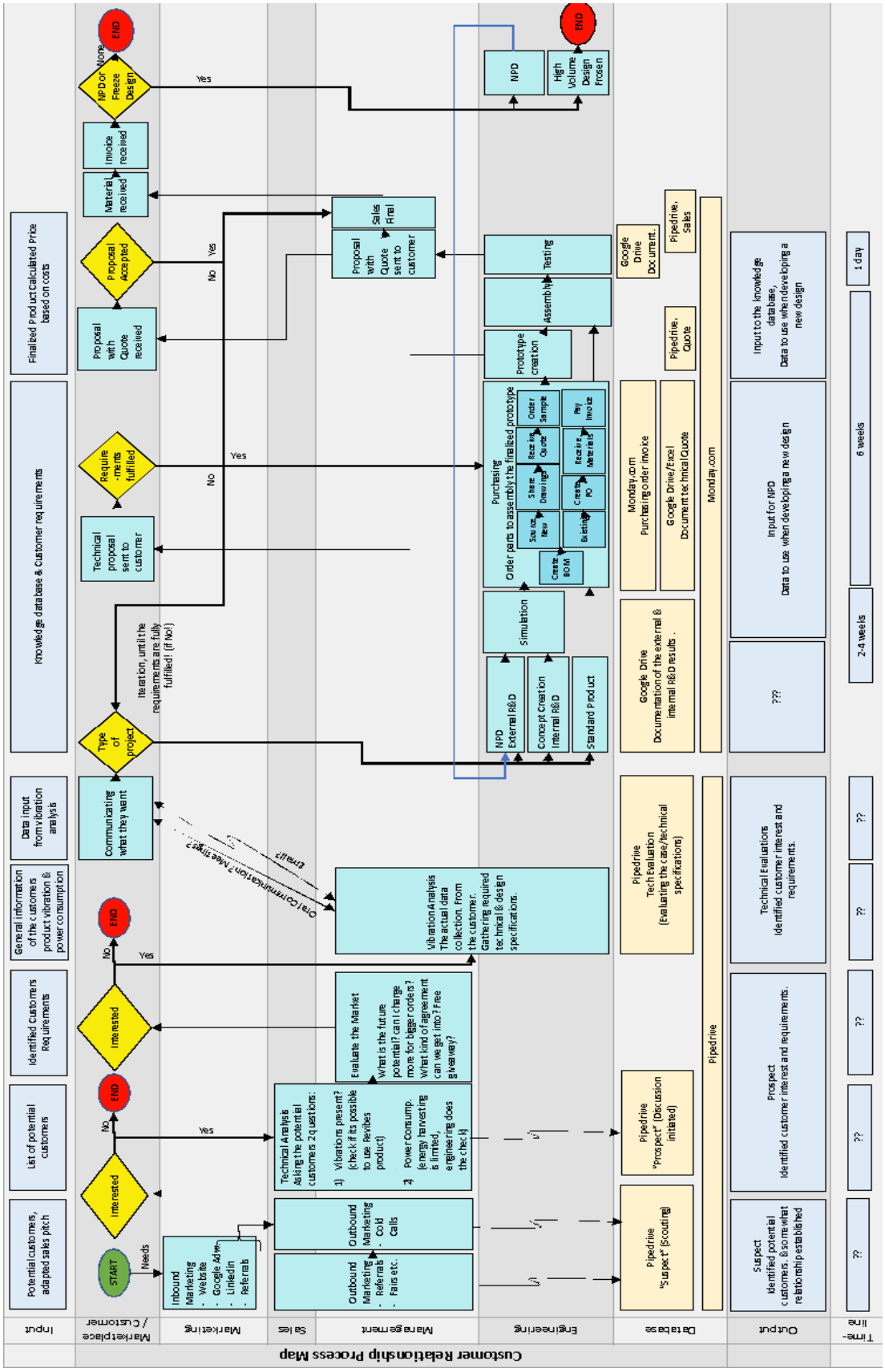
Appendix I4: ReVibe Energy: Versions 4 of Swimlane process map



