

UNIVERSITY OF LJUBLJANA  
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

**THE ROLE OF SUPPLIER RELATIONSHIP PLATFORMS IN SUPPLY CHAIN  
MANAGEMENT- THE CASE OF ECRATUM**

Ljubljana, June 2020

MARTA CAMI

## AUTHORSHIP STATEMENT

The undersigned Marta Cami, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title The role of supplier relationship platforms in supply chain management- the case of ecratum, prepared under supervision of prof. dr. Peter Trkman.

### DECLARE

1. this written final work of studies to be based on the results of my own research;
2. the printed form of this written final work of studies to be identical to its electronic form;
3. the text of this written final work of studies to be language-edited and technically in adherence with the SEB LU's Technical Guidelines for Written Works, which means that I cited and / or quoted works and opinions of other authors in this written final work of studies in accordance with the SEB LU's Technical Guidelines for Written Works;
4. to be aware of the fact that plagiarism (in written or graphical form) is a criminal offence and can be prosecuted in accordance with the Criminal Code of the Republic of Slovenia;
5. to be aware of the consequences a proven plagiarism charge based on the this written final work could have for my status at the SEB LU in accordance with the relevant SEB LU Rules;
6. to have obtained all the necessary permits to use the data and works of other authors which are (in written or graphical form) referred to in this written final work of studies and to have clearly marked them;
7. to have acted in accordance with ethical principles during the preparation of this written final work of studies and to have, where necessary, obtained permission of the Ethics Committee;
8. my consent to use the electronic form of this written final work of studies for the detection of content similarity with other written works, using similarity detection software that is connected with the SEB LU Study Information System;
9. to transfer to the University of Ljubljana free of charge, non-exclusively, geographically and time-wise unlimited the right of saving this written final work of studies in the electronic form, the right of its reproduction, as well as the right of making this written final work of studies

available to the public on the World Wide Web via the Repository of the University of Ljubljana;

10. my consent to publication of my personal data that are included in this written final work of studies and in this declaration, when this written final work of studies is published.

Ljubljana, \_\_\_\_\_ Author's signature: \_\_\_\_\_

## TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	<b>1</b>
<b>Study background</b> .....	<b>1</b>
<b>Research question and study objectives</b> .....	<b>2</b>
<b>Structure and Research methodology of the thesis</b> .....	<b>3</b>
<b>1 SUPPLY CHAIN MANAGEMENT</b> .....	<b>4</b>
<b>2 SUPPLIER RELATIONSHIP MANAGEMENT</b> .....	<b>7</b>
<b>3 TECHNOLOGICAL TRANDS IN SRM</b> .....	<b>13</b>
<b>3.1 Digitalisation of SCM and SRM in the global market</b> .....	<b>13</b>
<b>3.2 Cloud computing in supply chain</b> .....	<b>17</b>
<b>3.3 Information sharing in supply chain</b> .....	<b>22</b>
<b>4 SOFTWARE DEVELOPMENT METHODOLOGIES AND THEIR IMPACT ON DELIVERING A VALUABLE END PRODUCT</b> .....	<b>23</b>
<b>5 CASE STUDY – ECRATUM SRM PLATFORM</b> .....	<b>28</b>
<b>5.1 Methodology</b> .....	<b>28</b>
<b>5.2 Presentation of the company</b> .....	<b>29</b>
5.2.1 Ecratum products and the target audience .....	29
5.2.2 Current limitations/drawback that ecratum is facing .....	32
<b>5.3 Focal products in this research: PDoc Share and PDoc Collect</b> .....	<b>32</b>
5.3.1 Introduction to PDoc Share .....	33
5.3.2 Introduction to PDoc Collect .....	33
<b>5.4 Development of platform</b> .....	<b>35</b>
5.4.1 Analysis of the current situation .....	36
5.4.2 Survey and interview findings .....	40
5.4.3 Future improvements based on gathered user information .....	44
<b>DISCUSSION</b> .....	<b>49</b>
<b>CONCLUSION</b> .....	<b>51</b>
<b>REFERENCE LIST</b> .....	<b>52</b>
<b>APPENDIX</b> .....	<b>61</b>

## LIST OF FIGURES

Figure 1: Siemens' SCM Strategy .....	7
Figure 2: Supplier partnering hierarchy .....	9
Figure 3: Continuous cycle of Supplier Relationship Management activities .....	10
Figure 4: Critical success factors for SRM.....	11
Figure 5: Key value drivers for SRM.....	12
Figure 6: Challenges & issues when implementing SRM.....	13
Figure 7: Technological investments for a digital SC .....	14
Figure 8: Reshaping the definition, organization and operation of Supply Chain .....	16
Figure 9: Components of smart manufacturing.....	17
Figure 10: Supply chain breach.....	21
Figure 11: Waterfall model of the software development.....	24
Figure 12: Agile methodology in software development .....	25
Figure 13: Scrum agile methodology .....	27
Figure 14: PDoc Share interface in ecratum platform.....	33
Figure 15: PDoc Collect interface in ecratum platform .....	34
Figure 16: User adoption of PDoc Collect after release.....	42
Figure 17: User adoption of PDoc Share after release .....	42
Figure 18: Weekly user subscription.....	44

## LIST OF APPENDICES

Appendix A: Summary of the Thesis in Slovenian Language .....	1
---	---

## LIST OF ABBREVIATIONS

**CEO**– Chief Executive Officer: the most executive position in charge of managing an organization

**CPFR**– Collaborative planning, forecasting, and replenishment: concept of conducting joint practices to boost supply chain integration

**CTO** – Chief Technology Officer: executive position focused on the technological needs and management within an organization

**CS**– Customer Support: a team within an organisation that is responsible for offering a range of customer services to assist customers in performing the right usage of the product or service.

**CSM**– Customer Service Management: an approach towards managing a company's interaction with their customers.

**EDI** – Electronic Data Interchange: structured way of sharing information electronically

**ERP**– Enterprise Resource Planning: software integrating finance, logistics, human resources, project management, manufacturing, work-flow, high-level development environment and other industry-related applications into a single source (McQueen & Teh, 2000).

**IoT**–Internet of Things is the concept of a giant network where devices are connected via Internet to collect, share and transfer data over a network without requiring human-to-human or human-to-computer interaction.

**IT** – Information Technology: use of computer used to store, manipulate and process data

**KPIs** – Key Performance Indicators: set performance measurement values

**MVP** – Minimum Viable Product: minimum value of a product to be delivered to the customers

**SCM** – Supply Chain Management: the management of the flow of goods and services within a supply chain

**SCRM**– Supply chain risk management: management of risks along the supply chain

**SRM** – Supplier Relationship Management: the discipline that manages interactions with key organisations that supply goods and services to the organization

**ROI**– Return on Investment: ratio between profit and costs of investment

**R&D** – Research & Development: set of activities and resources used to create new ideas or improve existing ones

**SaaS** – Software as a Service: subscription models for software



# INTRODUCTION

## Study background

The term supply chain can be defined as a process in which suppliers, manufacturers, distributors, and retailers are working together during the whole process of manufacturing the product and delivering it to the end-user. More specifically, all parties are involved in various phases from getting the raw material, transforming this material into a product that will satisfy users' needs and make sure this product reaches the end customer (La Londe & Masters, 1994). However, even though supply chains are created with the main aim to reduce costs, find the right partners to deliver the products and stay competitive on the market, proper management is crucial for the successful operation. Supply chain management (hereinafter: SCM), is all about the right optimization and strategic planning to identify, acquire, gain, allocate and manage all the needed resources that are involved in the workflow of achieving strategic objectives (Flynn, Harding, Lallatin, Pohlig & Sturzl, 2006).

The available literature and the scientific studies that are done in the field of SCM do highlight the importance of supplier relationship management (hereinafter: SRM) as the key to successful operation on a company's supply chain. However, as mentioned by Carter (2010), for companies to achieve the desired supplier management, it is crucial to building healthy relationships that will help to streamline and excel processes among business partners. This way, companies will manage to work better with their key critical and strategic partners to catch the opportunities immediately, improve the service level, reduce the costs, and be the innovative leaders in the market. Similarly, in the article published by Webb (2017), SRM is defined as the process that is enabling companies to identify the supplier categories and build strategies that will help them to support and maintain healthy relationships among them. Three essential steps that they have mentioned during this process are:

- Supplier segmentation that will help to group suppliers in terms of their importance towards the company and measure them against profitability and risk vulnerability
- Supplier strategy development, on the other hand, indicates the activity of aligning the business processes in the way that internal resources and stakeholders are distributed and aligned accordingly.
- Supplier strategy execution aims for involving suppliers into critical strategic decisions and sharing vital information to work and deliver better solutions.

The practice of effective SRM is crucial for companies to sustain competitiveness in the market by delivering innovative products and services. Effective SRM requires focusing on the implementation of different organizational processes and activities to rearrange the supplier base (Forkmann, Henneberg, Naude & Mitreg, 2016).



Furthermore, nowadays attention should be given to the adoption of information technology (hereinafter: IT) if companies would like to achieve process efficiency improvements, real-time decision making, and sharing relevant information in real-time with their business partners. This way, the organizations that are integrating IT solutions inside their supply chain will benefit by having an optimized network of the supply chain that will enable companies to outperform competitors in the current global market, reduce the levels of inventory and supply chain costs and provide an increased service level for customers (Varma & Khan, 2017). Companies are focusing on adopting the latest technological trends, and sometimes this means that they have to adjust their business model (Trkman, Budler & Groznik, 2015) or revise their strategic plans. One of these trends due to disruptive technologies is cloud computing, representing Internet-based computing that offers a solution for shared and automated processes, resources, and information (DaSilva, Trkman, Desouza & Lindič, 2013). When this concept is being used correctly, it can bring significant benefits to the whole supply chain process and the relationships among all actors (Hassan, 2011). One of the definitions explains the cloud supply chain as the phenomena where two or more actors are associated together through cloud services offered, related information on the supply chain, and assets (Lindner et al., 2010).

### **Research question and study objectives**

The main objective of the thesis is to analyse how relationships among manufacturers and suppliers are affected due to the development of supplier relationship platforms (SRM). Thus, the main research question for this thesis is: how the right use of IT, more specifically, in what extent the proper adoption of Cloud Computing enabled SRM is affecting how the supply chain operates in a globalised market.

During this thesis, I have focused on analysing SCM, its importance and benefits that it brings to an organisation. Furthermore, a broader study of SRM is presented. I have presented a detailed view of SRM by explaining what this discipline implies, the impact that this concept brings into maintaining healthy business relations among business partners and how it is evolving with the development of IT. Attention is given on how IT, more specifically how cloud computing, is affecting the supplier relationship.

The practical part of the thesis is composed of a case study where I have analysed in detail the evolution of cloud computing enabled SRM products. These two products are providing an easy way of requesting and distributing product-related documentation and enable users to manage better and maintain a business relationship with their clients. Through this case study, I examine my research objective by demonstrating how these products have changed the way that companies exchange information within the supply chain and how business processes are automated due to the shift to optimise SRM via cloud computing.

During my thesis, I have:

- Examined existing literature to identify the impact that adoption of an SRM platform has on the overall SCM performance
- Examine the importance of SRM platforms in providing more efficient methods for users to manage their interactions with customers and suppliers quickly and efficiently.
- Examine how IT is impacting the way how business partners exchange information within the supply chain
- Analyse the current situation of the users that have already adopted an SRM platform called ecratum and compare performance before and after recent product launch
- Analyse future improvements of the SRM products provided by the company ecratum based on user feedback and technological trends

### **Structure and Research methodology of the thesis**

This thesis is structured into two parts: theoretical and practical-case study. The theoretical part of the thesis consists of a descriptive approach where I have included relevant literature to support my research.

This section starts with an introduction to SCM. In more details, I have analysed the importance that SCM has on the organisation using up to date literature such as scholarly papers, books and case studies. Next, I have been focusing on SRM discipline and along with this section, I have presented an introduction regarding SRM, the impact that SRM has on the efficient SCM, the benefits that companies gain from having well established and well-managed SRM and the impact that IT has on SRM today. Moreover, attention is given to the topic of digital transformation within SCM. I have reviewed the available literature on how the right adoption of IT can positively impact the relationship among business partners within SCM by demonstrating case studies with examples from well-known companies operating on the globalised market. More specifically, I have dived into how cloud computing is used in SCM to facilitate process automation.

The practical part of the thesis consists of a case study where I use available data from a German company that is providing Software as a Service (hereinafter: SaaS) SRM platform, called ecratum. Even though ecratum provides a set of tools in the field of SRM and Customer Service Management (hereinafter: CSM), I have been mostly focused only on two products: PDoc Share and PDoc Collect. I have explained these two products in detail, giving more information regarding the research phase of the product, the development, implementation and feedback loop.

To study the interest that users have toward these tools, I have conducted a survey. This survey consists of several multiple-choice questions about how companies are dealing with file/information sharing and the new products offered through SRM as a facilitator for their daily business tasks. This survey targets a sample of the quality and purchasing representative personas from companies that are using ecratum.

As the next step, I conducted unstructured interviews with Chief Executive Officer (hereinafter: CEO), Chief Technology Officer (hereinafter: CTO) and representative from Customer Success (hereinafter: CS) team to get more insight behind the general vision and idea of the products, problems or challenges faced during the development, implementation, user onboarding and product adoption.

Furthermore, I have analysed to see how these two products have changed the way companies exchange business-related information with their suppliers. I analysed the current situation, gathered feedback from users, compare performance before and after product launch and elaborated how information sharing in the cloud has impacted their daily work.

## **1 SUPPLY CHAIN MANAGEMENT**

A supply chain is a powerful network between companies and their suppliers that includes all the steps and processes done among them to create and deliver a final product to satisfy the end user's needs. Along this vital process, many critical factors contribute to achieving the company mission. These crucial factors are sharing of information, different activities, cross-functional teams, vendors, distributors and other touchpoints that are the facilitators of turning raw material into a final valuable product that is delivered to the customer (Galaskiewicz, 2011). An adequate supply chain is crucial for the efficient operation of manufacturing companies in today's competitive and globalized market. While facing this market, customers are continually seeking for more excellent value and have higher demand towards satisfying their needs. Due to this, it is not sufficient if companies focus only on optimizing operations within the organization, but more focus should be given to the whole supply chain in order to stay competitive (Huhns, Stephens & Ivezic, 2002).

As the supply chain is represented by a flow of products, money and information, SCM is focused on efficient integration of all activities involved during this process and managing complex relationships in order to achieve a sustainable competitive advantage (Stadtler, 2008). Similarly, authors Monczka, Handfield, Giunipero, and Patterson (2015), in their book about purchasing and supply chain management mention that SCM requires proactive management that goes equally on both flows to coordinate involved goods, services, knowledge, information and financial capital from the state of raw material through the end product. They define supply management as the strategic approach that companies take through:

- Strategic responsibilities to make sure that the decision taken to pursue different activities will have a crucial impact on the overall organizational performance and along with the long-term goals and objectives of the company
- Managing the supply base is another important point that highlights the importance of the capability to manage a more extensive network of global suppliers directly to achieve the set objectives

- A process approach to secure the goods and services that are needed to deliver the results from the most efficient supply chain. This approach follows the path that identifies, evaluates, selects, manages and then develops the suppliers.
- Cross-functional environment composed of purchasing representatives, engineers, quality assurance profiles, suppliers and other participants depending on the business background that works together for the same target

SCM undergoes intensive operations because a process perspective is a crucial element in strategic decision-making. With strategic decision-making, immediate results are reflected in operational processes (Cegielski, Allison Jones-Farmer, Wu & Hazen, 2012). Strategic development of an efficient decision-making system might be affected by a misalignment of operational constraints. Most functional areas of a business are affected if supply chain risk management (hereinafter: SCRM) is not provided at the right time (Percy, Parker & Giunipero, 2008). The SCM approach attracts much attention from companies in various industries, and its proper implementation is crucial to managing the complexity that comes with the supply chain. Furthermore, successful SCM provides better visibility and information transparency across the network to give a better understanding of processes, improve inventory management, advance on-time delivery, and optimise overall performance (Fawcett, Magnan & McCarter, 2008).

Customers are extremely important, especially in today's competitive market where, due to global supply chains, markets are open, and customers can easily procure and change products in order to meet their needs. Therefore, with globalisation, companies must keep up with growing international demand in order to succeed in a highly competitive market. At this point, global sourcing plays an important role, as it allows companies to get closer to international markets and quickly source all kinds of goods and services that they need to excel without facing any geographical barrier (Trent & Monczka, 2005). As emphasised in a study conducted by Kotabe and Murray (2004), global sourcing requires companies to cope with quickly evolving technology and, at the same time, reduce their expenses, increase quality and improve customer service, alongside close coordination across domestic borders between R&D, production and marketing operations.

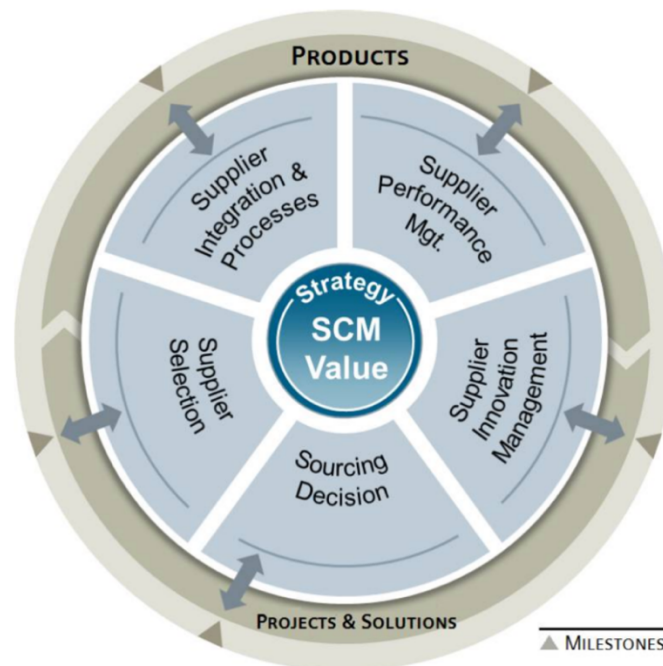
An important activity when discussing supply chain is the supplier qualification process. This part of the supply chain represents the fundamentals of performing a successful procurement activity by focusing on contracting the right suppliers that will help the company to operate and achieve the desired results successfully. In a nutshell, supplier procurement helps organisations to ensure that the right suppliers who have the needed qualification to fulfil a set of contracted tasks are acquired. Acquiring qualified suppliers is done by defining the criteria that suppliers must meet in order to win, and also reasonable prices are being negotiated along this process. This way, unqualified suppliers are being rejected, and this step can help companies to reduce the costs that can come by performing business with unqualified suppliers. Supplier screening is an important activity that is

undertaken during the supplier qualification process. It is practised to ensure that the right suppliers who do meet the criteria are procured. Supplier screening requires a set of steps such as checking supplier references, financial checks, surge capacity and on-site visit to supplier's production facilities (Wan & Beil, 2009). Once this stage has been completed, next would be to request the supplier's information related to their goods and services. Such information request can depend and differ based on the situations, and it can be in the form of a request for information (RFI), request for proposal (RFP) and request for quote (RFQ) (Beil, 2010).

As described above, supplier qualification is a multistage process in need of a defined set of steps and requirements until the right business partners are contracted. A typical example is the multinational German industrial manufacturer Siemens, which follows a multistage process when it comes to supplier qualification. The process starts with a supplier's access to Siemens's standardised application, SCM STAR, where detailed information is initially provided, and a commitment made to compliance to defined standards in respect of sustainability in the supply chain. The next step can differ based on the supplier's portfolio, but usually, the process follows the path of a manual supplier check in terms of their background and compliance with different standards concerning the environment, health and safety. If this process is successfully completed, then Siemens accords the selected suppliers the status 'ready-for-business'. These qualified suppliers, based on the qualification results, are then segmented by Siemens into preferred suppliers and strategic partners. For both segments, Siemens focuses on developing healthy long-term relationships, building development plans, and collaborating on new solutions. Furthermore, Siemens (2018) has described the most important factors that help the organisation build the foundation of the SCM strategy and deliver value, one of which is the process of supplier qualification and selection. As seen in the Figure 1, the factors are names as:

- Supplier integration & processes
- Supplier performance management
- Supplier innovation management
- Sourcing decision
- Supplier selection

Figure 1: Siemens' SCM Strategy



Source: Adapted from Siemens (2018).

