AALBORG UNIVERSITY
STUDENT REPORT

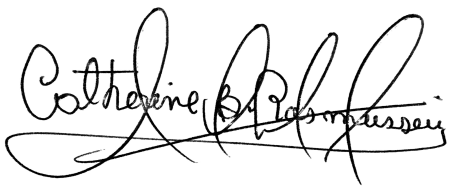
Study Board of Industry and Global Business Development
Fibigerstræde 16 DK - 9220 Aalborg East
Phone +45 99 40 93 09
lft@m-tech.aau.dk
www.en.ses.aau.dk

Title:	Information Communication Technology Implementation Factors for Small and Medium Enterprises of Latin America
Semester:	4th
Semester theme:	Master Thesis
Project period:	Autumn 2019
ECTS:	30
Supervisor:	Yohanes Kristianto Nugroho

SYNOPSIS:
This research investigates the current relevant Information Communication Technology' (ICT) implementation factors in small and medium enterprise of developing countries in Latin America.

The results show, that there is correlation between the factor cost and the software demand forecasting management and vendor management inventory. Furthermore, there are a correlation between CEOs experience in ICT use and the implementation factor "Easy implementation".

However, there are several individual positive and inverse correlations between the use of some ICT tools in supplied chain sub-process such as inventory management, costumer relationships



Catherine Barandiarán Rasmussen

Number printed:	[2]
Pieces Pages:	[71]
Pages Appendix:	[0]
Enclosures:	[1]

By signing this document, each member of the group confirms participation on equal terms in the process of writing the project. Thus, each member of the group is responsible for the all contents in the project.

Table of content

Table of content **3**

Table list **4**

Figure list **4**

Abbreviations **5**

1. Introduction **6**

1.1 Background and research questions *8*

2. Literature Review **9**

2.1 General definitions used in this chapter *9*

2.2 The tree Supply Chain Macro Processes (SCMP) *12*

2.2.1 Customer Relationship Management (CRM) processes 13

2.2.2 Internal Supply Chain Management (ISCM) processes 15

2.2.3 Supplier Relationship Management (SRM) - Supply Chain Integration 17

2.3 E-commerce and SMEs *21*

2.4 How ICT improve supply chain performance in Small Medium Enterprises? *23*

2.5 Relevant factors and implementation phases of ICT in SMEs *25*

3. Methods **31**

4. Data analysis and results **38**

4.1 Descriptive analysis *38*

4.2 Inferential Analysis *47*

6. Conclusion *58*

References **62**

Table list

Nr.	Title	Page
1	Main software ICT in Supply Chain Systems.	20
2	Main ICT tools in e-commerce.	21
3	Relevant ICT implementation factors to SMEs of developing countries in Latin America	30

Figure list

Nr.	Title	Page
1	Example of interview closed questions	32
2	Research codes	34
3	ICT used in Supply Chain Macroprocesses coding	34
4	Answers quantification	34
5	Full data company size and CEOs experience	35
6	Full data Supply chain software used for SME in Latin America	35
7	Internet Applications used in SME of Latin America- Full data	35
8	ICT used in Supply Chain Macroprocesses in SME of Latin America Full data	36
9	Relevant ICT implementations factors in SME of Latin America	36
10	Experiment design	37
11	Company size frequency	39
12	CEOs ICT tools use management experience in years	39
13	Company size and CEOs ICT tools use management experience	39
14	Frequency of supply chain software using in SMEs	40
15	Statistical result of supply chain software use for SMEs CEOs in developing countries of Latin America	41
16	Internet applications used by CEOs in supply chain.	42
17	Descriptive statistical results of Internet Applications used by SMEs CEOs developing countries in Latin America	43
18	Current use ICT in SMEs' supply chain macroprocesses of developing countries in Latin America	44
19	Supply chain sub- processes frequencies in SMEs	44
20	Descriptive statistical analysis of ICT using in SMEs supply chain macroprocesses	45
21	ICT relevant implementations factors to SMS from developing countries in Latin America	46
22	Descriptive statistical analysis of ICT implementations factors of SMEs for developing Countries of Latin America	47
23	Regression plot of CEOEX-TESU	48
24	Coefficient analysis CEOEX-TESU	49
25	Normal P-p plot of regression CEOEX-OPPR	49
26	Coefficient p-value CEOEX-OPPR	49
27	Lineal regression CEOEX-ESIM	50
28	Coefficient p-value CEOEX-ESIM	50
29	Lineal regression COMPSIZE-ENPO	51
30	Coefficient p-value COMSIZE-ENPO	52
31	Lineal regression Cost-DFM software	52
32	Lineal regression equation cost-VMI	53
33	Correlation between supply chain macro processes -supply chain software-internet applications	54
34	Correlation test ENPO-IMCP	55
35	Anova test results ENPO-IMCP	55
36	Significance coefficient ENPO-IMCP	55
37	Correlation test ENPO-IMIM	55
38	Significance test ENPO-IMIM	55
39	Anova test ENPO-IMIM	55
40	Correlation ADTY-IMTP	56
41	Significance coefficient test ADTY-IMTP	56
42	Anova test ADTY-IMTP	56
43	Inferential verification test ITC relevant implementation factors and ITC current use in supply chain macro processes	57