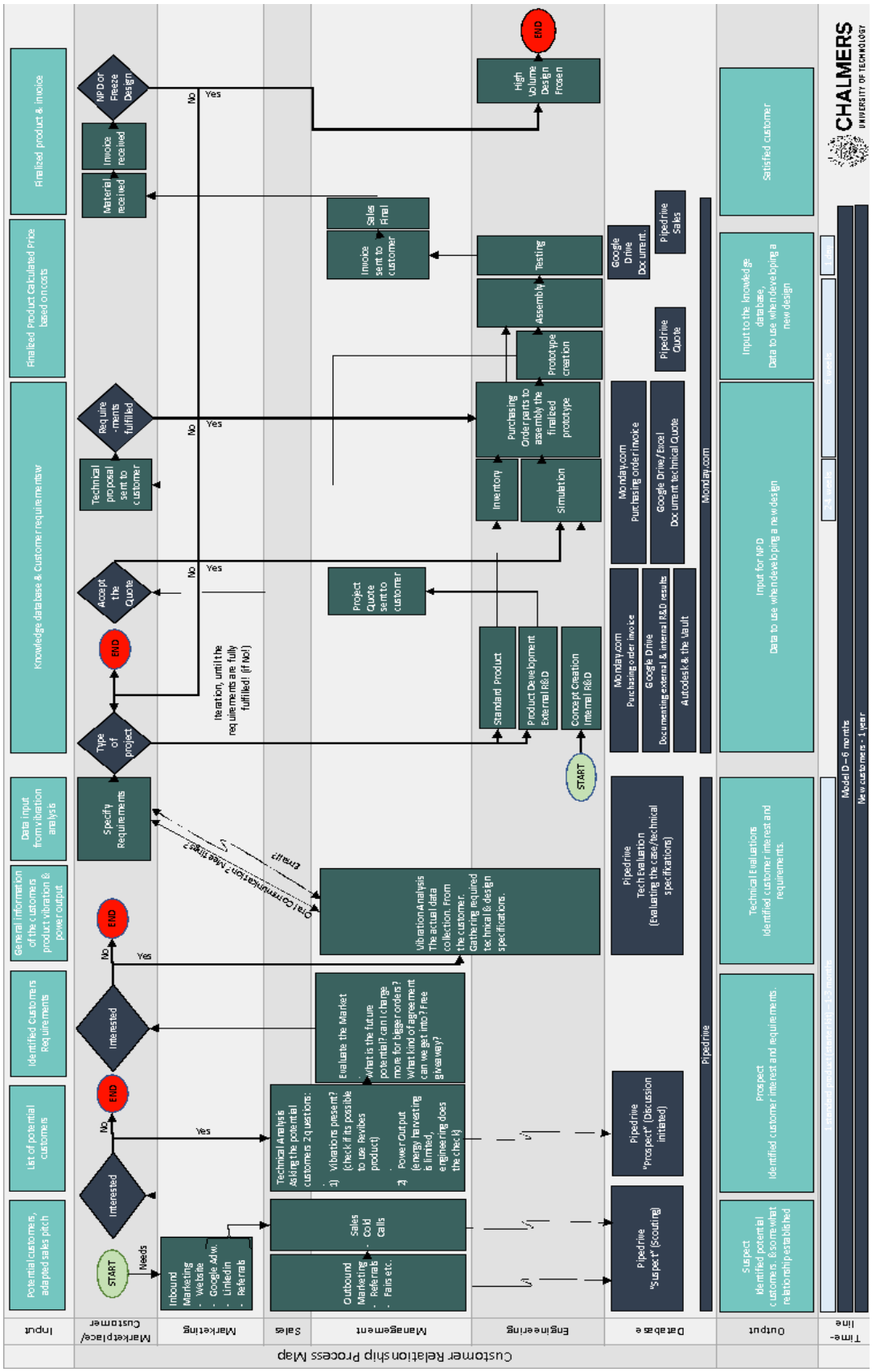
Appendix I5: ReVibe Energy: Versions 5 of Swimlane process map