However, the research paper by Singhal, Agarwal and Mittal (2011) explains how during the years, the growth of supply chain has brought along several issues that have arisen as a consequence of complex network evolution between companies. Furthermore, the authors explain that such issues as supply planning, designing, coordination of materials and information flow are not present only when companies operate across the globe but also within countries. Companies must practice SCRM in order to identify the risk inside the supply chain and develop strategies to assess and mitigate the threats throughout the end-to-end supply chain (Lindroth & Norrman, 2001). Adopting SCRM will not only enable companies to have the right strategies in place to identify, reduce and mitigate supply chain risk but it also presents the key to ensuring further profitability and continuity (Brindley & Ritchie, 2004). Trkman and McCormack (2009), acknowledge the importance of SCRM and so they have presented a conceptual model to manage supply chain network risk. This model is based on contingency theory, and it suggests a framework for supplier risk assessment by focusing on supplier characteristics, the firm strategy and performance.

## 2 SUPPLIER RELATIONSHIP MANAGEMENT

As it is seen from all the scientific studies, supply chain refers to the whole system where material, financial and information flow leads to the customers, retailers, distributors, manufacturers, and suppliers. ("Supplier Relationship Management (SRM)," 2015).

"An SRM system strategically aims for collaboration with suppliers, so that a company can develop a new product competitively and produce goods efficiently" Park, Shin, Chang & Park (2010). Maintaining healthy relationships throughout the supply chain is crucial for having continuous process improvement and achieving business goals. SRM discipline focuses on achieving this by recognising that not every client-supplier relationship should be treated with the same approach but instead manage every relationship individually to achieve closer relationships and better performance (Lambert & Schwieterman, 2012). Teller, Kotzab, Grant and Holweg (2016) demonstrated the potential value of key SRM for organisations that work with supply chains, alongside its viability to integrate better and ease the management of said chains, therefore generating value for both customers and shareholders. Similarly, in another study supplier relationship management is defined as the main prospect of successful SCM where IT has leveraged the ways for businesses in terms of communication, information exchange, relationship development (Wu, Hazen & Hall, 2013).

Even though SCM management demands have led businesses to higher profitability and sustainable competitive advantage, a more cooperative, strategic and proactive approach is needed. This approach can only be achieved by customer-focused strategies, resilience, efficiency and agility (Zsidisin & Ritchie, 2009). Moreover, businesses must strengthen their procurement, outsourcing, processes, information transfer and sharing. SRM is the new philosophy through which supplier capacity and commitment can be rapidly increased (Pearcy, Parker & Giunipero, 2008). Responsiveness, security, reliability and dependability are the core customer expectations that should be given recognition by the organisation or its intermediaries. Trust, formalisation and relationship investments are the three factors affecting SRM (Porter, 2019)

Similarly, Liker and Choi (2004) highlight the importance of establishing close relationships with suppliers, along with open and transparent communication, as a critical factor in supplier responsiveness and success. Their study is based on a 20-year evaluation of famous automobile companies such as Toyota and Honda, from which the authors conclude that in order to create long-lasting, loyal and robust supplier relationships, strategic and operational partnerships are essential. As a result of their research, Liker and Choi (2004) present a framework highlighting the six steps that every company should consider if it aims to build great supplier relationships in its supply chain. As shown in Figure 2, the first step the authors recommend is to observe how suppliers work and learn their processes. The next step is to turn the suppliers' rivalries into opportunities by sharing knowledge and participating into joint activities. The third step is monitoring the suppliers closely and building a feedback loop. As the next step, the authors suggest focusing on having the right environment where they can build the right supplier's technical capabilities. Once technical capabilities are on

place, the focus should be shifted on sharing the relevant information with suppliers. It is crucial to define a standard structure and format of the information and share it via setting up meetings with a clear agenda. The final step in the hierarchy is conducting joint improvement activities to improve processes continuously.

*Figure 2: Supplier partnering hierarchy*



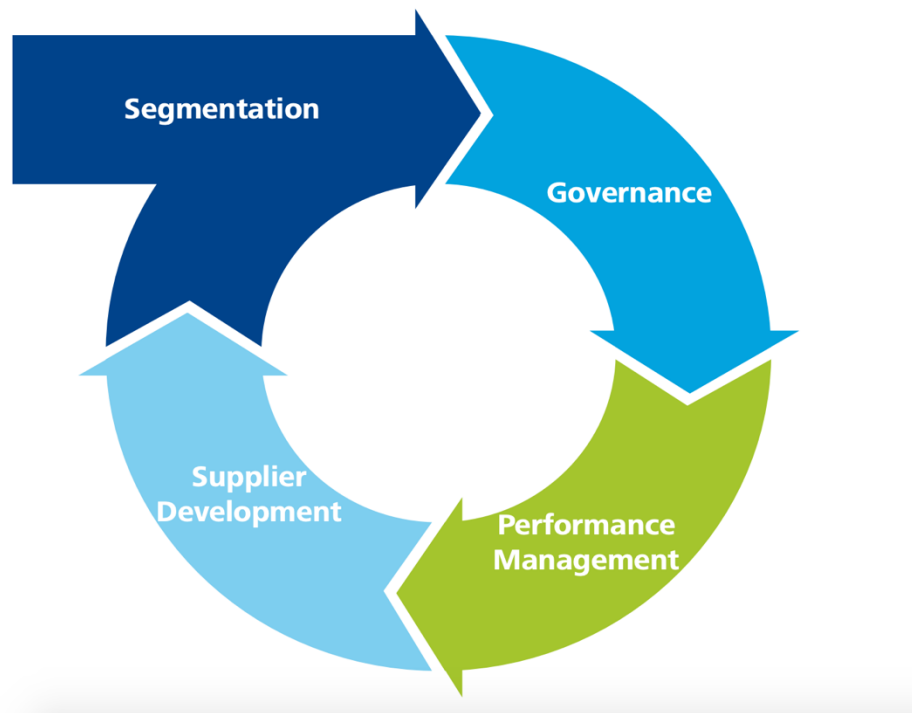
*Source: Adapted from Liker, J. K., & Choi, T. Y. (2004).*

Deloitte (2015) explains four main activities that enable companies to gain the most value from their collaboration with suppliers. These activities follow a cycle that starts with supplier segmentation, supplier governance, performance and management, and supplier development (Figure 3). Not all suppliers have the same impact on the organisation; thus, it is essential to categorise and segment the suppliers based on a defined set of criteria. Through this segmentation, key strategic suppliers can be identified and ranked. After doing supplier segmentation, the next step is the setting of supplier governance and, based on the ranking, suppliers should be included in internal processes, aligned with the organisation, and become part of roadmaps and strategy settings. Subsequent performance management is crucial for setting a successful SRM. This stage requires a continual process of setting key measures for priority suppliers, tracking the performance based on defined metrics, and always



monitoring this process to ensure that best performance is achieved. Once these three activities are successfully established and performed, it is then essential to establish a joint business development with critical suppliers to share future planning, the setting of long-term initiatives, and a schedule of different activities from which both sides can benefit and sustain a healthy SRM.

*Figure 3: Continuous cycle of Supplier Relationship Management activities*



*Source: Adapted from Deloitte (2015).*

Integrating SCM into company processes by applying the benefits of technology has strong potential for sharing data across the organisation and with other teams (Subramani, 2004). O'Marah (2016) emphasises that digitalisation is the most important external factor affecting the supply chain. Focusing on SRM, integrating the core system aspects would leverage new ways for businesses in terms of relationship development and information interchange (Seman, Zakuan, Jusoh, Arif & Saman, 2012).

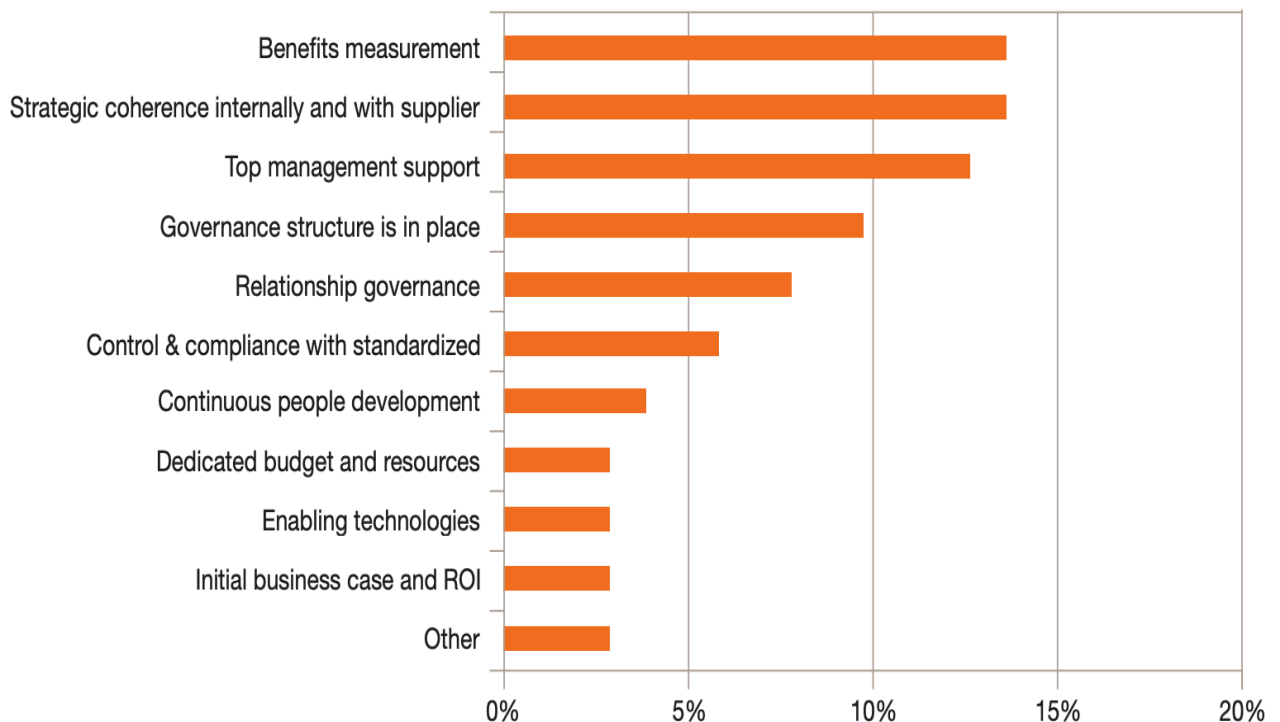
According to a study done by PWC, Hoek (2013), the benefits that companies gain after establishing SRM in their organisation are:

- More efficient processes
- Reduction of inventory
- Improved customer satisfaction
- More sustainable products or processes
- Better access to technological innovations
- Higher responsiveness to customer demand

- Improved on-time delivery by suppliers
- Better quality of the end product
- Better access to new products/market

However, to leverage the benefits of the SRM platform, it is important firstly to define critical success factors. In the same study conducted by PwC (Hoek, 2013), some critical success factors for SRM are defined after analysing responses from users that participated in the study.

*Figure 4: Critical success factors for SRM*



*Source: Adapted from Hoek (2013).*

As shown in Figure 4, when organisations establish an SRM platform, they should also initially define the benefits they want to measure against this new implementation. This process of definition will facilitate the measurement of success. Ensuring strategic coherency between the supplier and the buying partner is another crucial step in determining the success of SRM. The third factor is sponsorship by top management. As mentioned in the same publication from PwC (Hoek, 2013), having this support will help ensure that the right resources support the adoption and implementation of SRM and that the right focus within an organisation is given to the new platform. Once these critical success factors are met, SRM will provide all involved parties with the central values, such as innovation, sustainability, legality and resilience. However, to achieve these key values, elements like trust, open communication, empathy and a win-win orientation should be practised in the interaction among the parties to make the most efficient use of SRM (Figure 5).

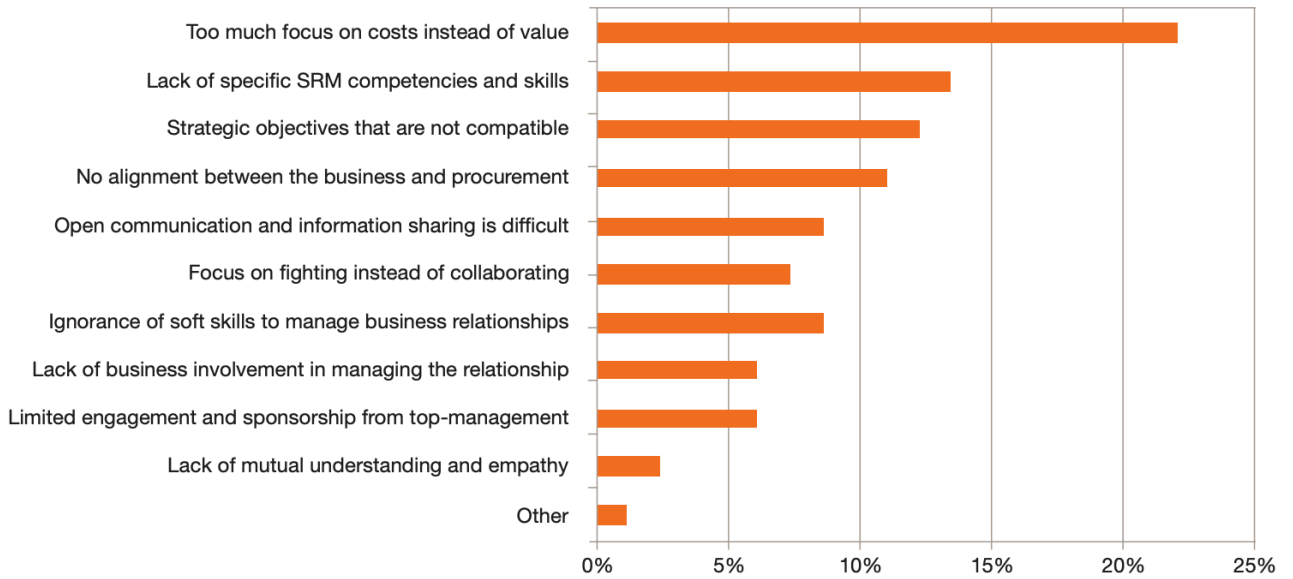
Figure 5: Key value drivers for SRM



Source: Adapted from Hoek (2013).

The same study also represents some challenges that accompany the implementation of SRM. As seen earlier in this section, the benefits of the successful establishment of SRM in companies are valuable and crucial to keep long-lasting relationships and performance of the business; however, some key challenges may be faced in its adoption. Figure 6 summarises the results that were gathered after companies were asked to rank the top three challenges they faced when implementing SRM in their organisation. The main challenge relates to costs because too much focus on reducing costs might have a long-term effect on value creation, as companies might not pay enough attention to aspects such as innovation, sustainability and so forth. The next challenge is lack of SRM competencies and skills. As the adoption of SRM requires a new mindset and new skills, some companies that are lacking the needed skill set might face a challenge during the implementation. Companies placed the topic of strategic objectives third. Strategic objectives become an issue when there is a difference in strategic thinking between the buyer and the supplier. One real scenario, as described in the study, can be the situation when one of the buying business partners aims to build a partnership, but the supplier is focused on making full use of the customer.

Figure 6: Challenges & issues when implementing SRM



Source: Adapted from PwC Hoek (2013).

### 3 TECHNOLOGICAL TRENDS IN SRM

#### 3.1 Digitalisation of SCM and SRM in the global market

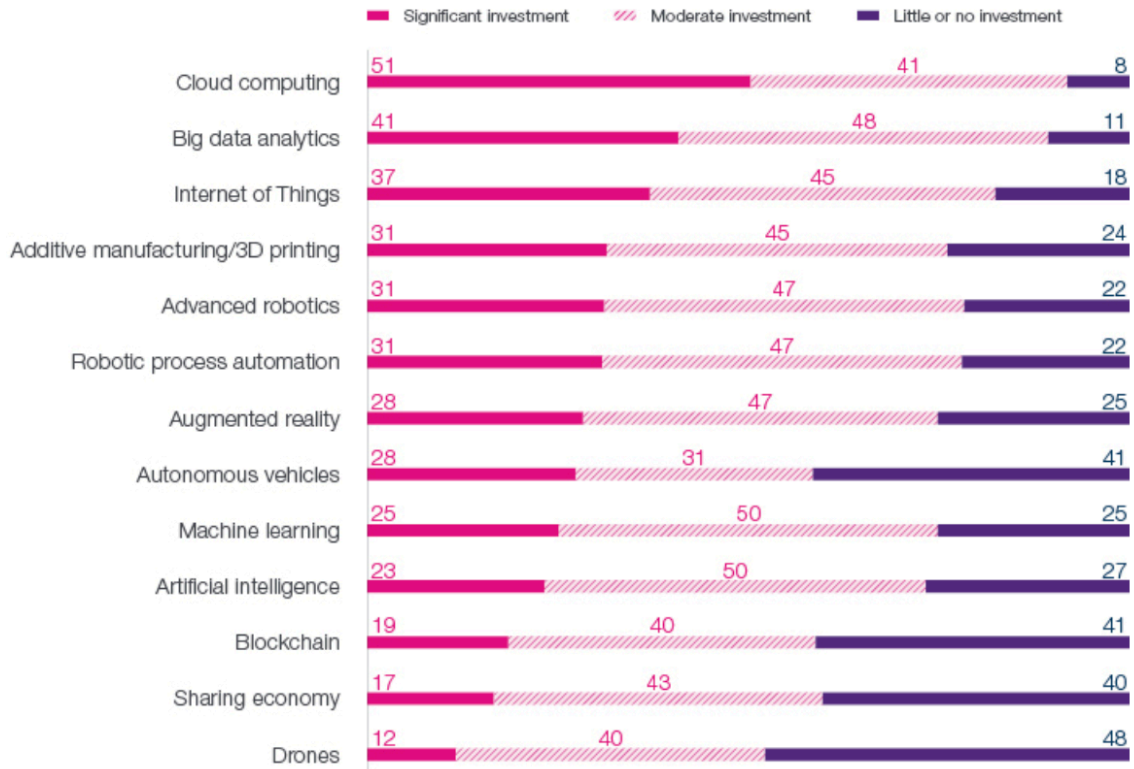
The interconnectedness of supply chain operations and logistics is related to IT. The rapid development of information technologies nowadays is affecting SCM by bringing new challenges and opportunities. To highlight the importance of the digital influence on the field of SCM and SRM, Aronow (2019) presents the results of a survey with 1,187 respondents, showing that companies highly consider investing into technological aspects that will lead into a future digital supply chain. As can be seen in Figure 7 significant focus is placed on cloud computing, big data analytics, and the Internet of things (hereinafter: IoT) as future contributors to achieve a successful digital supply chain.

The study by Accenture (Schramm, Wright, Seng & Jones, 2010) argues that cloud computing technology offers a powerful transformation of the traditional supply chain and that soon every company will adopt cloud computing to some extent in their supply chain. In recent years, thanks to cloud computing, a plethora of tools and frameworks have arisen that allow better process management. These collaborative platforms offer a series of advantages in terms of process standardisation, fewer visibility barriers, centralised knowledge access, and plenty of opportunities to simplify processes (Schramm, Wright, Seng & Jones, 2010)

Figure 7: Technological investments for a digital SC

### Investing to Make Supply Chains Digital

Level of Investment in technologies identified as "disruptive and Important" for future supply chain strategy



Source: Adapted from Aronow (2019).