Appendix I6: ReVibe Energy: Versions 6 of Swimlane process map



Appendix I7: ReVibe Energy: Versions 7 of Swimlane process map



Appendix J: Balanced Scorecard

Strategy What are the drivers of your success?	Measures	Target	Action Plan
Financial Perspectiv	**F1.** Revenue	**F1.** 25 million in 2020	
F1. Increase revenue from Sales			
Customer Perspective	**C1.** Number of customer complaint **C2.** Number of repeat orders **C3.** Profit margin **C4.** Number of new (paying) customers	**C1.** Constantly reduce with respect to previous period & in relation to number of products sold. **C2.** Minimum 50% of the customers should come back within 1 year. **C3.** 10% including administration & overhead. **C4.** 4 new (paying) customers/month a. *"Call" 100 customers/month (first contact) (inbound-outbound)*	**C1.** "Frequently made mistakes" -list to avoid it. **C2.** Ask right questions to the customers. a. *Understand their level of interest.* b. *Clarify their intention.* **C3.** Streamline process(repeatedly) – pilot project development. **C4.** CRM methodology for conversion rate
C1. Increase customer satisfaction **C2.** Increase customer retention **C3.** Increase customer profitability **C4.** Increase customer acquisition			
Internal Perspective	**I1.** Establish high volume production: a. *Suppliers* b. *Contract Manufacturers* **I2.** Conversion time a. *Suspect – close deal* b. *Suspect – Response* **I3.** Customer rate, suspect to sale	**I1.** Operational Targets: a. *2 Suppliers/Bottleneck* b. *Evaluate Contract-manufacturers capacity (x) :* - *x < 10.000 units* - *10.000 < x < 50.000 units* - *x < ∞* **I2.** Conversion time: a. *Sales – first contact to decision on pilot project – 3 months* **I3.** Conversion rate 1,2 to 2,5	**I1.** Prepare the bottleneck list: a. *Monitor* b. *Audit* **I2.** Develop a clear & concise pilot package **I3.** Divide data on CRM properly (input), Develop a methodology that provides valuable data
I1. Operational Excellence **I2.** Improve customer lead time (development time) **I3.** Improve customer conversion rate			
Learning Perspective	**L1.** QMS – details on how to handle these. Business- & product-certifications. **L2.** Number of components to customize (in relation to…), i.e have design base that is cylindrical or quadratic? (ex. Model D for everything).	**L1.** Get a ISO9001:2015. Implement and apply for audition at: __date?__ **L2.** Try to have 2-3 products of platform to modularize	**L2.** When we customize, we do it modularized. a. *How many products can we get out of it?* **L3.** Organisational knowledge a. *QMS implementation* b. *Extend PLM to include quality deviations*
L1. (L3) Develop strategic relationship with suppliers **L2.** (L4) Establish product portfolio **L3.** (L2) Improve Organisational knowledge			

References

Aycan, D. (2012). Don’t Let the Minimum Win Over the Viable. [online] Harvard Business Review. Available at: https://hbr.org/2012/05/dont-let-the-minimum-win-over [Accessed 8 Jun. 2018].

Basics: Documenting a Real QMS. (2014). [Blog] Mastercontrol. Available at: https://www.mastercontrol.com/gxp-lifeline/basics-documenting-a-real-qms [Accessed 3 Jun. 2018].

Bayraktar, E., Jothishankar, M., Tatoglu, E. and Wu, T. (2007). Evolution of operations management: past, present and future. *Management Research News*, 30(11), pp.843-871.

Bergman, B. and Klefsjö, B. (2010). *Quality: from customer needs to customer satisfaction*. 3., [rev.] ed. Lund: Studentlitteratur

Birkinshaw, J., Zimmermann, A. and Raisch, S. (2016). How Do Firms Adapt to Discontinuous Change? Bridging the Dynamic Capabilities and Ambidexterity Perspectives. *California Management Review*, 58(4), pp.36-58.

Boon Wan, T., Chow- Chua, C., Goh, M. (2003) "Does ISO 9000 certification improve business performance?", *International Journal of Quality & Reliability Management*, Vol. 20 Issue: 8, pp.936-953, https://doi.org/10.1108/02656710310493643

Boone, M and Snowden, D. (2007). *A Leader’s Framework for Decision Making*. [online] Harvard Business Review. Available at: https://hbr.org/2007/11/a-leaders-framework-for-decision-making [Accessed 31 May 2018].

Bowen, D. & Dean, J. (1994). Management Theory and Total Quality: Improving Research and Practice through Theory Development. *The Academy of Management Review*, 19(3), p.392.

Börjesson, V. (2018). Catch up on the latest buzz around ReVibe Energy. [online] ReVibe Energy. Available at: https://ReVibeenergy.com/press/ [Accessed 9 Jun. 2018].

Bryman, A. and Bell, E. (2011). *Business research methods*. 3. ed. Oxford: Oxford University Press

Castka, P., Prajogo, D., Sohal, A. and Yeung, A. (2015). Understanding firms′ selection of their ISO 9000 third-party certifiers. *International Journal of Production Economics*, 162, pp.125-133.

Chen, C., Anchecta, K., Lee, Y. and Dahlgaard, J. (2016). A Stepwise ISO-Based TQM Implementation Approach Using ISO 9001:2015. *Management and Production Engineering Review*, 7(4).

Child, J. (1972), Organization structure and strategies of control: A replication of the Aston study. *Administrative Science Quarterly* 17 (2): 163-177.