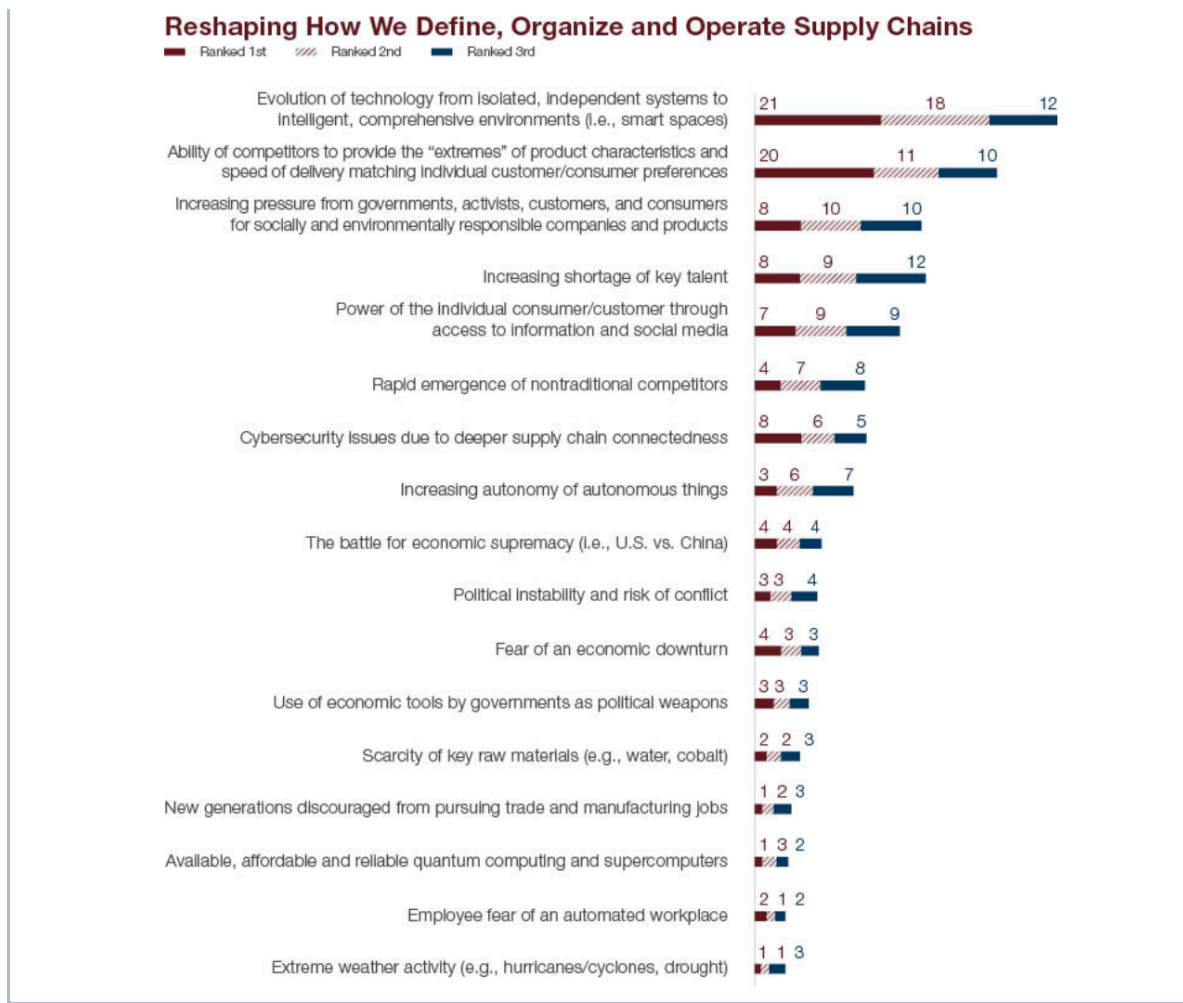
As described by Oracle (2016), resistance to the integration of IT in the supply chain can bring companies to a situation where they face a lack of flexibility to respond quickly to rapidly changing business and customer needs. There can also be issues with integration and communication among different sectors of the business and different business partners. Companies that stick to the traditional SCM will face limited visibility and creativity if no technology is applied. As a result, all these mentioned issues can profoundly impact the company's performance and growth when operating in today's highly innovative and globalised market. Oracle (2016) states that the modern business organisation should focus on adopting an efficient and agile approach in the supply chain, automating business processes by reducing manual processes and spreadsheets. The concept of the modern business comes with the end-to-end supply chain that supports the company's operation under dynamic market challenges. The type of supply chain that is supported by contemporary software solutions is characterised by:

- Agility. With the use of solutions offered by a cloud-based supply chain, the sharing and streamlining of information have become more accessible, helping the business to be agile and respond quickly to rapidly changing demands.

- Ease of use. Software tools such as are offered today are delivered with an easy-to-use interface and intuitive user experience that can be used by people of any background at any time from any device.
- Completeness and connectivity. This point highlights the advantage that the supply chain software offers when it comes to the integration of different IT solutions, sourcing data from one cloud to another in order to provide the end user with the experience to work on a robust platform with different solutions that will help with real time collaboration and decision-making.
- Cost and efficiency. There are different supply chain cloud-based solutions available for any organisation, regardless of the size or the background. These solutions have different prices and subscription options to suit different budgets.
- Security. To ensure that higher security for suppliers' data, cloud-based solutions come with advanced encryption, high-level virus scanning, and other features to ensure the highest data security.
- Fast, flexible and safe deployment. A cloud-based supply chain offers the possibility to introduce new features and processes incrementally without having to transform the whole business. This way, businesses will iterate more often and have continual feedback. This feedback will be used on the upcoming releases and perform better planning and forecasting for the future (Oracle, 2016).

Relationship characteristics can be influenced by enabled heterogeneity, but loyalty, solidity, commitment and trust are only activated by a mechanism of digitalisation (Fiala, 2005). Due to the advent of the internet, suppliers are able to engage worldwide. Moreover, effective and flawless SCM processes help both suppliers and customers (Gunnarsson & Jonsson, 2003). In the latest report published by the SCM World Community (2019), when SCM is reviewed to define the trends of the past year, it is clearly seen that respondents acknowledge the importance of technology: the majority of answers, when asked to consider what is reshaping how they define, organise and operate the supply chain, rank the evolution of technology from an isolated, independent system to an intelligent system first (Figure 8).

Figure 8: Reshaping the definition, organization and operation of Supply Chain



Source: Adapted from SRM, Aronow (2019).

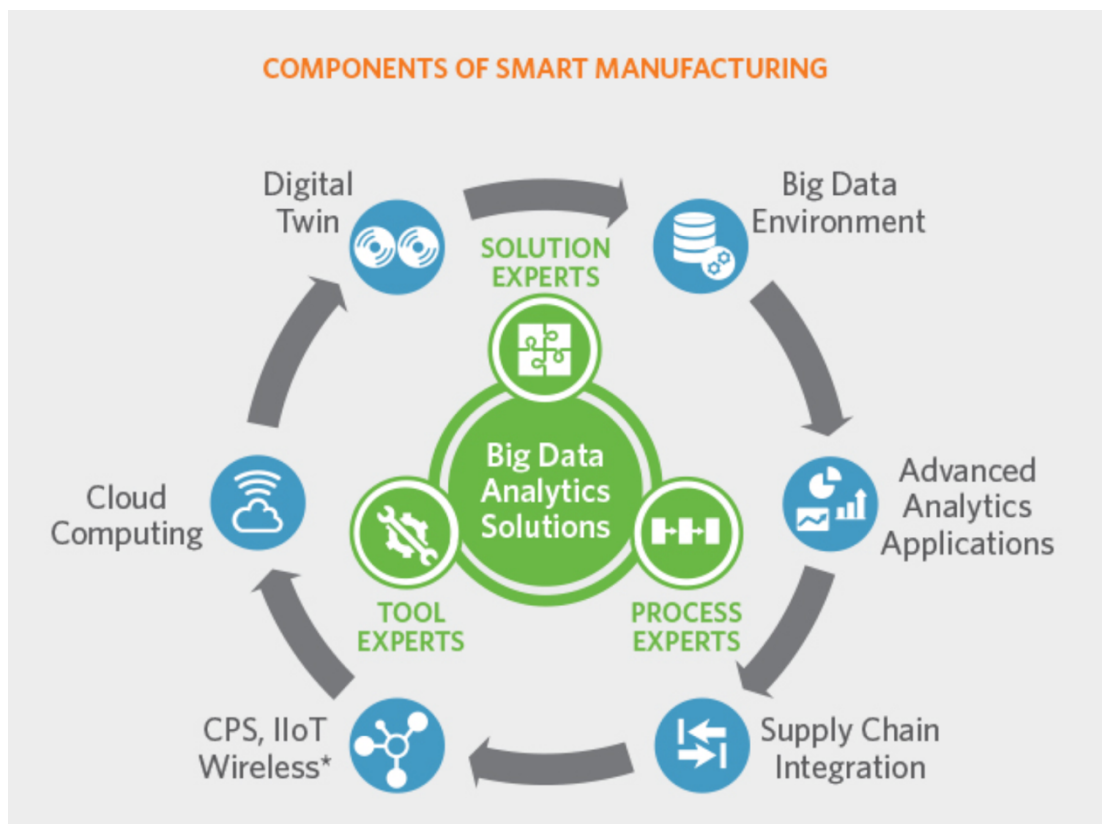
Nowadays, IT solutions have brought a high level of competition among firms so there is a strong need to track inventory and other relevant factors regularly because unclear data can cause communication issues among participants (Xue, Wang, Shen, & Yu, 2007). SCM often lacks warehouse management, inventory management which turns out to be a headache for the managers. IT has eased these tough times for businesses (Xue, Wang, Shen, & Yu, 2007). Moreover, linkage of all stages is required, because the primary raw materials and other resources are needed at the various stages of SCM planning. A supply chain needs more diverse planning than just logistics in order to evaluate and plan appropriately for consumption, delivery, transportation, storage, processing, and manufacturing (Halil, Mohammed, Mahbub & Shukur, 2016). IT solutions can help manage such processes anywhere at any time with the full tracking of inventory.

Moreover, strategic development is crucial for efficient decision-making: otherwise, operational constraints might be affected and become misaligned. Operations and strategy should go hand in hand for proper decision-making. Reduced supply chain performance and decentralised decisions in the upstream of the supply chain are due to the so-called bullwhip

effect (Fiala, 2005), this effect created due to information asymmetry; the bullwhip effect is impacted by the customer demand for information (Haddad & Blome, 2017).

As stated by Lammers (2019), manufacturers nowadays need to focus their collaboration with suppliers on cloud technology in order to achieve their goals, solve problems, and deliver the final product to the customer in the shortest time. In his report, Lammers (2019) also mentions that smart manufacturing is the key to success for any company, and it should include the software, tools, human resources and an environment where information can be shared (Figure 9).

Figure 9: Components of smart manufacturing



Source: Adapted from Lammers (2019).

### 3.2 Cloud computing in supply chain

As a result of digitalisation of the supply chain, attention is given to managing suppliers' relationships using installed programs or cloud-based software (Conway & Curry, 2012). Recognition of the cloud-based solution is realised worldwide: implementation has been at a high level, though some organisations have neglected this. According to Rittinghouse and Ransome (2016), the cloud is the more feasible option for organisations due to the holistic platform through which communication is streamlined, productivity is increased, and silos



are broken down. As a result, the plugin capabilities of cloud computing have made the management of any business operation easier to access anywhere, with higher transparency and trust. Another explanation is provided by Smith (2009), where cloud computing is defined as the possibility of bringing together the hardware and software in any location worldwide and making it accessible through the internet to an organisation of individuals. Having such accessibility throughout the company can be extremely beneficial, as the success of the supply chain depends a lot on the information flow and whether the required information with the required content is shared among the right people at the right speed (Huang & Lin, 2010).

Carroll, Van Der Merwe and Kotze (2011) demonstrates the scenario where companies can combine different hardware and software components that are purchased from different providers and link everything together via the cloud to deliver a compelling business solution. However, the author highlights the importance of mitigating security risks in order for the cloud computing operations to be more robust.

Durowoju, Chan, and Wang (2011) mention scalability as another important benefit that comes with the implementation of cloud computing technologies. The authors explain scalability as an essential factor that enables flexibility in the sense of coping with the changing computing demand by supporting the upgrading or downgrading of computing power depending on the demand; as a result, companies have the right amount of resources required at any moment. Similarly, in the context of supply chain management, due to the integration of cloud computing technologies, companies can own intelligent solutions that help secure better information management and thus achieve a balance between supply and demand.

The impact of cloud computing technologies is highly noticeable when companies operate in dynamic global markets. Companies are striving to create and manage the most efficient SC and fulfil the demand from customers who are more informed regarding the choices in the market. Also, customers nowadays have a wider variety of goods and services to choose from, as geographical boundaries are almost non-existent albeit this may change a bit due to the COVID-19 (Seifert, 2020). The pandemic situation has presented some challenges for the global supply chain. 'Supply shocks' came as a result of limited production after Chinese authorities imposed restrictions on movements of people and reducing social contacts. As a result, the global supply chain faced availability disruptions on goods sourcing from China. On the other side, 'demand shocks' is a consequence of restricted movement and curfews from where individuals respond by purchasing within single day goods that have months' worth. Recent publications highlight that due to the recent events on global supply chains, companies must rethink their operations models in regard to international outsourcing production. As a result, avoiding supply dependencies and supply bottlenecks can lead to higher efficient supply operation. (Seifert, 2020; Seric, Görg, Möslé & Windisch, 2020).

As a result, companies regularly face changes in the market demand, unpredictability, and new trends in the market in which they operate. For this reason, to perform better than the competition and deliver goods and services most efficiently and effectively, being agile and quickly adopting the latest market innovation is key to success (Swafford, Ghosh, & Murthy, 2008). As mentioned above, SCM consists of coordinating all activities until the end product or service delivers to the final customer. However, what Lou, Liu, Zhou, and Wang (2011) mention is that during the SCM cycle, there are two well-defined flows: material and information flow. All the parties that are involved in the supply chain process and relationships need to share relevant information. This information flow has traditionally been shared and managed over the years in other ways compared to how it is done today. Telephone, fax, letters, electronic data interchange (hereinafter: EDI), etc. are some of the most common ways companies have managed the information flow, whereas today they rely on the power of the internet and new technologies to make the most efficient use of information and transform it into a valuable input for better decision-making (Cutting-Decelle et al., 2007).

Further studies, one of them the paper by Chengalur-Smith, Duchessi, and Gil-Garcia (2012), explain the importance of the adoption of cloud-based supply chain software and the benefits of its implementation. Chengalur-Smith, Duchessi, and Gil-Garcia (2012), conducted empirical research that resulted in two significant findings. The authors state that companies that are investing in cloud computing technologies and moving their SCM towards web-based supply chain applications will benefit from the capability for instant information sharing, which will result in more exceptional business performance and growth. Besides, with the help of web-based supply chain management, companies can integrate the new SCM system with other existing business systems to leverage scalability, real-time communication, and fast decision-making across the whole business. The web-based solution, EDI and other technical solutions have proved to be an essential success factor for efficient planning, supply forecasting and replenishment.

For companies operating in the global market with no geographical barriers, the use of new technologies is crucial to ensure supply transparency. This approach presents a critical factor to build trust and maintain the reputation of the company not only with suppliers but also with customers, the government and other companies. The adoption of new technologies supports real-time information sharing regarding product data, the availability of information, and any other detail that is important to ensure that quality, product safety and ethics are in line; as a result, this will promote transparency across the supply chain. Supply chain excellence is dependent on the bi-directional communication of suppliers. Effective information sharing and integration can only be achieved by incorporating IT into supply chain management. IT applications and revolutionised technological processes promote the virtual supply chain with the invention of enterprise resource planning (hereinafter: ERP), decision support system, electronic commerce, bar codes, radio-frequency identification

(RFID), EDI and more, which are possible due to the IT and new business practices (New, 2010).

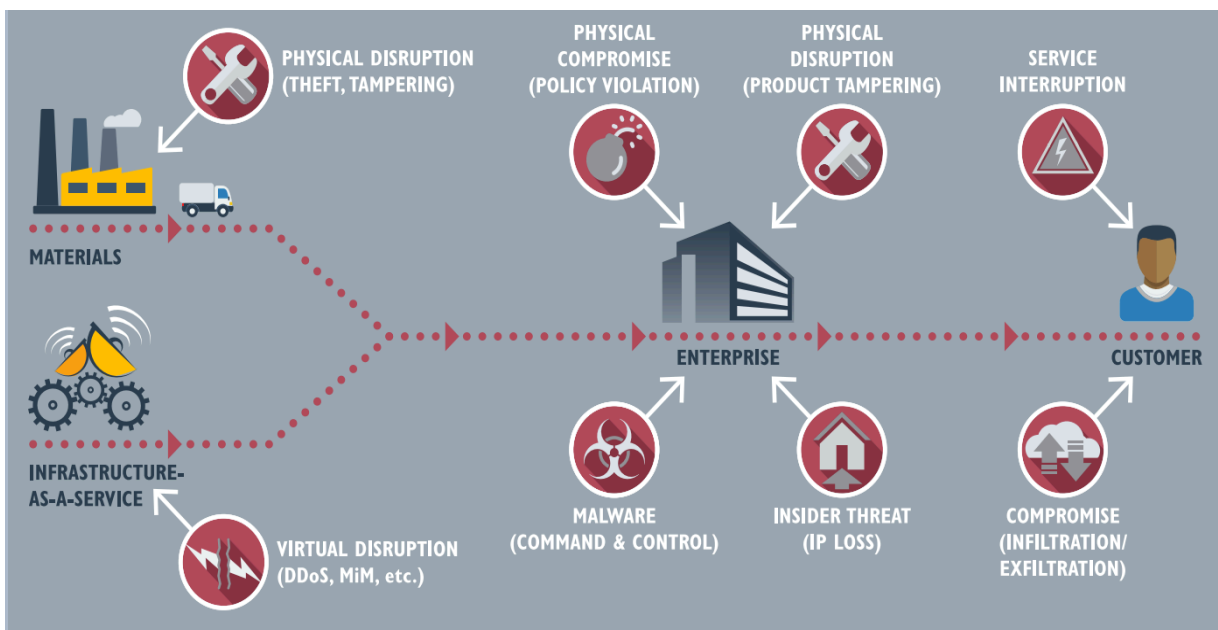
When discussing how companies have benefited from the adoption of information technologies in their supply chain, the best example is perhaps the collaboration between Wal-Mart and Procter & Gamble (Grean & Shaw, 2002) to conduct the collaborative planning, forecasting and replenishment (hereinafter: CPFR) initiative. This partnership shows how the proper use of IT to enable data sharing across the supply chain can leverage significant benefits, such as better coordination among business partners and managing right inventory levels to ensure that Wal-Mart's sales goals are in accordance with the production targets of the manufacturer—in this case, Procter & Gamble. As mentioned earlier, information sharing is an essential strategy for the efficient operation of the supply chain. Following the same strategy in regards to information sharing, Wal-Mart and Procter & Gamble experimented a lot in the field of information exchange via information technologies because their main aim was to manage and share data concerning the inventory level. In contrast, the retailer can easily manage the frequency of orders, quantity and tracking of shipments. Leveraging the benefits of using technology and cloud solutions, these companies have managed to practise the CPFR initiative successfully. They have conducted efficient planning of their logistics operations, efficient coordination of production scheduling and on-time demand planning. They have expanded the product design initiatives by having better supplier innovation as a result of the more robust relationship between the business partners. Even though the results that come with the adoption of the CPFR are promising for the efficiency of the supply chain, companies should not disregard the challenge that this initiative might bring to the workflow between buyers and sellers. Thus, the company must make sure that implementation of the CPFR is beneficial and that it aligns with the existing IT, internal systems, the organisational structure and vision, and processes and workflows (Harsono, 2013).