Child, J. (1972), Organisational Structure, Environmental and Performance: The Role of Strategic Choice. *Sociology*, 6(1), pp.1-22

Christensen, C. (1997), *The Innovator's Dilemma*, Boston: Harvard Business School Press.

Clark, R. (2018). 4 Types of B2B Customers and How to Approach Them - TKO Marketing Solutions. [online] TKO Marketing Solutions. Available at: https://tkomarketingsolutions.com/4-types-b2b-customers-approach/ [Accessed 11 Jun. 2018].

Cole, R.E. (2002), "From continuous improvement to continuous innovation", *Total Quality Management*, Vol. 13 No. 8, pp. 1051-1056.

Cox, K. (2016). Achieving Quality In The Startup Environment. [online] Quality Magazine. Available at: https://www.qualitymag.com/articles/93379-achieving-quality-in-the-startup-environment [Accessed 3 Jun. 2018].

Cummings, D. (2018). Hockey Stick Growth for Startups. [online] Available at: https://davidcummings.org/2010/12/19/hockey-stick-growth-for-startups/ [Accessed 31 May 2018].

Deming, W.E (1986). *Out of the crisis*. Cambridge University Press, Cambridge, Massachussets.

Digital-astronauts.com. (2018). Hockey Stick Growth for Startups. [online] Available at: http://www.digital-astronauts.com/hockey-stick-growth-startups/ [Accessed 31 May 2018].

Donaldson, L., (2001). *The Contingency Theory of Organizations*. Sage Publications.

Dubois, A. and Gadde, L. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research*,55(7), pp.553-560.

Everett, J. and Watson, J., (1998). Small Business Failure and External Risk Factors. *Small Business Economics,* Volume 11, pp. 371-390.

Feinleib, D. (2012). *Why Startups Fail: And How Yours Can Succeed*. New York: Paul Manning

Garvin, D. A., (1984), What Does "Product Quality" Really Mean?, *Sloan Management Review (pre-1986);* Fall 1984; 26, 1; ProQuest Central pg. 25

Greiner, L E. (1998), Evolution and revolution as organisations grow. Reprint of a 1972 article. *Harvard Business Review*, 76 (3): 55-67

Gunasekaran, A. and Ngai, E. (2011). The future of operations management: An outlook and analysis. *International Journal of Production Economics*. 135 (2012): 687–701.

Hull, J. (2016). How Your Leadership Has to Change as Your Startup Scales. [online] Harvard Business Review. Available at: https://hbr.org/2016/05/how-your-leadership-has-to-change-as-your-startup-scales [Accessed 9 Jun. 2018].

Iso.org. (2016). ISO 9001:2015 for Small Enterprises What to do? Advice from ISO/TC 176. [online] Available at: https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/iso_9001_2015_for_small_enterprises-preview.pdf [Accessed 2 Jun. 2018].

Iso.org. (2018). Guidance on the requirements for Documented Information of ISO 9001:2015. [online] Available at: https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/documented_information.pdf [Accessed 2 Jun. 2018].

J. Hodges, N. and Link, A. N. (2018). *Knowledge-Intensive Entrepreneurship An Analysis of the European Textile and Apparel Industries.* Cham: Springer International Publishing

Jabnoun, N., Khalifah, A. and Yusuf, A. (2003). Environmental Uncertainty, Strategic Orientation, and Quality Management: A Contingency Model. *Quality Management Journal*, 10(4), pp.17-31.

Juran, J.M. (1989). *Juran on leadership for quality.* McGraw-Hill, New York

Kataria, M. (2017). MVP Paradox And Here's How To Fix Your MVP Before Its Too Late!. [online] Hacker Noon. Available at: https://hackernoon.com/mvp-paradox-and-what-most-founders-need-to-be-aware-of-3a5f8c3acb76 [Accessed 8 Jun. 2018].

LAI, K. (2017). Implementing the Quality Startup Management System model in Hong Kong: a case study. *International Journal of Quality Innovation*, 3(1).

Larkin, M.; O'Halloran, D., (2018). Collaboration between Start-ups and Corporations. A Practical Guide for Mutual Understanding. *World Economic Forum*, ref.170118 – case 00038358

Lenander, B. and Westman, B. (2018). LumenRadio. [online] LumenRadio. Available at: https://lumenradio.com/company/ [Accessed 9 Jun. 2018].

Linderman, K.; Schroeder, R. G; Zhang, D. (2012),
The moderating role of contextual factors on quality management practices. *Journal of Operations Managemen*t, 01/2012, Volume 30, Issue 1-2

Luthans, F. and Stewart, T. (1977). A General Contingency Theory of Management. *The Academy of Management Review*, 2(2), p.181.