Information flow plays a crucial role in determining the success of the supply chain lifecycle. This success is the result of a well-established communication infrastructure that facilitates and supports real-time information exchange between all participants in the supply chain in order to make faster decisions and respond to internal and external conditions (Matopoulos, Barros, & Vorst, 2015). Moreover, as described by Ben-Daya, Hassini, and Bahroun (2019), the most critical point when talking about information exchange in the supply chain nowadays is not the accessibility of the relevant information but rather having the right technologies to collect, store and process big data. In the same study it is pointed out that with the advancement of technology—specifically the IoT the data that derive from smart devices can be of tremendous importance for the efficiency of the supply chain if the data collection process, analysis and usage are performed successfully.

On the other hand, although all the factors mentioned above make cloud computing technology necessary for the successful operation of the supply chain, there are still some concerns and risks associated with its adoption. Much research has been done in this field.

In the report published by the European Network and Information Security Agency (2009), the risk that might arise from cloud computing is defined in different groups—for example, organisation and policy risk that can affect the reputation of the company, trust relations with its customers, etc. Technical and legal risks are the ones who follow. However, other studies have focused on the privacy and security risks that could present a security breach for companies that apply cloud computing technologies in their supply chain (Shackleford, 2015; Zissis & Lekkas, 2012). In his paper, Shackleford (2015) describes the technological risks associated with new technologies in the supply chain and highlights best practices on how to manage such risk and carefully evaluate the technology, people and processes within the company. In the same study, as shown in Figure 10, software malware and insider threats that could modify the vendor’s credentials are some of the factors that can allow a supply chain breach and increase vulnerability, with a direct influence on the final customer’s trust in the company and its perceived safety.

Figure 10: Supply chain breach



Source: Adapted from Shackleford (2015).

Similarly, in a recent study by Botta, De Donato, Persico, and Pescapé (2016) on how to achieve successful integration of cloud computing with the IoT alongside security, privacy and legal aspects, additional challenges are found to need attention:

- Heterogeneity. Applications nowadays function through a combination of different operating systems, hardware, platforms and services that need to support integration in the cloud.

- Performance. As cloud applications come with set criteria and performance requirements that need to be met, this might represent a challenge, since we are talking about a network that has to support and be stable for more significant storage and performance.
- Reliability. This point becomes a challenge when the performance of critical application depends on the adoption of the cloud technologies. As described in the study, device failure, unreachability or variable quality of service measurements, can represent a concern when applications are set up under resource-constrained environments.
- Big data and large scale. The issue with the large scale comes with the information retrieved from smart devices that are at the heart of the IoT. A vast amount of information is coming from different devices, and cloud technology needs to be prepared in terms of storing, processing and analysing this information.

For companies that adopt cloud computing to practise cloud-based solutions to manage their supply chain, the benefits are indisputable. However, the risks that come with the implementation of the new technology should not be ignored. Companies should expect such risks and know how to control them by practising an effective risk management approach in terms of identifying the risk at an early stage, assessing the risk accordingly, and controlling it (Truong, 2014).

### **3.3 Information sharing in supply chain**

Information flow in the supply chain is tough to furnish at the global level. Communication and efficient transactions are time-consuming processes and might be prone to error. In supply chain networks, businesses are revolutionising processes to sharpen their business performance and to become more diverse in terms of technology, communication and information sharing (Jede & Teuteberg, 2015)

A more profitable supply chain with reduced uncertainty and increased information sharing can only be achieved by supply chain partnerships (Biswas, 2014). In order to coordinate the units, information exchange plays a vital role. Similarly, Lee and Whang (2000), indicate that information sharing is a crucial factor in reducing the bullwhip effect since both upstream and downstream sharing lead to better and more efficient collaboration, decision-making, planning and forecasting among all participants in the supply chain.

Consistently sharing real-time information in global networks is another matter of grave concern in carrying out SCM processes with the available cloud computing services (Cegielski, Allison Jones-Farmer, Wu & Hazen, 2012). The supply chain's digital processes gain competitive advantages in terms of efficiency and decision-making. Profitability and proficiency are the basic norms when applied to the activities and strategies of supply chain cloud-based solutions.

Optimising organisational decisions and competitiveness in SCM and supplier relationships has been possible only due to the exponential growth in information and communication technology (Cegielski, Allison Jones-Farmer, Wu & Hazen, 2012). The advent of IT has reduced the electronic risks, lowered the inventory needs, and improved the service level, where communication and coordination are crucial aspects of SCM (Schramm, Nogueira, & Jones, 2011). Decision-making processes affect the cross-functional contributions of businesses in respect of production, safety, health and delivery lead times. Dissemination of such processes has changed the traditional supply chain to robust digitisation in the management of the risks (Masoumik, Abdul-Rashid, Olugu, Ghazilla & Ariffin, 2014)

Businesses tend to be agile in order to have enhanced computing when streamlining and sharing information over cloud-based solutions (Subramani, 2004). Collaboration among suppliers goes beyond the borders; decisions are taken on short deadlines, and the extent to which a company can be agile in the international supply chain is an essential factor in determining its future success (Vastag, Kasarda & Boone, 1994). According to Christopher and Lee (2000), companies operating in various markets face a lot of competition and shorter lifecycles, which lead to higher uncertainty, and so the ability to be agile and responsive to the supply chain is crucial. Agility plays a vital role in compiling and sharing data with business partners at the peak time: for this reason, success during unpredictable periods can be better achieved by having an IT infrastructure that enables centralisation of the supply chain and collaborative planning (Agarwal, Shankar & Tiwari, 2007). Scalability is another specification of a cloud-based SCM system, referring to the accessibility of the more scalable data sets. Global businesses need perfect collaboration and communication in order to keep proper lines of operation. Supply chains are prone to electronic risks, as a result of which scalability might be affected by the complexity and vulnerability of the system. Scalability of SCM remains a significant hurdle due to fluctuations in requirements. Thus, the flow of a business is hindered and not managed within or outside the network (Masoumik, Abdul-Rashid, Olugu, Ghazilla & Ariffin, 2014). Within a matter of minutes, SCM providers can respond to suppliers. This instant growth capability helps in the fulfilment of processes.

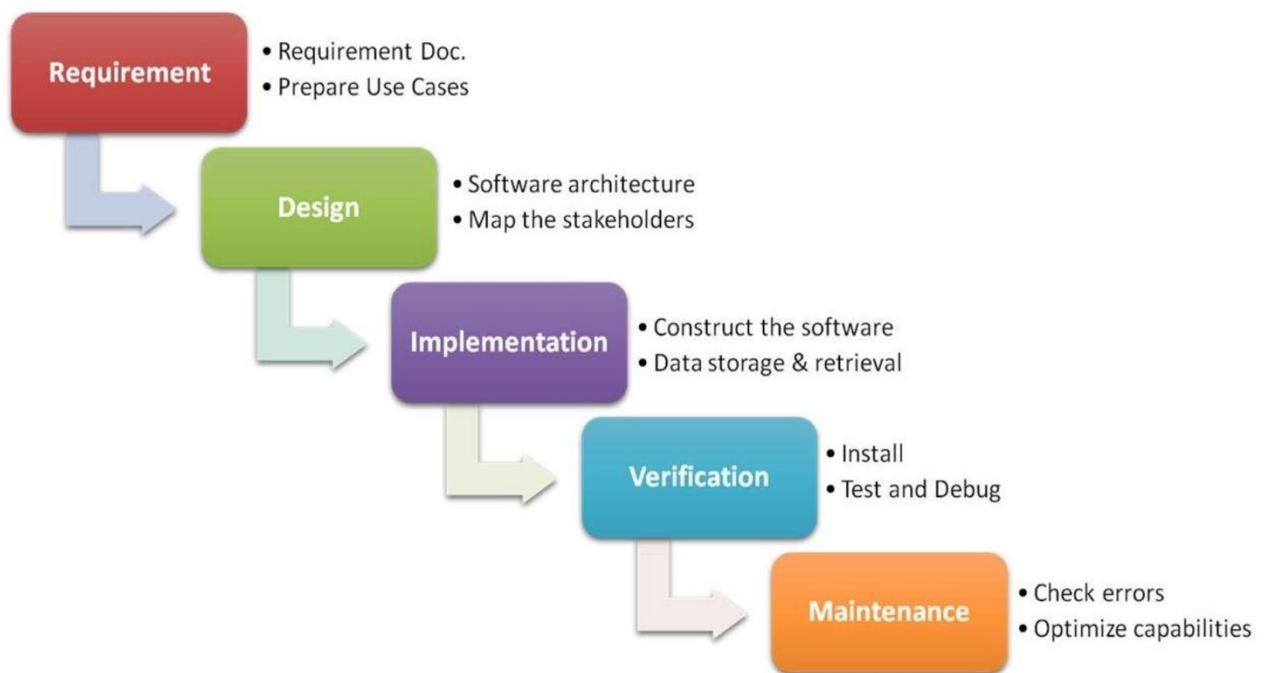
As we can see from all the scientific studies that are elaborated on this paper, supply chain management, SRM and IT are interconnected in terms of agility, integration, planning, scalability and competitiveness.

#### **4 SOFTWARE DEVELOPMENT METHODOLOGIES AND THEIR IMPACT ON DELIVERING A VALUABLE END PRODUCT**

Today there are many software development methodologies defined and adapted by different industries and company characteristics. Groups of traditional software development methodologies that follow the lifecycle model such as Waterfall method are known to have set of defined activities and results that are expected to be delivered at the end of each phase

as a prerequisite for the subsequent phase to start (Kasser, 2002). In other words, as explained by Verma, Bansal and Pandey (2014) in his study on the development methodologies, this type of methodology can be defined as a linear activity where the end-result is an output of defined stages such as requirement analysis, designing, implementing validation, integration and maintenance, with no space for any change or adjustments of requirements during the time process is ongoing. Figure 11 indicates a visual representation of the waterfall methodology and all the composing steps that are dependent on each other to deliver the end-result (Royce, 1970).

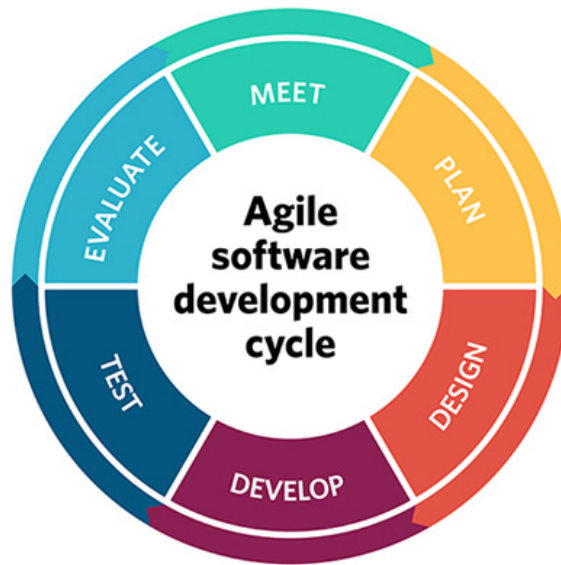
Figure 11: Waterfall model of the software development



Source: Adapted from Verma, Bansal and Pandey (2014).

However, as described by Highsmith and Highsmith (2002), customers do not always have a clear expectation and understanding of their necessities. Thus, this can influence software development by imposing change on the scope of the requirements or the initial vision in order to deliver a product that will satisfy the user needs. This is where agile software development methodology plays a significant role because, in this situation, agile methodology decreases the number of structured processes that the project should undertake. Such initiative allows faster response to the constant change in user requirements, external factors, deadlines etc. (Erickson, Lyytinen & Siau, 2005). Several different agile methodologies can be used by teams when building software, and all of them have common approach (Figure 12) into offering an iterative strategy to software development, providing greater flexibility into software requirements, focus on collaborative teams and highlighting the simple product design (Larman & Basili, 2003).

Figure 12: Agile methodology in software development



Source: Adapted from Larman and Basili (2003).

Similarly, during the case study on this thesis, I have elaborated the agile software development methodology that was used to develop the SRM product and analysed the benefits that such methodology can provide in securing high flexibility to deliver a final product that will meet the user's requirements. As outlined earlier, agile methodology is suitable for dealing with requirements that are changing fast. It is composed of a small team that is focused on frequent increments and short iterations processes to deliver results as fast as possible (Cardozo et al., 2010). Scrum represents a method of Agile methodology that is highly used during software development and is characterised by having different roles, manifestos and process that team members need to follow in order to deliver within the defined time by consuming minimal cost (Mahalakshmi and Sundararajan, 2013). Scrum is one of the agile methodologies that is characterised by the ability to adapt to the changing environment. As shown in Figure 13, it is composed of having defined processes, roles, responsibilities and meeting that are happening regularly. The Agile-stage-gate system presents the systematic approach that builds the product from the initial idea to its launch. This system is defined as the most efficient solution that companies have used to deliver final outputs following an agile methodology and to be able to overcome in advance any flaw that might impact the new product. Even though we are used to reading and experiencing the agile methodology mostly on IT software development, nowadays this methodology is also adopted by manufacturers when building physical products, and this is known as the AgileStage-Gate hybrid model. Companies who have successfully adopted this methodology have been benefiting by launching products that deliver value to the end customer, improve the internal teamwork by having dedicated teams. They focus on a single project, more efficient communication by holding daily meetings reviews, and establishing more efficient processes after having constant customer feedback and performance review. The highlighted



benefits come along as a result of the newly adopted culture of working and developing a product on a series of sprints.

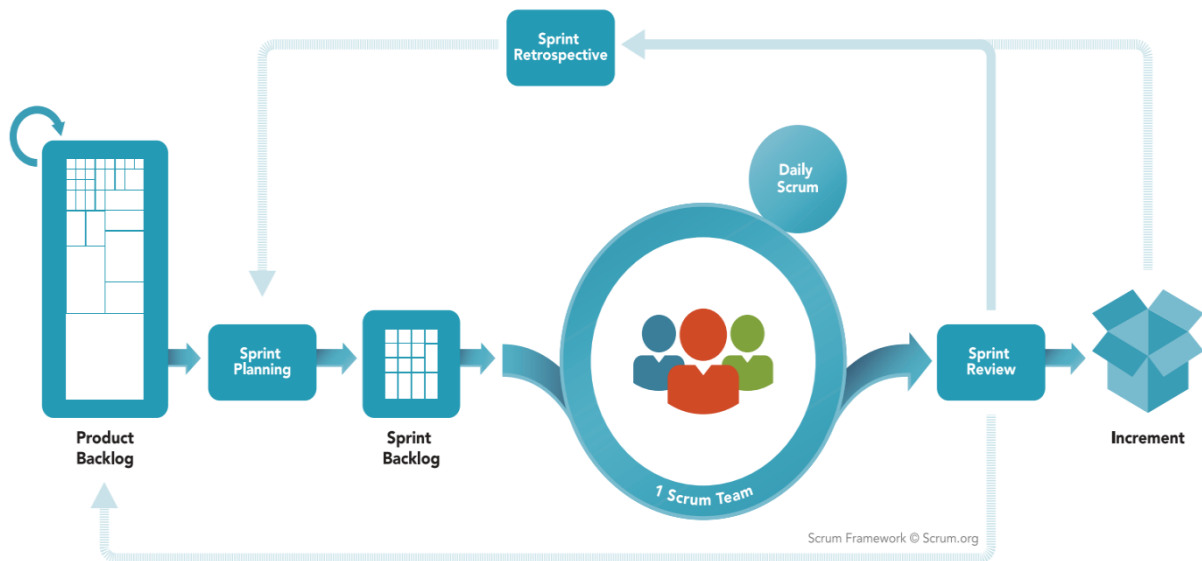
The project sprints are defined by a timebox of 2 or 4 weeks, where the development of the new product is taking place. Each sprint begins with a planning phase where goals and objectives align among the team. Next, are the daily meetings hosted by scrum master where all the team member updates each other regarding the progress of the tasks they have been working. Following on, when the product has been released a demo to show the outcome to the stakeholders needs to be scheduled. The sprint retrospective is the last activity where all the performance reviews and key takeaways grasped for the next coming iteration (Cooper & Sommer, 2016).

When practising this methodology and adapting the stage-gate model to boost productivity and innovation, project governance is an important topic that controls and influences business operations. Projects need to undertake such screening criteria in order to analyse if the needs of the final users will meet, and if the project will deliver the intended value for the company.

The gatekeeping process helps companies to make the right decision based on the performance of the project and conclude whether the project will take one of the following directions:

- Go: the work can continue, and the project should proceed forward
- Kill: the project is evaluated as a poor investment; thus, the work has to stop immediately to save unnecessary costs.
- Hold: in some cases, the project has successfully passed the screening process, but at the moment, there are other more critical topics prioritized that can bring higher value. A project can be set on hold and continue later.
- Recycle: this situation can be faced when the project is known to provide investment, but the functionality is delivered in a poor-quality format.
- Conditional go: Project can start only when some predefined events are complete

Figure 13: Scrum agile methodology



Source: Adapted from Scrum.Org(2019)

The idea of Continual Improvement process is not new, this has been around for many years, and in a way or another, it imposes the key to success for any company operating in different industries (Kuhn et al., 2011). Innovation can occur in different ways, but as Chang (2005) highlights, companies that are continually able and eager to improve their products and processes are highly competitive, more likely to succeed and they are more capable of dealing with changes and reducing failure. Similarly, when it comes to developing a digitized product, we face continual improvement along until the end delivery. As elaborated by Fitzgerald and Stol (2014), the collaboration among the business strategy and software development should always be in sync and work closely in order enabling continuous product planning that is crucial to become agile.

Software development offers a form of continual process, and when it comes to developing digital products, companies must adopt the efficient agile working methodology and be fast enough to capture the share on the market. In order to achieve this, continuous delivery and deployment are essential activities to allow the product to move fast forward and also identify flaws and bugs in an earlier stage (Shahin, Ali Babar & Zhu, 2017). Practising continuous delivery and deployment of the digital product, of course, entails technical support since the risk of this product failing in the market is higher (Olsson, Alahyari & Bosch, 2012). For the efficient rollout of the product, automated testing, product A/B testing, different techniques of product launch and also user acceptance tests are beneficial activities that should be practised (Kohavi et al., 2013). User acceptance test, as described by Davis and Venkatesh (2004), happens at the last stage before the product is rolled out and the main focus is having actual people who will use the product in the future to test it based on requirements and make sure the software can handle the request and satisfy its clients.

Furthermore, an essential topic in platform development is the mobile approach. As mentioned earlier on my research and also highlighted by Barata, Da Cunha and Stal (2018), information sharing within the supply chain is a critical success factor, especially during the current industrial revolution. Even though cloud computing technologies and IoT are adopted by most of the companies into their business processes, focusing and going mobile is the next step that companies should include into their vision when competing globally (Barata & Cunha 2016). Current adoption and usage of mobile devices are changing the way that customers connect and build relationships with the companies. As a result, this common behaviour influences the connection until the end production process because the form of communication, data sharing and decision making is highly influenced by the use of mobile devices (Schweiger, 2011). Companies must consider supporting their web-based SRM solutions into mobile devices that can be carried and used by end-users at any time. This way, complex supply chain networks can be handled and managed successfully if the movement and access of data and information are being conducted on faster means with greater flexibility and accessibility from scalable, supported solutions in different mobile devices (Arsovski & Rankovic, 2011).

## **5 CASE STUDY – ECRATUM SRM PLATFORM**

### **5.1 Methodology**

To better understand the importance of building digital products and integrating IT in supply chain management, I analysed a practical case study to identify the relative influence how adopting and using such products can influence the relationships among suppliers and overall supply chain. More specifically, this thesis analyses the current situation of companies that are shifting towards cloud computing to manage their documentation and relationship with suppliers, the benefits that they are leveraging and potential future needs that will arise as a result of digitalisation. I have used ecratum- a SaaS product that delivers SRM solutions. Through this product I have analysed how the technology has impacted supply chain, I have elaborated the journey of developing advanced SRM products, users' needs on today's market and the influence that the digitalisation has on defining this needs and in the end, results and conclusion that derives from such study by suggesting solutions for the future.

I have been myself involved as part of a team who was responsible for building the initial product, in the role of associate Product Manager. For this reason, I have followed Product Management lifecycle steps to build the framework for the case study I have elaborated below and to describe better the necessary steps in building digitised SRM product.

The necessary data is collected from current clients of ecratum platform that are familiar and have well adopted the product. I have surveyed 45 companies that are currently using ecratum, and they cover a wide range of industries such as the food industry, pharmaceutical,

automotive, construction and textile industry. Moreover, I conducted unstructured interviews with five ecratum employees, ranging from CEO, CTO and CS team representatives to understand the competitive advantage of the product, its value, requirements and challenges faced among the way.

## **5.2 Presentation of the company**

The case study is based on a German company called ecratum GmbH. Ecratum was founded in 2013 in Berlin and offers a business to business platform for manufacturers to manage their relationships with customers and suppliers. Currently, this platform is being used by 25.000 companies in 80 different countries and various industries. This web-based platform offers a variety of SaaS solution that focuses mostly around SRM and Customer Relationship Management in helping manufacturers to perform more efficiently, decrease operational risks and gain a competitive advantage during their day to day tasks with their suppliers and customers.

The idea behind this product was born due to the challenges that the founder of the company noticed while working closely with Quality and Purchasing departments of small and medium-sized enterprises. The challenges implied mostly administrative and communicative cases when the quality and purchasing departments was dealing with supplier relationships. Thus, the development of a web application platform that would ease the process of SRM by offering document and data exchange, document management and communication network for business partners was established. The CEO of ecratum highlights that the main goal of the platform is to provide effective SRM in a way that is easy, safe, time and cost-efficient for business partners to use to complete their day to day tasks.

### **5.2.1 Ecratum products and the target audience**

Ecratum aims to streamline a lot of time-consuming processes taking place during supply chain- for this reason, this platform provides an easy to use navigation, items and functionalities for the account users so they will be able to perform their daily tasks efficiently and have everything organized into a single place. The Dashboard on the platform enables users to check their sent and received tasks along with their categories so this way they can have a direct overview of their "To-Dos" and the "To-Dos" of their business partners. Moreover, they are informed regarding these to To-Dos either daily or weekly, depending on the frequency that the user has set for as a preferred time frame. The communication among business partners is done via tasks that reflect a message/documentation user wants to deliver to their business partner or to receive from them. Depending on the ecratum product user has activated on the account, the task types that they can send or receive vary. However, the following are the most frequently used tasks:

- Product document task

- Evaluation task
- Corrective Action task
- Document task
- Question task
- Agreement task
- Audit task
- General task
- Support task
- Complaint task
- Contact task

To keep track of the task that each user has on the account, ecratum organizes the exchanged tasks into three pages/groups:

- Inbox to view all the tasks received and updates regarding these group of tasks.
- Outbox is the location to check tasks and updates that the user has delivered to the business partner.
- Teambox is used to view all cumulative tasks received by all users from the company

SaaS tools that ecratum provides are sort into two bundles of products: Customer Management tools and Suppliers Management tools. Each service can be easily bookable based on a plan subscription price that is more suitable for the company, meaning they have different limits and functionalities. However, the main goal of these two groups of products is allowing manufactures to manage their interactions with customers and suppliers quickly and efficiently. As part of my research, I have analysed and explained how two ecratum's product work: PDoc Share and PDoc Collect. However, other successful products that ecratum provides and that have already generated a high rate of interest are:

### **Corrective actions**

This product offers to its clients a display of the problematic incidents among business partners and allows both parties to communicate over these incidents, document and record all communication regarding the incidents in one place. Besides, clients can track, evaluate and analyse the recorded incidents and find the best solution. This way, ecratum documents the entire complaint (corrective action) process into one platform where suppliers receive an immediate notification of any corrective action and a quick overview of created, processed and resolved corrective actions are available at any time for the sender.

### **Supplier Qualification**

With this product, ecratum offers clients the possibility to manage and qualify all related supplier information into a single place. Once the clients subscribe to Supplier Qualification, they will have the composed part of this product: supplier profile, supplier documents,

supplier approval, supplier audit and supplier agreement. The main functionalities of the product are:

- Automatically request, collect and archive of all supplier's information
- Invite and connect with other companies on the same platform
- Collect and manage all contracts and agreements into a single centralized place
- Automatically sending reminders to suppliers for important tasks and deadlines
- 365 days audit-ready
- Historical track of the latest approval status from Quality and Purchasing teams

### **Supplier Evaluation**

Supplier evaluations product targets individually Quality and Purchasing professionals to enable them to regularly and efficiently evaluate suppliers. Having an easy to use interface, users with only a few clicks can set up an evaluation cycle, complete pending evaluations and automatically share the results with their suppliers. As a result, companies will boost their supplier evaluation efficiency by having centralized feedback and transparent feedback; supplier quality will be strengthening due to collective and effective team evaluations and excel supplier relationships by continually monitoring and tracking the evaluation progress.

As a product manager, I had often interaction with the clients to find out more about their working style and habits so that I could bring the best input for the software. From my communication and interaction with clients, I can define the persona between the age range from 28-55, and they usually have degrees in microbiology or biochemistry and work mostly into the food industry. This data indicated that the target audience of the project I worked, presents quite a large market with different ages. They are qualified professionals who not only work in the office but also on the laboratory floors, also taking care of raw material deliveries. The typical working day of the persona might vary as it is found that one day the quality management may be on the laboratory floor testing materials to make sure that there are no foreign bodies or other damages. The next day they can be in the office taking care of documentation and at the same time organizing emails or solving all unanswered requests for documents that it is seen as anxious tasks by them.

Since these individuals need to make sure they have all of the needed documents, they are also very stressed out during the time of an audit. As a result, we can see that the personas are doing at the same time the laboratory and also the document management work as one individual usually, unless it is a large company, which usually has multiple individuals in a department. Quality managers, at times, do have associates that work with them on this paperwork, but the associates also run into the same problems and usually ask for help from the quality managers. This slows down the process and still does not solve the problem of having all of the documents at hand at a needed time frame. A deeper analysis of the process of documentation collection showed that usually, it takes about three weeks for the quality managers to prepare for the audit. However, before the actual audit, there is also an additional unannounced audit, for which the quality manager cannot prepare with such a short notice

based on all of the spreadsheets, paper documentation and online folders they have. This audit does not fail them, but the auditor comes back a few weeks later to double-check and make sure that all of the documents are present. If the second audit fails, there is a chance for product recall.

Before adopting advanced SRM platforms, the most common tools that were used by Quality managers to run their daily tasks were:

- Excel
- Dropbox
- Google Drive
- Email
- SAP or other enterprise systems
- Hard drive storage (numerous folders with countless spreadsheets)

### 5.2.2 Current limitations/drawback that ecratum is facing

However, there are some drawbacks and limitations that the company is currently facing. One current challenge is of the lack of high-level analytics which does not currently allow understanding of which parts of the app users are using most, where they experience challenges while performing different tasks, or the use of data analytics to support new product development and scope definition more efficiently. Product onboarding process flow is another challenge for ecratum, since a new user that signs up for the service currently receives no guidance on how to perform the first tasks on the app. Even though ecratum is focusing on building a product that is easy to use and self-explanatory, some processes on the app, such as supplier evaluation or handling forwarded tasks in the chain of trader and producer, can be very challenging to perform. Ecratum is trying to handle this situation by planning a project where a support widget and online onboarding process will be set on the app for the first-time user. As ecratum is expanding into new geographical markets, a current challenge is the language. This is a challenge for the product team mostly, because it presents a limitation in terms of direct user interviews, research and feedback loops to learn more about the current situation. Furthermore, the company does not yet have country representatives, and different languages are spoken. This leads to unclear scope and functionality requirements definitions and different expectations from the users' side. Related to the language, another problem is the translation of the user interface as the terminology is usually specific and requires language expertise to make sure that the right translation is chosen to deliver the information.

### 5.3 Focal products in this research: PDoc Share and PDoc Collect

Focusing on the role of IT in managing supplier relationships, I did study two products, PDoc Share and PDoc Collect in more detail to understand their impact on the companies' overall supply chain. This section explains the functionality of these products, including information

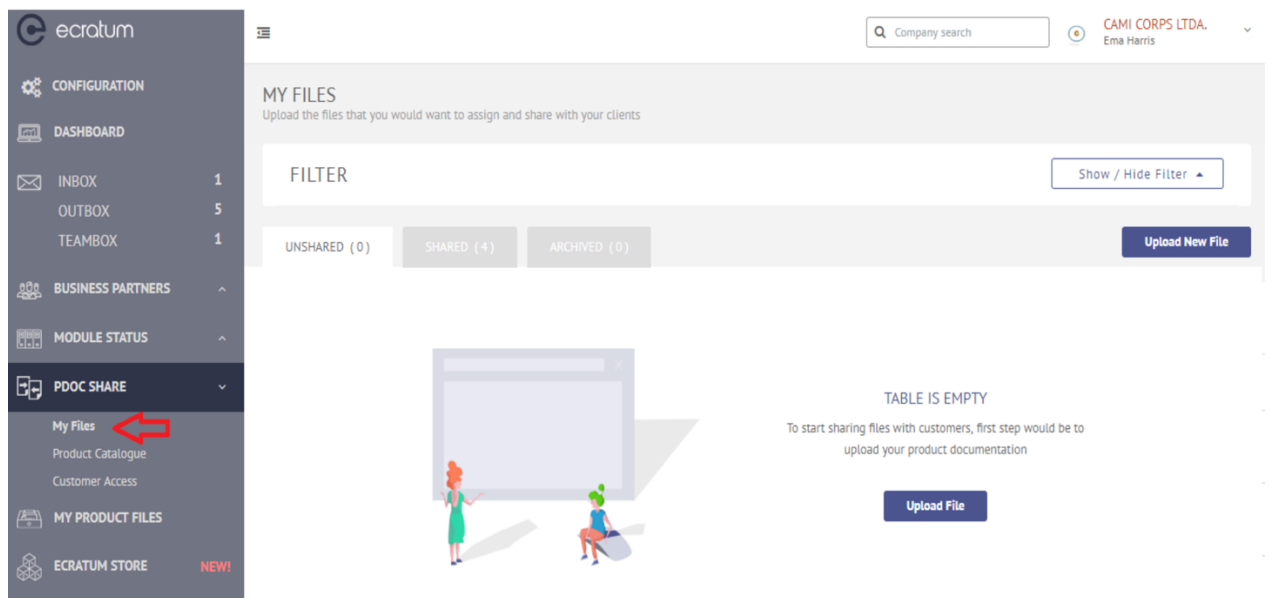
from the initial idea of building them, users' interest, the development phase, implementation and user feedback.

### 5.3.1 Introduction to PDoc Share

PDoc Share is an ecratum product (Figure 14) that targets suppliers and helps them easily manage the product documentation for goods they sell, saving time and increasing productivity. This way, suppliers can foster healthy business partnerships by keeping customers up-to-date on essential product changes. This tool allows customer service teams easy distribution of product documentation to their customers by offering an easy interface and the option to recycle product documentation already uploaded to ecratum. Other significant benefits that this tool provides to suppliers are listed below.

- Easy file management and storage in multiple languages.
- Potential to invite multiple customers to share product documentation at the same time.
- Letting customers subscribe to products and be automatically notified about any change made to products and product documents. This way, everything will be done automatically, and there will be no need to send manual update emails or make phone calls.
- Allowing customers to download any product documentation when they need it.

Figure 14: PDoc Share interface in ecratum platform



Source: Adopted from Ecratum (2019).

### 5.3.2 Introduction to PDoc Collect

PDoc Collect (Figure 15) is the other product that is analysed in my thesis. This product targets clients and offers them an advanced way to collect and manage product documentation from their suppliers. From his experience working as an IT consultant, the

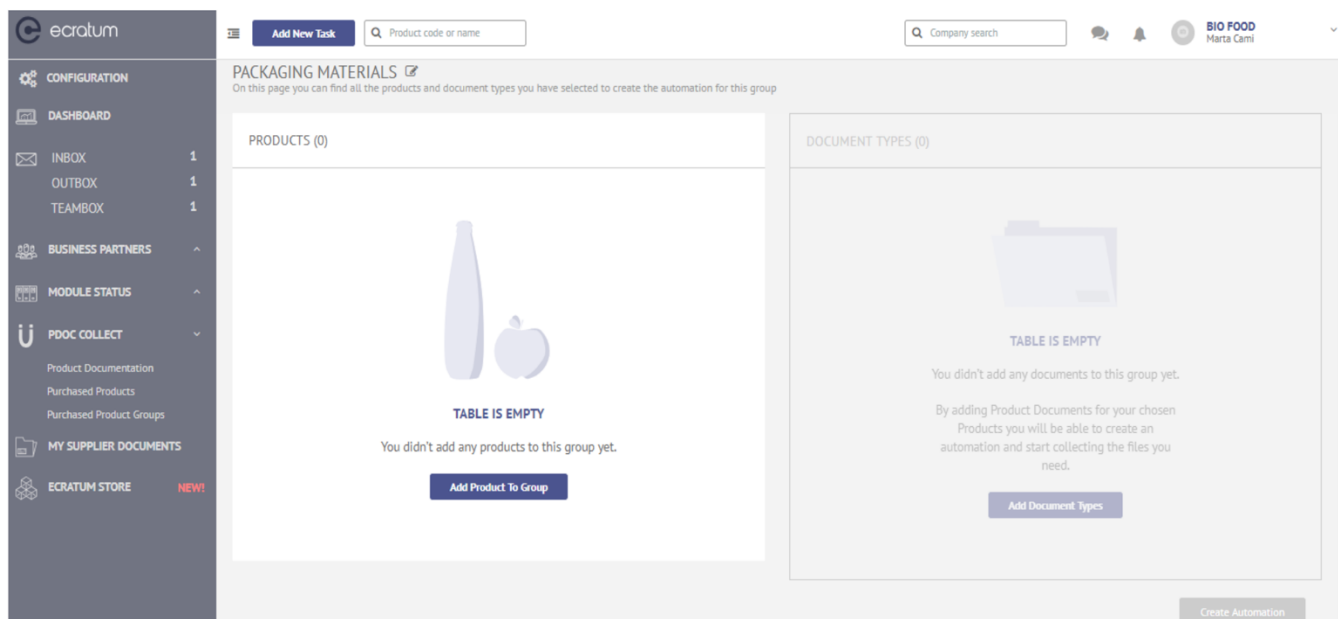


CEO of ecratum explained how quality control personnel spend a large part of their daily routine collecting, updating and reviewing product documentation from suppliers. As a result, the need for a software tool to support this time-consuming work became crucial with the advancement of IT. With this challenge in mind, PDoc Collect is built to provide an innovative way to collect and manage documentation. The product offers its customers features to specify the requirement of the product documentation easily and to automate the documentation request based on set criteria if necessary, and a simple interface where they can review, store and update the documentation. Moreover, to minimise miscommunication between the parties, the product offers a feature that allows the user to insert internal or external comments on document tasks. Therefore, the involved parties can be on the same information loop and have transparency over the tasks.

Users report that with the feature of PDoc Collect they have increased the efficiency of their daily performance. This improvement on the daily performance is a result of having a centralised product documentation space that they can access at any time from any place; always being ready for an audit; collaborating effectively with their team on incoming documentation.

Therefore, by automating time-consuming manual requests, and eliminating the long phone calls and endless email threads to collect product documentation, users can save a considerable amount of their daily work time. Using PDoc Collect, clients explain that they have improved their business relationships with suppliers since the technology has enabled them to build trust and security in relevant document exchange and speed the cycle of work by removing the middle man (sales) in the process of documentation.

*Figure 15: PDoc Collect interface in ecratum platform*



*Source: Adopted from Ecratum (2019).*

## 5.4 Development of platform

A brief summary of the outline of this case study follows the steps explained below.

### **Idea → Think → Build → Launch**

Problem      Research      Implement      Results

#### 1. Idea generation stage

During this phase of my work, I have analysed the current situation of users that have adopted the SRM platform. This stage aimed to determine what the problem was and the initial trigger that made users switch to digital platforms to manage their relationships within the supply chain. Moreover, I conducted unstructured interviews with stakeholders to understand their point of view and dig deeper into the benefits and solutions that ecratum provides, along with objectives and future goals. As a result of this first phase, I have gained a better understanding of:

- The initial problem and why it needed to be solved.
- Identifying who are the users of the product and their main characteristics.
- Elaborating the business needs and potential for such a product.
- Introduction to ecratum by elaborating the product that it offers and how the solutions satisfy its customers' needs.

#### 2. Think and research phase

Having successfully completed the first stage and having set the initial foundation to continue my studies, I took a step further and got closer to the product users in order to gather data to help the further development. Identifying the platform users during the initial step of my research allowed a smoother process in this step. As a result, I have:

- Reached out to users to understand their needs and current solutions to the problem.
- Prepared questionnaires for the users and conducted unstructured interviews with stakeholders.
- Analysed data gathered from questionnaires sent and defined the success of the product.
- Proposed further product ideas based on the research results.

#### 3. Build and launch phase

After collecting and analysing data on customers, I moved on to the next step that explains the technical approach that is followed to develop the PDoc Collect and PDoc Share products. During this step, I interacted closely with the development team. Moreover, I conducted an unstructured interview with the CTO to become familiar with the technical risks that might arise and the chosen development methodology. Furthermore, I studied the

design of the product by analysing the interaction with the other departments and highlighting the importance of involving designers early in the process.

At a later stage, I explained in more detail how the features are built, the sprints and techniques adopted. Last but not least, I tackled the release process to analyse the information that is collected for release, how the potential customers are approached, and communication and knowledge sharing within the company, ultimately tracking and measuring the success

#### 5.4.1 Analysis of the current situation

To study the products that this platform provides, I reached out to the head of the CS team at ecratum and gathered information on the main characteristics highlighted by clients that make this platform very attractive in the field of SRM for its customers. The following points were provided.

- Collection of product-related information (e.g. product specifications, migration documents, packaging documentation, etc.) in a single place.
- Keeping product-related information up to date automatically (asking suppliers to review and, if necessary, replace their documents).
- Managing supplier qualification and approval processes before completing first purchase, or re-qualifying suppliers with whom a relationship was already established.
- Defining corrective actions for business partners and managing problem resolution processes with them.
- Collecting, storing, and keeping agreements and contracts up to date.
- Automating processes for future business interactions to save time.
- Sending feature requests, feedback and complaints to suppliers.
- Easy and fast access to the supplier's product catalogue and documentation.
- Providing an overview of the status of all documents that have already been requested through the platform.
- Being audit ready at any time with all the information integrated in one platform.

However, there are certain SRM challenges/problems that ecratum is aiming to solve by digitalising the SRM experience for its customers.

The CEO of ecratum pointed out SRM challenges like gaps in communication among business partners, non-transparency of different business processes, and dissatisfactory quality parameters regarding product documentation or supplier specification. However, with the use of IT, ecratum aims to eliminate these challenges by automating many processes. One of the best-known processes is the flow of exchange of product and supplier documentation. The platform enables quality managers to gather the right documentation by reaching their suppliers directly. This way, document requests bypass the purchasing department, making communication more efficient and the cycle of collecting the right documents faster.