Maechler, N., Sahni, S. and van Oostrum, M. (2016). Improving the business-to-business customer experience. [online] McKinsey & Company. Available at: https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/improving-the-business-to-business-customer-experience [Accessed 11 Jun. 2018].

Marmgren, M., Alänge, S. and Book, S. (2016). Interactions between Ideas and Behaviour in Organizations. *Quality Innovation Prosperity*, 20(2), p.185.

McAdam, R., Miller, K. and McSorley, C. (2016). Towards a contingency theory perspective of quality management in enabling strategic alignment. *International Journal of Production Economics*.

Miller, D., and Friesen, P. H. (1982). Innovation in conservative and entrepreneurial firms: Two model of strategic momentum. *Strategic Management Journal* 3 (1): 1-25

Milliken, F. (1987). Three Types of Perceived Uncertainty about the Environment: State, Effect, and Response Uncertainty. *The Academy of Management Review*, 12(1), p.133.

Miles, R., Snow, C., Meyer, A. and Coleman, H. (1978). Organizational Strategy, Structure, and Process. *The Academy of Management Review*, 3(3), p.546.

Morton, N. and Hu, Q. (2008). Implications of the fit between organizational structure and ERP: A structural contingency theory perspective. *International Journal of Information Management*, 28(5), pp.391-402.

Newiso9001.files.wordpress.com. (2016). Clause-by-clause explanation of ISO 9001:2015. [online] Available at: https://newiso9001.files.wordpress.com/2016/12/clause_by_clause_explanation_of_iso_9001_2015_en.pdf [Accessed 3 Jun. 2018].

Ng, S.C.H., Rungtusanatham, J.M., Zhao, X., Ivanova, A., (2015). TQM and environmental uncertainty levels: profiles, fit, and firm performance. *Int. J. Prod. Res*. 53, 4266–4286.

O'Reilly, C. and Tushman, M. (2013). Organizational Ambidexterity: Past, Present and Future. *SSRN Electronic Journal*.

Piercy, N. (2012). The Role of History in Operations Management. *Business History*. 54, 2, 154-178

Powercell.se. (2018). PowerCell - Press releases. [online] Available at: https://www.powercell.se/en/newsroom/press-releases/ [Accessed 9 Jun. 2018].

Ries, E. (2011). *The lean startup*. London: Portfolio Penguin.

Sitkin, S., Sutcliffe, K. and Schroeder, R. (1994). Distinguishing Control from Learning in Total Quality Management: A Contingency Perspective. *The Academy of Management Review*, 19(3), p.537.

Sandino, T. (2007). Introducing the First Management Control Systems: Evidence from the Retail Sector. *The Accounting Review*, 82(1), pp.265-293.

Sousa, R. and Voss, C. (2008). Contingency research in operations management practices. *Journal of Operations Management*, 26(6), pp.697-713.

Semuels, A. (2018). Why Does Sweden Have So Many Start-Ups?. [online] The Atlantic. Available at: https://www.theatlantic.com/business/archive/2017/09/sweden-startups/541413/ [Accessed 31 May 2018].

Simplexmotion.com. (2018). About us | SimplexMotion. [online] Available at: http://simplexmotion.com/about/ [Accessed 9 Jun. 2018].

Shacklett, M. (2018). Five risks of using a startup as your vendor | ZDNet. [online] ZDNet. Available at: https://www.zdnet.com/article/five-risks-of-using-a-startup-as-your-vendor/ [Accessed 2 Jun. 2018].

Steiber, A. and Alänge, S. (2013) "A corporate system for continuous innovation: the case of Google Inc.", *European Journal of Innovation Management*, Vol. 16 Issue: 2, pp.243-264, https:// doi.org/10.1108/14601061311324566

Steiber, A. and Alänge, S. (2013a). Do TQM principles need to change? Learning from a comparison to Google Inc. *Total Quality Management & Business Excellence*, 24(1-2), pp.48-61.

sweden.se. (2018). Innovation in Sweden. [online] Available at: https://sweden.se/business/innovation-in-sweden/ [Accessed 20 May 2018].

Veeva.com. (2018). Unifying Quality Management with Modern Solutions: Key requirements for Managing Quality in a Complex Value Chain. [online] Available at: (Newiso9001.files.wordpress.com, 2016) [Accessed 2 Jun. 2018].

Zhang, D., Linderman, K. and Schroeder, R. (2012). The moderating role of contextual factors on quality management practices. *Journal of Operations Management*, 30(1-2), pp.12-23.