To dig deeper into understanding how this platform has changed the way that supplier relationship-related processes were done before, in an interview with a representative from the CS team, I received valuable insights based on summarised ecratum client feedback. From his daily communication with customers, the representative stressed that ecratum has drastically changed and facilitated documentation management, leading to more productive relationships among business partners. He explained that before ecratum, customers used to conduct documentation management using traditional tools like email, Excel sheets, fax, etc., storing them on external hard drives or even collecting them as hard paper copies. Following this path, customers would get frustrated since the documentation would be collected in an unstructured way, making it challenging to find the required information quickly. Not all the collected documentation would be stored in a single place; it was difficult to access it at any time from any place, and the process of reviewing and analysing was time-consuming. Due to these issues, companies are moving their traditional SRM to advanced technological platforms where they can be more efficient and stay competitive while working closely with their suppliers. Dealing with extensive data via Excel would get confusing, and most of all, it was not ideal for visualising the required data. Users were creating lists of required documents and certifications and continuously updating them manually. Based on the lists of things that they would need, they had to email every supplier individually. This workflow tended to be very time consuming, and they started to realise the need to automate the process and to be able to sort through their data, as they had countless lengthy spreadsheets with little or no overview.

For users relying on Dropbox and Drive, the experience was similar. Neither of these tools is tailored to store and sort through all the specific data that our users have. Examples include lists of required documents for products. Based on these lists, users request what they need. Using Drive and Dropbox does not provide an overview to the user where the status of document collection/completion are shown. These tools are made mostly for the storage of documents and not for analysis or an overview of what is the status quo. Further, there are many risks and compliance issues associated with using public cloud storage. One of the cases is the Dropbox since it has been a target for many security breaches. This tool offers a straightforward user interface that it allows the files to be shared easily, yet, on the other side, it has taken the attention of many cyber-criminals (Batters, 2016).

Users that relied on email as a tool to exchange information and documentation had to look through the spreadsheets that they had created, handpick the items that they need, and individually send requirement emails to their suppliers. Responses from suppliers were not guaranteed.

- Most of all, since the quality professionals get all the emails from the suppliers, it is very easy for them to lose those documents in their inbox.
- Customers do not have an easy way of tracking everything in one place or of seeing the connection between what was requested and what they got in return.

Even though part of the target audience was a step ahead with implementing SAP and other systems for their company to manage supply chain processes, they still faced problems along the way. These systems do not save time for our users, as they are challenging to use and to have every set up takes vast monetary resources. The biggest issue is that the suppliers have to have credentials in order to reply to any of the requests made by the suppliers through these systems, which leads to unhappiness from the quality managers. In the end, the return on Investment (hereinafter: ROI) appeared to be quite low due to all of these issues.

As a result of using the tools as mentioned earlier and not being able to tackle their problems efficiently, users are adopting SRM tools to foster their daily tasks and improve their performance overall. Ecratum is a customised digital tool that is built with a supply chain process in focus. Thus, it offers its customers the ability to:

- Make sure that the files they have are valid and up to date.
- Make sure that they have all the files based on their list of requirements (for product documentation and certificates from suppliers).
- Have an overview of all of their files.
- Store documentation in one place.
- Communicate and receive documents in one place

With such a system, users can create checklists which are then visualised as a bar graph based on the files that they have. They can ask for files in bulk based on these requirements, and the responding user does not need to have an account (unlike the enterprise systems), which increases the response rate by 70 per cent. With bulk actions in terms of requirement list creation, requests to suppliers, and smart sorting and filtering, users can cut down their documentation workload by at least 40 per cent. This number does depend on how they use the app, but since most of their job is automated, they do not have to ask for files that may have expired constantly: they can easily set an expiration date and reminders for suppliers. Ecratum then triggers automatic emails to which the suppliers simply respond, and the files arrive on the user's account.

Unlike Excel, the system provides a clear overview of all document expirations and requirement list completion. The users are then easily able to glance at their data and take action based on the overview. This, again, is powered by the automation in the system, which takes the burden of one-by-one requests from the users. Most importantly, all documents, communications and the data overview are tracked in one place. The documents are no longer scattered in different places, and the company is easily able to pass an audit with the use of smart search and navigation.

During my interactions with users, I noticed that auditors do not always ask for all of the files in each audit. They can ask for specific files, which the quality manager needs to find. At this point, ecratum provides powerful tools within the system, like tags and searches, that are very helpful when it comes to finding the right information at a given time.

As a result, with input from the customer service team, I was able to identify a list with main advantages that the suppliers would receive from using this platform to respond to the task received from their clients:

- Reduce the time needed to provide clients with documentation that they request
- Possibility to create a centralised product catalogue and upload the product documentation
- Easily share product documentation with customers in a safe encrypted way
- Receive feature requests, feedback and complaints from clients and instantly respond to them
- Help in achieving better customer service and product quality by analysing all incoming complains
- Possibility to create a Knowledge Base within the platform that gives 24/7 access to their customers

Over the past years, ecratum has come up with new tools that have positively impacted and changed the way business partners engage with each other to achieve better supply chain management. As is elaborated in the case study, PDoc Share and PDoc Collect are products that have come along with several features and that have been rolled out to users to streamline and improve processes by focusing on cloud computing technologies. The product features, such as reminders, automated request sending, multi-approval documentation, multi-upload documentation, file sharing and tagging, file collecting, and sorting and email ingestion have proved to be highly successful, with a high rate of adoption from users.

Furthermore, there are additional benefits that contribute to making customers use web-based SRM software. With insights from the CS team and having to interact with ecratum customers personally while working as a product manager, I have noticed that companies in various industries are highly attracted to automated processes within SRM. Automated processes can save a lot of labour and time resources, allowing a faster completion cycle of daily tasks and more space to focus on other essential operations.

Thus, with the use of IT ecratum offers features like:

- Workflows: users can practice this feature to create automated workflows for the documentation tasks, product documentation tasks and question tasks.
- Automatic Reminders: performing manual document and supplier management can become a struggle and can lead to unwanted consequences. To avoid this case, Reminders are highly used by customers in order to keep track of the documentation expiry date (if they have one), re-upload, notification on important events with their suppliers etc.
- To-do task emails: these emails are sent by ecratum to suppliers to notify them regarding the tasks they have to complete for their clients. In case suppliers do not complete the tasks, the system keeps sending emails in a one-time per week time interval. This way,

suppliers always know the number of pending tasks they have to complete and on the other side, clients do not have to be worried about reminding their suppliers to send the needed information.

#### 5.4.2 Survey and interview findings

As a Product Manager working together with the team responsible for building these two products, I had the opportunity to reach out ecratum customers directly and understand their interest in offering more advanced software in the field of SRM. Before starting to build PDoc Share and PDoc Collect, I prepared a questionnaire, the results of which would be used to understand users' interest in the planned innovations. This questionnaire was created in both English and German and was sent to a group of active companies chosen from the CS team. The questionnaire included six questions through which I aimed to identify how the process of documentation exchange was performed currently. More specifically, the questions sought to understand the volume of products sold/bought, the volume of documentation needed for these products, how many people inside the company were responsible for managing this task, what tools they used to perform the supplier relationship, and how interested these companies were in a new contemporary solution.

Analysing the results from the 45 companies that responded, I concluded that the interest rate expressed from the respondents was quite high. Overall, 52 per cent of respondents were positive towards using this tool. These respondents did not currently use any specific tool to manage documentation from their business partner, and they used email as a way of exchanging information. Regarding the volume of the products traded and the amount of documentation they exchanged, most of the answers (~70%) indicated up to 500 products with often up to ten documents requests per product.

After analysing user interest towards a new software tool to hasten and improve SRM, the decision to continue with the development of the product was made. Furthermore, a number of companies that participated in the survey agreed to join Beta testing for the new features. This feedback is used in my research with the purpose of analysing user behaviour and adoption when it comes to the use of IT in supply chain processes.

#### **Post-deployment interviews and user feedback**

During the development and implementation phases of these products, I had the chance to communicate with the CTO at ecratum regarding the methodology and user participation when building PDoc Share and PDoc Collect. Having this opportunity, I scheduled an unstructured interview with the CTO at ecratum. The interview was conducted with the aim of getting to know the workflow and the processes that were followed during the development of the new products on the platform. The main focus related to the methodology used in requirements gathering, developing products, the flexibility of the team in coping with scope change, product backlog and the final result. This interview took in total around

30 minutes and was held at a suitable time for the participant following the first round of development. I started the interview with a brief introduction to my research, explaining my goal and the focus. The participant was asked about the development methodologies and approach used. However, considering that the interview was unstructured with no predetermined set of questions planned beforehand, a lot of interesting and useful insights emerged as we discussed the topics I initiated.

During the interview, the CTO stressed that the development team was highly focused both back end and front end wise to develop an interface that was easy for the users to navigate. The goal was to build the file upload, file assign, review and filtering with as few steps as possible. For this reason, during the development phase, the team prepared prototypes and conducted a few user tests to gather feedback. After a few months of hard work and a slight change of scope in order to meet user expectations, the roll-out plan and deployment of these products on the ecratum platform was successfully achieved.

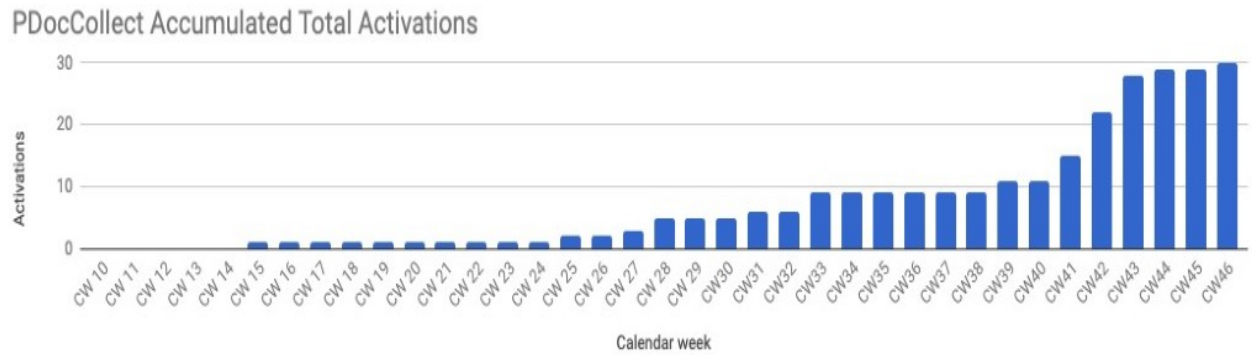
The development team responsible for the PDoc Collect and PDoc Share products worked by practising the SCRUM agile methodology. Practising this methodology, many continuous releases were performed, meaning that the products were not released as a full pack once all the features were developed. In contrast, small development iterations were conducted which made it possible for the clients to have new functionalities in shorter cycles. This was beneficial for the company in that feedback was collected in advance and it was possible to find product performance ache cases and bugs earlier.

The product team was highly focused on clearly defining software and user requirements for the project and made sure the user feedback was adequately analysed and incorporated into the product development cycle.

The products were displayed in ecratum store, the marketplace inside the application from where clients could subscribe to the plan that was most suitable for them. Both PDoc Collect and PDoc Share are available in multiple languages and have English and German user support. Figure 16 and Figure 17 show the data that capture the number of product activations by new customers on PDoc Share and PDoc Collect in the time frame of calendar weeks. These are customers who did not use the product before but started to adopt it recently via the ecratum marketplace.

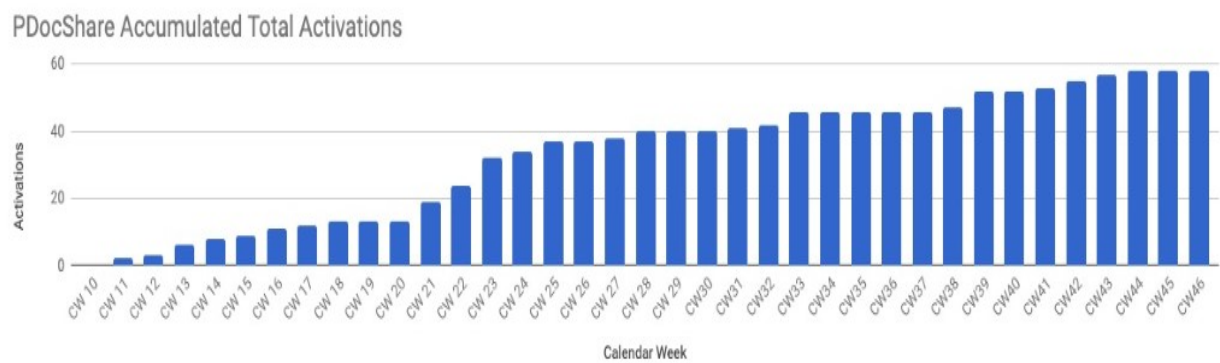


Figure 16: User adoption of PDoc Collect after release



Source: Own work.

Figure 17: User adoption of PDoc Share after release



Source: Own work.

The data show that these products have a positive growth rate, rising weekly. However, to learn more about their adoption, efficiency and user satisfaction, I gathered user feedback with the help of the CS team. In total, 86 companies were contacted by telephone and asked how they found these products during their everyday interaction with business partners. From the total feedback, 38 per cent of companies contacted were completely satisfied with the product. These companies had no complaints regarding sharing the documentation, managing it or communication with business partners. During the analysis, I noted that these companies had in common the number of documents they exchanged (usually up to five) and the fact that they only exchanged standard documentation that was usually the same for their clients: there were no individual templates or information for different companies.

The rest of feedback indicated that companies value the idea of the tools but, due to the extensive volume of their work, they have raised some interesting points. Companies that used the ecratum platform even before the creation of these products stated that it would be more efficient if all the previous documentation that had been exchanged via ecratum were

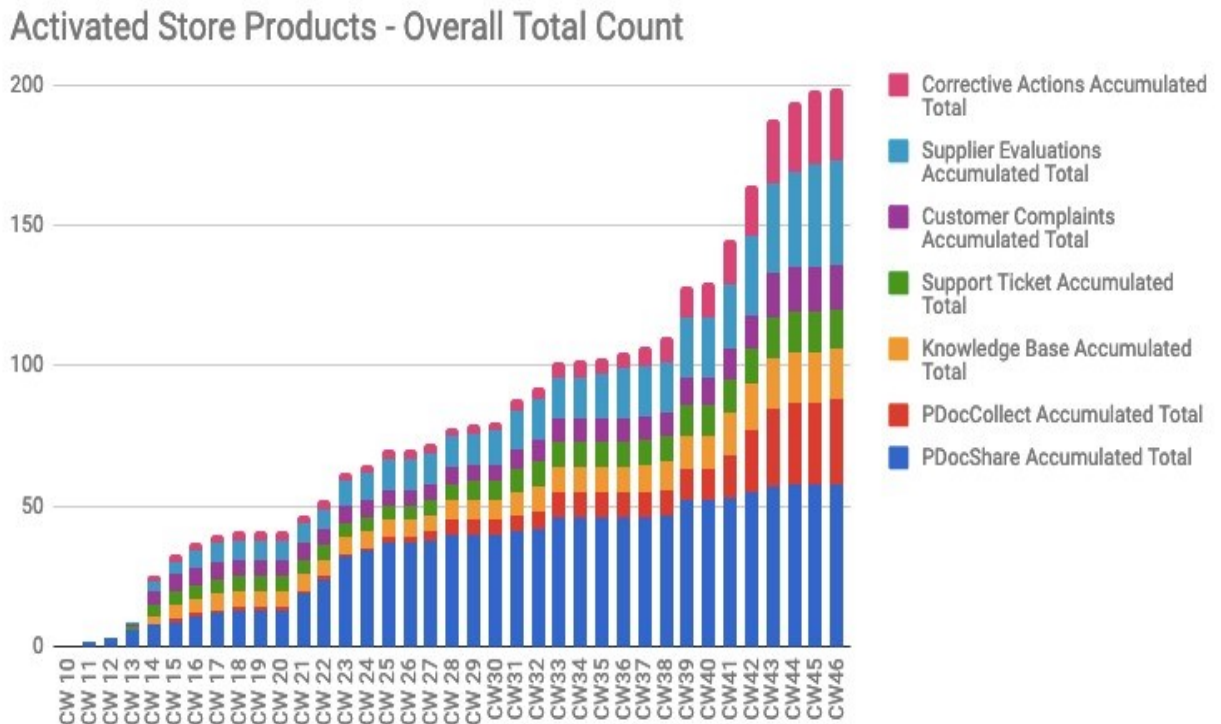
stored and usable in the new product. This would mean they did not have to upload it again and build product documentation storage for tasks they had already performed.

Another important point that mentioned was the improvement of the mass sharing/assigning of documentation. Companies said that they were moving towards cloud computing when interacting with their suppliers, and so it was essential to complete different tasks in a short time. In the first version of PDoc Share, for each file that was uploaded, the user must assign it to the right product, document type and language. This process is found to be time-consuming for some of the respondents, who would like to use the tool for a large amount of documentation: they would rather have an option to multi-assign or upload files at the same time that covered a bundle of products.

Digging deeper into the conversations with customers, I noted that in the following versions of the product, customers expected to see the possibility of a link between PDoc Share and PDoc Collect. This would mean that if a supplier uploaded a file to respond to a product documentation task in ecratum, he should have the ability to use this task information in PDoc Share. Similarly, if a supplier has uploaded the file in PDoc Share and shared with the client that is sending the task, the customer should get that information from there instead of sending a task. Moreover, since the current logic of requesting required documentation on ecratum works based on the task, clients that deal with a more significant number of suppliers were interested in having an integrated feature in PDoc Collect that would allow the automation of tasks for a product group. This way, they would save time by having task automation triggered and bypassing the manual process of creating individual tasks for every request they need to complete within their supply chain operation.

Finally, the behaviour data available from the adoption of the new products that ecratum was providing to users, shows that users' interest in advanced SRM features that rely heavily on cloud computing technologies is continually growing. Figure 18 offers a visual representation of the subscription activity for the new products.

Figure 18: Weekly user subscription



Source: Own work.

### 5.4.3 Future improvements based on gathered user information

#### Delivered improvements in the second development phase of the product

Similarly, as part of the product team at ecratum, I followed the same path and practices while working in the next development round after the initial PDoc Share and PDoc Collect version were delivered and rolled out. In comparison to the previous versions, I had more defined requirements from users and in addition, better visibility on their interaction with the features on the interface that was captured and analysed using web-based behaviour tracking tools (heatmaps and recordings).

Automated testing was practised highly during this round of development to perform many tests in a short time. This type of test it is mostly used once the initial software is developed and aims to remove numerous manual processes by relying on software tools that are creating test cases based on program’s specifications (Rafi, Moses, Petersen & Mäntylä, 2012). On the other hand, A/B testing presents a technique to test the functionality and performance of the product by presenting two variations of it to the audience and comparing the results (Dixon, Enos & Brodmerkle, 2011). I was thoroughly focused with building A/B tests that were carefully tailored for different groups to find out the most efficient and effective user interface for log-in processes, navigation menu performance, file sharing

access and also testing product content in general. In addition to A/B testing and web tracking performance, a feedback loop with users was practised understanding the direction and expectations from the active platform users in order to improve the experience on-site by performing iterative process improvements. To achieve the most efficient use out of this practice, an employee was assigned to be fully in charge of the feedback capturing and storage, analysing and preparing this feedback to be used for making strategic decisions that would influence the roadmap of the development process.

Following the methodologies mentioned above and tools lead to working process shift that drastically impacted the performance of the team and customer satisfaction overall. As a result, the roll-out of the second product version delivered smart features with significant business values that improved customers' satisfaction and attracted new product sign-ups from different marketing campaigns.

the **Multi Upload** feature was launched as part of PDoc Collect portfolio product, round. Previously, Suppliers that work with clients via ecratum were receiving some particular product document tasks related to the same products but requested by different customers. As a consequence of this scenario, they had to reply to those tasks individually, and of course, this process was time-consuming considering the number of tasks they were receiving. With the new functionality instead of answering the documentation tasks on an individual basis, suppliers can save a significant amount of their working time by answering multiple tasks at once. The advanced interface allows suppliers to select multiple product document tasks that are delivered into their account and then uploading a single file that answers all the selected tasks at once.

Moreover, on this version of the product improvement, **Multi Approve** feature was also added. This way, both business partners are taking advantage of the new technological improvements on the platform to speed up the process of document exchange. With Multi Approval, clients can approve all the incoming documentation on their inbox for the cases when they have requested the same documentation for a number of defined products by their side. Initially, customers had to go over all the tasks with files that were present on their inbox and manually approve or disapprove each of them. Such action was time consuming and lead to reduced customer satisfaction when working on scenarios with exchanging multiple documentation at once. However, after the deployment of this feature into the platform, one of the biggest ecratum customers reported that they are extremely satisfied using multi approval to review the tasks they receive from suppliers. This particular customer is also one of the most active users on the platform with the highest amount of documentation stored into the platform, and for this reason, their feedback was crucial to evaluate the value of the new improvements. Based on their report, 60% of the tasks can be reviewed with multi approval.

Supplier participation was an issue that occurred for many clients when using ecratum. As described by CS representatives, the main reason for this was the condition that suppliers

had to sign up and go through the registration phase in order to respond to tasks created for them. Even though ecratum has a large base of active suppliers, there are also suppliers that are not willing to adopt such a platform. This, of course, raises a problem for clients when they want to move their SRM process online and use web software instead of traditional methods. To facilitate the supplier activation, participation and responsiveness on tasks the new **Email Ingestion** feature was built. Email Ingestion help customer with collecting all the product documentation files more efficiently with less effort needed from the supplier base that is not using ecratum platform. Using upload by email option, the tasks can be fulfilled by attaching the requested file directly on the notification email that the supplier receives on their email address when asked to provide documentation by customers. This way, suppliers can reply to the email by uploading the requested documentation and the email ingestion feature on the meanwhile, will link this file to its respective task in ecratum platform. As a result, the customers can achieve higher response rate and document completion by having all their supplier's documentation stored into a single place.

**Automation** of sending product document tasks was one of the new features introduced during the phase of product improvement. This feature has made possible for users to save the time they spend on manually sending every single product document task to a supplier by creating a product group where they can specify much documentation they need to request and trigger automation in just a few steps. The new interface on the application is asking users to input the name of products they want to gather documentation for, the document types needed for these products and as the last step: defining the suppliers they need to collect this information from. All this information is mandatory in order for the system to create the tasks and have them delivered to the supplier's account.

With this new implementation, the process of requesting and collecting multiple product documentation at the same time has drastically improved the way ecratum clients work using cloud technologies. As reported from one of the German clients of ecratum, including product automation feature into their daily operations has led to saving up to 30% of the time responsible quality assurance person was spending to request and collect these documentations.

Last but not least, a **reminder** was the next additional feature to be developed as part of product improvement round. Because users were integrating most of their daily manual tasks into the platform, the number of tasks that they have to complete, or review would grow every day. Thus, having the system trigger automatic reminders for to-do tasks would significantly increase the value of having a centralized digital product where all supplier-related information and tasks were stored. Now in ecratum, users can set reminders for tasks they want to re-evaluate or re-check with their business partner on a particular day. The system will trigger email and an in-app notification for the business partner once the expiry date of the document provided is approaching. In addition to the task reminder, the user will

also receive weekly reminders with a summary of the work they have to complete for their business partner. This way, users can save time, and they do not need to worry about sending emails or making phone calls to keep their documentation up to date. Moreover, they can work more efficiently by ensuring they have the latest documentation and sustaining healthy relationships with their business partners by providing them with transparency and overview of tasks.

New functionalities and their added value are summarized in Table 1

*Table 1: Summary of the new ecratum functionalities*

<b>Functionality name</b>	<b>Added value</b>
Multi upload	This feature facilitates the documentation exchange workflow for suppliers that receive particular product tasks requested by different customers but related to the same products. Instead of responding on tasks on an individual basis, this feature allows adding a single file to those multiple tasks at once.
Multi approve	Multi-approval allows customers to accept several identical documents in just a few clicks. These documents have to be uploaded into the system from the suppliers via Multi-upload. This way, ecratum ensures that the same documentation is valid for multiple tasks.
Email Ingestion	Email ingestion facilitates the collection of product documentation from the supplier base that is not using ecratum platform. Through upload by email functionality, sharing and collecting documentation into one centralized place has become more efficient and comfortable. Documentation uploaded via the email is automatically stored into customers ecratum account.
Automation of sending product document tasks	Automation feature is simplifying the process of collecting multiple product documentation at the same time. Customers will need to create a Product Group from where the automation set-up is done. Once the set-up is completed and automation is triggered, tasks will be sent to the selected suppliers within few minutes
Reminders	Automatically triggered reminders in the form of in-app or email notification keep customers informer about important to-dos and overview of the progress. Reminders can be

---

triggered for the event of task expiration, task review, task completion and weekly progress summaries.

---

*Source: Own work.*

### **Possibilities for further improvement of the products**

Analysing the growth that ecratum had over the years and also observing users behaviour, we can see that ecratum expanded from a simple documentation management tool into a powerful B2B platform. Besides focusing on transforming the management of supply documentation, ecratum aims to use the latest IT solutions and go further by providing an environment for business partners to build and maintain healthy business relationships. After operating in the market for seven years, ecratum's goals and vision have been adjusted to synchronise with the rapid development of technology in order to deliver the products that will be competitive and meet user's needs. This practice is seen with the evolution that this SRM platform has gone through, starting as a web application with the single functionality of requesting and responding to documentation tasks between suppliers and clients and later growing into SaaS tool that has to boost the supply chain efficiency for its clients.

This advancement of the company and the platform itself is the result of rapid development and the influence that IT has made over the past years. As we are living in a digitised world where technology is part of our daily life activities, tremendous change and advanced Supply Chain digitisation, it is not an exception. With the rapid digitalisation and adoption of IT on companies, integration of ecratum platform with other external tools that companies are using should be considered. In addition, mobile devices nowadays tend to be considered as a necessity when working in a dynamic environment and a crucial factor to target when focusing on multi-channel strategy. Thus, , the importance of building a mobile application should be prioritised and placed in the roadmap to expand the product and increase customer satisfaction.

As it is seen during the empirical research I have elaborated during this paper, the concept of the IoT has impacted the overall supply chain by automating the purely operational tasks. Besides, the adoption of cloud computing technologies has enabled companies to perform better demand planning and relationships with their business partners within the supply chain. However, even though the change and the development it has turned out to be a success factor for companies that have improved the supply chain, this does not indicate that further investment for additional technological advancements and digitised products should be left aside. In contrast, the case study that I have elaborated indicates that SRM platform is always requiring incremental development in order to offer the most efficient output to support the supply chain and be competitive in the market.

Moreover, validating and discussing requirements with the users is the key to developing technological solutions. This user base should be carefully selected in order to ensure that all the personas of the product are involved and consulted during the initial phase of project development. Ecratum did not succeed to do this from the first kick-off for PDoc Share and PDoc Collect. However, after following this approach during the second phase of product development, significant product improvements were delivered. Another factor that can contribute to further product improvements is the practising of in-depth product analytics on all stages of the product. Product analytics was a limitation that ecratum was facing. Therefore, the product and development team could not make usage of data to understand that the customers with many variations of product documentation were struggling to use the system and send tasks to the different supplier base. If this limitation on data analytics would be solved, more insightful and data-driven decision making can be made in advance and solve potential gaps in product experience.

## **DISCUSSION**

The case study based on the SRM platform provided by ecratum shows changes of user behaviours while interacting with different tools to manage their documentation and relationships with suppliers.

Supply chain participants across different industries came to an understanding that the previous technical tools that were being used are not specifically made for the most efficient tracking and storage of all supplier documentation. As the supply chain moves towards more digitalized processes, the need for more sophisticated software and digital solution becomes inevitable.

Based on the ecratum case study, I observe that IT adoption within the supply chain has a direct impact on the way how quality assurance and purchasing personas conduct their daily tasks and how they interact with their business partners. As a result, the mentioned personas are always looking out for advanced tools with functionality than can automate manual processes. One of the most significant changes is the adoption of modern cloud-based SRM platforms. An SRM platform provides users with several benefits that have a direct influence on the efficiency of the whole supply chain management.

Mobility and accessibility of data is a significant benefit of the use of ecratum SRM platform. The adoption of ecratum lead to usage reduction of traditional mails, fax, Excel sheets and other tools that were used between business partners. These tools are not specifically tailored for supply chain operations, yet, they were only used as a workaround until a sophisticated software such as ecratum was adopted. Moreover, the transparency of data between departments is another important benefit. Since the system is permission-based, the users of ecratum share their documentation and tasks about suppliers with various departments; therefore various departments can simultaneously communicate.



Requesting and sharing data via cloud-based ecratum SRM can prevent data loss and ensure maximum file safety against unpredictable circumstances. As a result, using the cloud technologies to manage relationships with suppliers serves as a centralised storage unit for all the vital information with higher security that reduces the risk aversion of losing files due to hard drive malfunction or hard copy loss.

I have used an example of PDoc Share and PDoc Collect to analyse the product development, adoption and future user expectations. These products aim to digitalize the process of file management, storage and distribution between business partners. As described during the case study, I have analysed the user behaviour of the target audience and monitored each step of product development. The initial product research and the results from user interviews validated the value of the product. Having this as a strong backup, ecratum assigned the development team and established agile methodologies to build both of the solutions. Even though 38 per cent of the feedback answers showed that the users were highly satisfied with the product, there was still a gap in terms of functionalities that would be suitable for the broader ecratum audience.

Therefore, the product development conducted more in-depth user research and validated product requirements with a broader audience to make sure all user profiles were captured. Besides, A/B tests were performed to ensure the right functionality of new features was on place followed by a run of the beta test. Even though the delivery of some features such as multi-upload, multi approve, email ingestion, automation of sending product document tasks and reminders were released after several iterations and further effort from the team, they delivered confident positive output. These features exceeded user expectation. However, during the development journey of PDoc Share and PDoc Collect, I have discovered three areas of improvements that can help ecratum:

- The process of requirements gathering and validation. To ensure that the right user requirements are captured from the initial phase of product development, ecratum needs to perform more extensive research about its users. Better communication and feedback loops will also help the process and facilitate the requirement gathering. Also, besides involving customers on requirement gathering, requirement validation should be performed with the end-users. Pursuing this approach, ecratum will remove the missing communication gaps and at the same time deliver the functionalities that will meet expectations of a broader audience.
- Stronger data-oriented approach. Due to the lack of data analysis resources and tools, data-driven decisions were limited during the development of PDoc Share and PDoc Collect. Therefore, an in-depth analysis of the users' experience on the platform was missing. One of these issues was the time-consuming scenario where customers wanted to upload the same documentation to be sent to different suppliers (now solved with the multi-upload feature). For future success stories, it is important to establish a data-oriented approach within the team and the company as a whole. This way, ecratum will

have greater visibility of the current situation, forecast the future tendencies and capture any existent bug faster.

- The platform should continually keep up with the advancement of the technology and strive to offer users a new innovative solution, e.g. make the SRM platform more mobile-friendly. Another beneficial innovation would be the integration of ecratum with other digital tools that users have adopted on their daily work routine. Such tools relate to messengers application, document storage, address books and other resources from where important data and essential can be transferred into the platform.

In overall, using cloud solutions and IT in a supply chain and quality control context is beneficial in many ways, which in the end provide safety and security of information, making it accessible to most critical stakeholders and improving business processes within the company. However, this does not mean that companies should reduce their investment in technology to deliver new products once they have attracted a considerable number of clients. Instead, companies should strive to deliver solutions that will foster supply chain management continually.

Ecratum should continue being agile when developing new products as well as highly focused on gathering user feedback and requirements before planning the next set of products. As the case study demonstrates, the adoption of cloud computing technology has significantly improved performance and customer satisfaction. Ecratum should continue practising agile methodology to deliver the future product in an incremental approach.

## **CONCLUSION**

SCM is a key strategic approach towards establishing and maintaining the company's robust supply chain operations. According to the literature review, the focus of SCM is to ensure the coordination and optimization of the supply chain, it undertakes all the activities involved during the flow of goods, monetary values and information from the extraction of raw materials until the end delivery stage.

The theoretical part of this thesis suggests that building and maintaining healthy relationships with suppliers is a valuable aspect of supply management. Furthermore, healthy relationships with suppliers have a direct impact on supply chain performance. SRM discipline focuses on establishing close relationships with target suppliers based on trust, transparent communication, collaboration and mutual growth. This thesis explains that with the practising of SRM, companies can categorize and segment interactions with suppliers. It is crucial to acknowledge that the implementation of SRM may bring some challenges and risk for companies. However, identifying and tackling the challenges from an earlier stage will help companies to succeed with the SRM approach. Integration of IT inside supply chain processes leverage numerous benefits for the organization and its performance. Real-time information sharing, agility towards the market, security, smarter decision making, better

communication with business partners and streamlined business processes are some of the important benefits emerging with IT integration.

The thesis further explores the SRM, relation to IT and the ongoing digitization process that organisations are facing. As a result, the thesis indicates that the adoption of IT throughout SRM has a tremendous positive impact on the efficiency of the supply chain. Cloud computing has enabled powerful digital transformation for the traditional supply chain. Moreover, cloud computing technologies support web-based SRM solutions to enhance relationships with suppliers in the global market. Web-enabled SRM provides companies with streamlined communication, removing geographical silos, information sharing and ubiquity, centralized supplier knowledge and business transparency.

Through ecratum case study, this thesis describes the adoption of the web-enabled SRM platforms and the impact that cloud computing technologies have on supplier relationships. The provided in-depth analysis elaborates the change in user's behaviour that occurs as a result of the IT advancements on SRM. Results show that with the help of cloud computing, the process of exchanging documentation and information in the supply chain has gone through drastic changes. SRM users are moving away from traditional tools and workarounds and shifting attention towards more sophisticated digital solutions.

However, barriers on user's communication while defining and understanding the requirements, direct visibility and accessibility into analysing users' behaviour can be potential limitations when developing cloud-enabled SRM solutions. Therefore, it is vital to follow a user-centric approach focusing on collecting and validating requirements with users and use the power of data analytics to understand the current situation and forecast future trends.

After elaborating the impact that IT brings to the ongoing digital transportation of SRM, it can be concluded that to be a powerful cloud-based solution and competitive in the global market, continuous innovation is needed. Digital SRM platforms have to keep up with the latest advancements of technology by driving continuous development cycles, setup and follow agile mindset within their organisation.

## REFERENCE LIST

1. Agarwal, A., Shankar, R. & Tiwari, M. K. (2007). Modeling agility of supply chain. *Industrial marketing management*, 36(4), 443–457.
2. Aronow, S. (2019). *Digital Supply Chain Powers Workforce of the Future*. Retrieved March 29, 2020, from: <https://www.scmworld.com/digital-supply-chain-powers-workforce-future>
3. Arsovski, Z. & Rankovic, V. (2011). Mobile supply chain management—key technologies and applications. *International Quality Conference*, 5, 431–438.

4. Barata, J. & Cunha, P. R. (2016). Mobile supply chain management: Moving where? *In Proceedings of the 13th European, Mediterranean and middle eastern conference on information systems (EMCIS)* (pp. 1–13).
5. Barata, J., Da Cunha, P. R. & Stal, J. (2018). Mobile supply chain management in the Industry 4.0 era. *Journal of Enterprise Information Management*, 31, 173–192.
6. Batters, M. (2016, April 14). Security Comment: Why are people still using Dropbox for business?. *Legal IT Insider*. Retrieved August 29, 2019, from <https://legaltechnology.com/security-comment-why-are-people-still-using-dropbox-for-business/>.
7. Beil, D. R. (2010). Supplier selection. *Wiley encyclopedia of operations research and management science*. University of Michigan, Michigan, United States.
8. Ben-Daya, M., Hassini, E. & Bahroun, Z. (2019). Internet of things and supply chain management: a literature review. *International Journal of Production Research*, 57(15–16), 4719–4742.
9. Biswas, S. (2014). *Relationship marketing: concepts, theories and cases*: PHI Learning Pvt. Ltd.
10. Botta, A., De Donato, W., Persico, V. & Pescapé, A. (2016). Integration of cloud computing and internet of things: a survey. *Future generation computer systems*, 56, 684–700.
11. Brindley, C., & Ritchie, B. (2004). Chapter 1: introduction. *Ed., Supply Chain Risk*, Ashgate Publishing Ltd., Aldershot, Hampshire, UK.
12. Cardozo, E. S., Araújo Neto, J. B. F., Barza, A., França, A. C. C. & da Silva, F. Q. (2010, April). SCRUM and productivity in software projects: a systematic literature review. *In 14th International Conference on Evaluation and Assessment in Software Engineering (EASE)* (pp. 1–4).
13. Carroll, M., Van Der Merwe, A. & Kotze, P. (2011, August). Secure cloud computing: Benefits, risks and controls. *In 2011 Information Security for South Africa* (pp. 1–9). IEEE.
14. Carter, S (2010); “Supplier Management- What is a Supplier Relationship Management–Program?”. *EzineArticles*. Retrieved December 12, 2019, from <http://ezinearticles.com>.
15. Cegielski, C. G., Allison Jones-Farmer, L., Wu, Y. & Hazen, B. T. (2012). Adoption of cloud computing technologies in supply chains: An organizational information processing theory approach. *The International Journal of Logistics Management*, 23(2), 184–211.
16. Chang, H. H. (2005). The influence of continuous improvement and performance factors in total quality organization. *Total Quality Management & Business Excellence*, 16(3), 413–437.
17. Chengalur-Smith, I., Duchessi, P. & Gil-Garcia, J. R. (2012). Information sharing and business systems leveraging in supply chains: An empirical investigation of one web-based application. *Information & Management*, 49(1), 58–67.

18. Christopher, M. & Lee, H. (2004). Mitigating supply chain risk through improved confidence. *International journal of physical distribution & logistics management*.
19. Conway, G. & Curry, E. (2012, April). Managing Cloud Computing-A Life Cycle Approach. In *CLOSER* (pp. 198–207).
20. Cooper, R. G. & Edgett, S. J. (2012). Best practices in the idea-to-launch process and its governance. *Research-Technology Management*, 55(2), 43–54.
21. Cooper, R. G. & Sommer, A. F. (2016). Agile-Stage-Gate: New idea-to-launch method for manufactured new products is faster, more responsive. *Industrial Marketing Management*, 59, 167–180.
22. Cutting-Decelle, A. F., Young, B., Das, B. P., Case, K., Rahimifard, S., Anumba, C. J. & Bouchlaghem, D. (2007). A review of approaches to supply chain communications: from manufacturing to construction. *ITcon*, 12(2007), 73–102.
23. DaSilva, C. M., Trkman, P., Desouza, K. & Lindič, J. (2013). Disruptive technologies: a business model perspective on cloud computing. *Technology Analysis & Strategic Management*, 25(10), 1161–1173.
24. Lammers, D. (2019). Data and IP Security: Hot Topics at APC 2019 Conference. *Applied Materials*. Retrieved April 12, 2020, from <http://www.appliedmaterials.com/en-in>.
25. Davis, F. D. & Venkatesh, V. (2004). Toward preprototype user acceptance testing of new information systems: implications for software project management. *IEEE Transactions on Engineering management*, 51(1), 31–46.
26. Deloitte. (2015). *Supplier Relationship Management (SRM)-redefining the value of strategic supplier collaboration*. Deloitte. Retrieved August 17, 2019, from [https://www2.deloitte.com/content/dam/Deloitte/de/Documents/operations/Supplier\\_Relationship\\_Management\\_2015.pdf](https://www2.deloitte.com/content/dam/Deloitte/de/Documents/operations/Supplier_Relationship_Management_2015.pdf).
27. Dixon, E., Enos, E. & Brodmerkle, S. (2011). *U.S. Patent No. 7,975,000*. Washington, DC: U.S. Patent and Trademark Office.
28. Durowoju, O. A., Chan, H. K. & Wang, X. (2011). The impact of security and scalability of cloud service on supply chain performance. *Journal of Electronic Commerce Research*, 12(4), 243–256.
29. Ecratum. 2019. *Pdoc collect express*. Retrieved March 12, 2019, from: <https://www.ecratum.com/supplier-relationship-management/pdoc-collect-express>.
30. Ecratum. 2019. *Pdoc share*. Retrieved March 12, 2019, from: <https://www.ecratum.com/customer-service-management/pdoc-share>.
31. Erickson, J., Lyytinen, K. & Siau, K. (2005). Agile modeling, agile software development, and extreme programming: the state of research. *Journal of Database Management (JDM)*, 16(4), 88–100.
32. European Network and Information Security Agency. (November 2009). *Cloud Computing: Benefits, Risks and Recommendations for Information Security*. Retrieved February 09, 2019, from <http://www.enisa.europa.eu/act/rm/files/deliverables/cloud-computing-risk-assessment>.

33. Fawcett, S. E., Magnan, G. M. & McCarter, M. W. (2008). Benefits, barriers, and bridges to effective supply chain management. *Supply Chain Management: An International Journal*, 13(1), 35–48.
34. Fiala, P. (2005). Information sharing in supply chains. *Omega*, 33(5), 419–423.
35. Fitzgerald, B. & Stol, K. J. (2014, June). Continuous software engineering and beyond: trends and challenges. In *Proceedings of the 1st International Workshop on Rapid Continuous Software Engineering* (pp. 1–9). ACM
36. Flynn, A., Harding, M. L., Lallatin, C. S., Pohlig, H. M. & Sturzl, S. R. (Eds.) (2006), ISMGlossary of Key Supply Management Terms (4th ed.), Tempe, AZ: *Institute for Supply Management*.
37. Forkmann, S., Henneberg, S. C., Naude, P. & Mitrega, M. (2016). Supplier relationship management capability: a qualification and extension. *Industrial Marketing Management*, 57, 185–200.
38. Galaskiewicz, J. (2011). Studying supply chains from a social network perspective. *Journal of Supply Chain Management*, 47(1), 4–8.
39. Grean, M. & Shaw, M. J. (2002). Supply-chain partnership between P&G and Wal-Mart. In *E-Business Management* (pp. 155–171). Springer, Boston, MA.
40. Gunnarsson, C. & Jonsson, S. (2003). Charge the relationships and gain loyalty effects: Turning the supply link alert to IT opportunities. *European Journal of Operational Research*, 144(2), 257–269
41. Haddad, C. & Blome, C. (2017). *Supplier Relationship Management 2.0: Cross-industry Best Practices*. [Master's thesis, Université catholique de Louvain]. Louvain School of Management.
42. Halil, F. M., Mohammed, M. F., Mahbub, R. & Shukur, A. S. (2016). Trust attributes to supply chain partnering in industrialised building system. *Procedia-Social and Behavioral Sciences*, 222, 46–55.
43. Harsono, A. (2013). How Walmart Enhances Supply Chain Management With CPFR Initiatives.
44. Hassan, Q. (2011). Demystifying cloud computing. *The Journal of Defense Software Engineering*, (Jan/Feb), 16–21.
45. Highsmith, J. A. & Highsmith, J. (2002). *Agile software development ecosystems*. Addison-Wesley Professional.
46. Hoek, R. (2013). *Supplier Relationship Management How key suppliers drive your company's competitive advantage* (Publication). *PwC*. Retrieved November 01, 2019, from: <https://www.pwc.nl>.
47. Huang, C. C. & Lin, S. H. (2010). Sharing knowledge in a supply chain using the semantic web. *Expert Systems with Applications*, 37(4), 3145–3161.
48. Huhns, M. N., Stephens, L. M. & Ivezic, N. (2002, July). Automating supply-chain management. In *Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 3* (pp. 1017–1024). ACM.

49. Jede, A. & Teuteberg, F. (2015). Integrating cloud computing in supply chain processes: a comprehensive literature review. *Journal of Enterprise Information Management*, 28(6), 872–904.
50. Kasser, J. (2002). *The cataract methodology for systems and software acquisition* (Doctoral dissertation, Systems Engineering Society of Australia and ITEA Southern Cross Chapter).
51. Khan, A. (2012). Supplier Relationship Management - Current Problems and Solutions. *SSRN Electronic Journal*. Retrieved March 14, 2019, from <http://dx.doi.org/10.2139/ssrn.2303833>.
52. Kohavi, R., Deng, A., Frasca, B., Walker, T., Xu, Y. & Pohlmann, N. (2013, August). Online controlled experiments at large scale. In *Proceedings of the 19th ACM SIGKDD international conference on Knowledge discovery and data mining* (pp. 1168–1176). ACM.
53. Kotabe, M. & Murray, J. Y. (2004). Global sourcing strategy and sustainable competitive advantage. *Industrial marketing management*, 33(1), 7–14.
54. Kuhn, K. J., Giles, M. D., Becher, D., Kolar, P., Kornfeld, A., Kotlyar, R. & Mudanai, S. (2011). Process technology variation. *IEEE Transactions on Electron Devices*, 58(8), 2197–2208.
55. La Londe, B. J. & Masters, J. M. (1994). Emerging logistics strategies: blueprints for the next century. *International journal of physical distribution & logistics management*, 24(7), 35–47.
56. Lambert, D. M. & Schwieterman, M. A. (2012). Supplier relationship management as a macro business process. *Supply Chain Management: An International Journal*, 17(3), 337–352.
57. Larman, C. & Basili, V. R. (2003). Iterative and incremental developments. a brief history. *Computer*, 36(6), 47–56.
58. Lee, H. L. & Whang, S. (2000). Information sharing in a supply chain. *International Journal of Manufacturing Technology and Management*, 1(1), 79–93.
59. Lindroth, R. & Norrman, A. (2001), “Supply chain risk management: purchasers’ vs. planners view on sharing capacity investment risks in the telecom industry”. In *Proceedings of the IPSERA 11th International Conference*, 25–27 March, pp. 577–95.
60. Liker, J. K. & Choi, T. Y. (2004). Building deep supplier relationships. *Harvard business review*, 82(12), 104–113.
61. Lindner, M., Galán, F., Chapman, C., Clayman, S., Henriksson, D. & Elmroth, E. (2010, October). The cloud supply chain: A framework for information, monitoring, accounting and billing. In *2nd International ICST Conference on Cloud Computing (CloudComp 2010)*.
62. Lou, P., Liu, Q., Zhou, Z. & Wang, H. (2011, August). Agile supply chain management over the internet of things. In *2011 International Conference on Management and Service Science* (pp. 1–4). IEEE.

63. Mahalakshmi, M. & Sundararajan, M. (2013). Traditional SDLC Vs Scrum Methodology—A Comparative Study. *International Journal of Emerging Technology and Advanced Engineering*, 3(6), 192–196.
64. Masoumik, S. M., Abdul-Rashid, S. H., Olugu, E. U., Ghazilla, R. & Ariffin, R. (2014). Sustainable supply chain design: A configurational approach. *The Scientific World Journal*, 2014.
65. Matopoulos, A., Barros, A. C. & van der Vorst, J. J. (2015). Resource-efficient supply chains: a research framework, literature review and research agenda. *Supply Chain Management: An International Journal*.
66. McQueen, R. & Teh, R. (2000). Insight into the acquisition process for enterprise resource planning software derived from four case studies. *PACIS 2000 Proceedings*, 49.
67. Monczka, R. M., Handfield, R. B., Giunipero, L. C. & Patterson, J. L. (2015). Purchasing and supply chain management. *Cengage Learning*.
68. New, S. (2010). The transparent supply chain. *Harvard Business Review*, 88, 1-5.
69. O'Marah, K. (2016). *Future of supply chain*. Retrieved July 12, 2019, from: [http://www.scmworld.com/wp-content/uploads/2017/07/Future\\_of\\_Supply\\_Chain\\_2016\\_.pdf](http://www.scmworld.com/wp-content/uploads/2017/07/Future_of_Supply_Chain_2016_.pdf).
70. Olsson, H. H., Alahyari, H. & Bosch, J. (2012, September). Climbing the "Stairway to Heaven"—A Multiple-Case Study Exploring Barriers in the Transition from Agile Development towards Continuous Deployment of Software. In *2012 38th euromicro conference on software engineering and advanced applications* (pp. 392–399). IEEE.
71. Oracle (2016). *Why supply chain leaders are moving to the cloud*. Retrieved December 02, 2018, from: <http://www.oracle.com/us/oracle-supply-chain-e-book-2872641.pdf>.
72. Park, J., Shin, K., Chang, T. W. & Park, J. (2010). An integrative framework for supplier relationship management. *Industrial Management & Data Systems*, 110(4), 495–515.
73. Percy, D. H., Parker, D. B. & Giunipero, L. C. (2008). Using electronic procurement to facilitate supply chain integration: an exploratory study of US-based firms. *American Journal of Business*, 23(1), 23–36.
74. Porter, K. K. (2019). *Implementing Supplier Diversity: Driver of Entrepreneurship*: Springer.
75. Rafi, D. M., Moses, K. R. K., Petersen, K. & Mäntylä, M. V. (2012, June). Benefits and limitations of automated software testing: Systematic literature review and practitioner survey. In *Proceedings of the 7th International Workshop on Automation of Software Test* (pp. 36–42). IEEE Press.
76. Ralf W. Seifert (2015). *Digesting the shocks: how supply chains are adapting to the COVID-19 lockdowns*. Retrieved April 14, 2019, from: <https://www.imd.org/research-knowledge/articles/supply-chains-adapting-to-covid-19/>
77. Rittinghouse, J. W. & Ransome, J. F. (2016). *Cloud computing: implementation, management, and security*. CRC press.
78. Royce, W. (1970, August). The software lifecycle model (Waterfall Model). In *Proc. Westcon* (Vol. 314).



79. Shackleford, D. (2015). Combatting cyber risks in the supply chain. *SANS. org*.
80. Schramm, T., Nogueira, S. & Jones, D. (2011). Cloud computing and supply chain: A natural fit for the future. *Logistics Management*. Retrieved October 24, 2019, from <https://www.logisticsmgmt.com>.
81. Schramm, T., Wright, J., Seng, D. & Jones, D. (2010). Six questions every supply chain executive should ask about cloud computing. *Accenture Institute for High Performance*, 1–15.
82. Schweiger, C. L. (2011). Use and deployment of mobile device technology for real-time transit information (Vol. 91). *Transportation Research Board*.
83. SCM World community, (2019). The Future of Supply Chain: 2019 Edition, 2019. *Scm World*. Retrieved December 09, 2019, from: <https://www.scmworld.com/future-supply-chain-2019-edition/>.
84. Scrum.Org. (2019). *A Better Way Of Building Products*. Retrieved December 09, 2019 from: <https://www.scrum.org/resources/what-is-scrum>
85. Seman, N. A. A., Zakuan, N., Jusoh, A., Arif, M. S. M. & Saman, M. Z. M. (2012). The relationship of green supply chain management and green innovation concept. *Procedia-Social and Behavioral Sciences*, 57, 453–457.
86. Seric, A., Görg, H., Möhle, S. & Windisch, M. (2020). Managing COVID-19: How the pandemic disrupts global value chains. *UNIDO Industrial Analytics Platform*. Retrieved May 17, 2020, from <https://iap.unido.org/articles/managing-covid-19-how-pandemic-disrupts-global-value-chains>
87. Shahin, M., Ali Babar, M. & Zhu, L. (2017) —Continuous Integration, Delivery and Deployment: A Systematic Review on Approaches, Tools, Challenges and Practices”,
88. *IEEE Access*.
89. Siemens (2018) Supplier qualification process within supplier selection. *Siemens*. Retrieved February 12, 2020, from: <http://w5.siemens.com/cms/supply-chain-management/en/supplier-at-siemens/becomesupplier/steps-to-take/pages/process.aspx>.
90. Singhal, P., Agarwal, G. & Mittal, M. L. (2011). Supply chain risk management: review, classification and future research directions. *International Journal of Business Science & Applied Management (IJBSAM)*, 6(3), 15–42.
91. Smith, R. (2009). Computing in the cloud. *Research-Technology Management*, 52(5), 65–68.
92. Stadtler, H. (2008). Supply chain management—an overview. In *Supply chain management and advanced planning* (pp. 9-36). Springer, Berlin, Heidelberg.
93. Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS quarterly*, 28(1), 45–73.
94. Swafford, P. M., Ghosh, S. & Murthy, N. (2008). Achieving supply chain agility through IT integration and flexibility. *International Journal of Production Economics*, 116(2), 288–297.
95. Teller, C., Kotzab, H., Grant, D. B. & Holweg, C. (2016). The importance of key supplier relationship management in supply chains. *International Journal of Retail & Distribution Management*, 44(2), 109–123.

96. Trent, R. J. & Monczka, R. M. (2005). Achieving excellence in global sourcing. *MIT Sloan Management Review*, 47(1), 24.
97. Trkman, P. & McCormack, K. (2009). Supply chain risk in turbulent environments—A conceptual model for managing supply chain network risk. *International Journal of Production Economics*, 119(2), 247–258.
98. Trkman, P., Budler, M. & Groznik, A. (2015). A business model approach to supply chain management. *Supply Chain Management: An International Journal*. 20(6), 587–602.
99. Truong, D. (2014). Cloud-based solutions for supply chain management: A post-adoption study. *ASBBS Proceedings*, 21(1), 697.
100. Varma, T. N. & Khan, D. A. (2017). *Information technology in supply chain management*.
101. Verma, J., Bansal, S. & Pandey, H. (2014). Develop framework for selecting best software development methodology. *International Journal of Scientific & Engineering Research*, 5(4).
102. Vastag, G., Kasarda, J. D. & Boone, T. (1994). Logistical support for manufacturing agility in global markets. *International Journal of Operations & Production Management*.
103. Wan, Z. & Beil, D. R. (2009). RFQ auctions with supplier qualification screening. *Operations Research*, 57(4), 934–949.
104. Webb, J. (2017). What Is Supplier Relationship Management?. *Forbes*. Retrieved November 12, 2019, from <https://www.forbes.com/sites/jwebb/2017/02/21/what-is-supplier-relationship-management/#20ece47eec5a>.
105. Wu, Y., Cegielski, C. G., Hazen, B. T. & Hall, D. J. (2013). Cloud computing in support of supply chain information system infrastructure: understanding when to go to the cloud. *Journal of supply chain management*, 49(3), 25–41.
106. Xue, X., Wang, Y., Shen, Q. & Yu, X. (2007). Coordination mechanisms for construction supply chain management in the Internet environment. *International Journal of Project Management*, 25(2), 150–157.
107. Zissis, D. & Lekkas, D. (2012). Addressing cloud computing security issues. *Future Generation computer systems*, 28(3), 583–592.
108. Zsidisin, G. A. & Ritchie, B. (2009). Supply chain risk management—developments, issues and challenges. In *Supply Chain Risk* (pp. 1–12). Boston, MA: Springer.



## **APPENDIX**



## Appendix A: Summary of the Thesis in Slovenian Language

Glede na to, da oskrbovalno verigo predstavlja tok proizvodov, denarja in informacij, se management oskrbovalnih verig (v nadaljevanju SCM) ukvarja z učinkovito integracijo vseh aktivnosti v tem procesu in z upravljanje kompleksnih odnosov, da bi dosegli trajnostno konkurenčno prednost (Stadtler, 2008).

Literatura in znanstvene študije s področja SCM, povzete tudi v mojem magistrskem delu, poudarjajo ključni pomen managementa odnosov z dobavitelji (v nadaljevanju SRM) za uspešno delovanje oskrbovalne verige podjetja. Toda kot omenja Carter (2010), je za doseglo zelenega managementa dobaviteljev podjetja bistveno vzpostavljane zdravih odnosov, ki bodo pomagali racionalizirati in izboljšati procese med poslovnimi partnerji.

Glavni cilj tega dela je analiza, kako razvoj platforme SRM vpliva na odnose med proizvajalci in dobavitelji. Posledično se glavno raziskovalno vprašanje glasi: kako uporaba ustrezne informacijske tehnologije (v nadaljevanju IT), konkretnije v kakšnem obsegu vpliva pravilna uporaba platform SRM v oblaku na delovanje oskrbovalne verige na globaliziranem trgu?

Delo sestoji iz dveh delov, teoretičnega in praktičnega. Prvi del je analiza SCM, njegove pomembnosti in prednosti, ki jih prinaša uporabnikom. Poleg tega je predstavljena širša študija SRM. V delu se podrobno ukvarjam s SRM in pojasnujem, kaj disciplina obsega, kakšen vpliv ima na vzdrževanje zdravih poslovnih odnosov med poslovnimi partnerji in kako se razvija v povezavi z IT. Pozornost je posvečena tudi temu, kako IT oz. natančneje računalništvo v oblaku vpliva na odnose z dobavitelji. Praktični del sestoji iz študije primera, v kateri podatki platforme SRM ecratum podpirajo ugotovitve. Na temelju platforme SRM ecratum sem podrobno analizirala razvoj rešitev SRM v oblaku in spremembe v ravnanju uporabnikov, na katere je vplivala IT.

Integracija IT v procese oskrbovalne verige prinaša organizacijam in njihovi zmogljivosti številne prednosti. Rezultati kažejo, da zdaj več podjetij uporablja ta pristop in uživa v prednosti, ki jih digitalizacija omogoča. Deljenje informacij v realnem času, agilnost glede na trg, varnost, pametnejše sprejemanje odločitev, boljša komunikacija s poslovnimi partnerji in racionalizirani poslovni procesi so le nekatere od pomembnih prednosti, ki izhajajo iz integracije IT v oskrbovalno verigo.

Računalništvo v oblaku je omogočilo izrazito digitalno preobrazbo za tradicionalno oskrbovalno verigo. Poleg tega tehnologije v oblaku podpirajo rešitve SRM na spletu, ki izboljšajo odnose z dobavitelji na globalnem trgu. Rešitve SRM na spletu nudijo podjetjem poenostavljeno komunikacijo, odstranjujejo ozke geografske okvirje silosov, skrbijo za deljenje in vseprisotnost informacij, centralizirano znanje dobaviteljev in transparentnost poslovanja.

V tem delu s študijo primera ecratum opisujem implementacijo platform SRM na spletu in vpliv, ki ga lahko ima računalništvo v oblaku na odnose z dobavitelji.

V poglobljeni analizi se dodatno posvetim spremembam v ravnanju uporabnikov, ki izhajajo iz napredka IT in posledično SRM. Rezultati kažejo, da je s pomočjo računalništva v oblaku postopek izmenjave dokumentov in informacij v oskrbovalnih verigah doživel drastične spremembe. Uporabniki SRM se oddaljujejo od tradicionalnih orodij in rešitev ter svojo pozornost preusmerjajo k bolj sofisticiranim, digitalnim orodjem. Takšne rešitve, ki jih omogoča računalništvo v oblaku, so prilagojene njihovim potrebam in podpirajo deljenje informacij v realnem času, zahtevke in komunikacijo glede potrebovane dobavne dokumentacije.

Toda pri razvoju rešitev SRM v oblaku so lahko morebitni omejevalni dejavniki uporabniška komunikacija pri določanju in razumevanju zahtev, pomanjkanje jasne preglednosti in slaba dostopnost analitičnih podatkov ravnanja uporabnikov. Zato je pristop, ki se osredotoča na uporabnika pri zbiranju in potrjevanju zahtev ter uporablja zmogljivost analize podatkov za razumevanje trenutne situacije in predvidevanje smernic prihodnosti, ključnega pomena.

Po pojasnitvi vpliva IT na potekajočo digitalizacijo SRM lahko zaključimo, da je za zmogljivo storitev v oblaku, ki je konkurenčna na globalnem trgu, zahtevana nenehna inovacija. Digitalne platforme SRM morajo spremljati najnovejši napredek tehnologije in vzdrževati trajne inovacijske cikle ter pomagati pri vzpostavitvi in vzdrževanju agilne mentalitete v svojih organizacijah.