Abbreviations

Abbreviation	Full name
ADTY	Adaptability
AGVS	Automated Guided Vehicle Systems
AID	Automatic Identification
APS	Advanced Planning Systems
ASGV	Automated Guide Vehicle Systems
B2B	Business to business
B2C	Business to customers
CC	Cloud Computing
CEOEXP	CEO ITC experience (years)
COMSIZ	Company size (# workers)
CONT	Control
COST	Cost
CRM	Customer Relationship Management (software)
CRP	Continuous Replenishment Programs
CPRF	Collaborative Planning Forecasting and Replenishment (software)
CRM	Customer Relationship Management
EB	E-Business
EC	E-Commerce
ECM	Enterprise Content Management
ECR	Efficient Customer Response (software)
EDI	Electronic Data Interchanging (software)
EMAI	Easy Manual of instructions
ENPO	Environment /polices
ESCM	E-supply Chain Management
ESIM	Easy Implementation
ERP	Enterprise Resource Planning (software)
EVL	Evaluation
DFM	Design for Manufacturing (software)
DFM	Demand Forecasting Management (software)
FLEX	Flexibility
GIS	Geography Inform System
GPS	Geographical Information Systems
HDI	Human Development Index
ICT	Information and Communications Technology
IDS	Information Detected Systems
ININ	Information interchange
ISCM	Internal Supply Chain Management
MT	Mobil Technology
OCS	Online Conference System
OPPR	Optimization processes
PLAN	Planification
RAPR	Rapid Processes
RARE	Rapid Results
S&OP	Sales and Operation Planning
SCEM	Supply Chain Event Management (software)
SCM	Supply Chain Management
SCMP	Supply Chain Macro Processes
SCP	Supply Chain Planning (software)
SCO	Supply Chain Operations
SCS	Supply Chain Strategy
SME	Small and Medium Enterprises
SLAN	Several languages
SM	Social Media
SRM	Supplier Relationship Management
STIK	Short Time Training
TEKL	Technological knowledge
TESU	Technic support
VMI	Vendor Managed Inventory (software)
VSAT	Very Small Aperture Terminals
WBT	Web Based Tracking

1. Introduction

Information and communication technologies (ICT) is a set of integrating technology systems, which contributes to the gathering, dissemination, and storage of large amounts of information using elements such as software, hardware, and telecommunications application. The goal of ICT is to optimize communication, data storage, data analysis, and information exchange between two or more stakeholders (Harry Bouwman, 2005). However, ICT is also designed to contribute to the decision-making process (Correa, 2008)

The managers and decision-makers within a company must consider certain internal and external factors to choose the best ICT to implement in their organization. These factors should cover the needs for data collection, storage, processing, and exchange of information at all levels of the supply chain. For the reasons above, it can argue that each company must carefully choose the most appropriate combination of technological tools to meet their requirements and organizational form.

However, choosing the right technology is a critical decision for any company. It requires a careful analysis of various factors from different perspectives such as economic, social, governmental, situational, competitive, and strategic according to the model of consumer and buyer behavior in the business environment (Kotler (2001)).

The reasons why an entrepreneur decides to invest in information technology, also depends on various factors, such as the size of the company, the type of strategy to follow, cost reduction, increment of productivity, new markets, design of new products, reduction of risk, and improvement of corporate image (Estallo, 2010).

However, this decision is even more difficult to make, when the business is small or medium SMEs, and its resources are limited. In these cases, the ICT implementation decision needs to prioritize implementation factors. The definition of SMEs significantly varies between countries depending on the local policies, and several factors, such as the number of employees, value of fixed assets, production capacity, essential characteristics of the inputs, level of technology used, capital employed, management characteristics and economic development, are part of the definition (Enquobahrie, 1997). In this study, the definition of EU, 2007, is applied. It considers small firms with a staff headcount from 2 to 10 workers, turnover from 1 to 2 million Euros, and medium company with 11 to 50 workers, turnover from 3.1 to 10 million Euros and annual balance of 2 to 10 million Euros. The objective of this research is to analyze the most relevant factors that influence the

acquisition of ICT in small and medium enterprises in developing countries in Latin America, considering the analysis of nine companies located in this region.

Latin America is a Hispanic region made up of twenty-four sovereign states and several territories. This region includes all Portuguese and Spanish-speaking nations south of the United States. The countries share significant similarities because Spain or Portugal colonized them. The region includes a North American country (Mexico) other Central American countries such as Guatemala, Cuba, Haiti, Dominican Republic, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Puerto Rico, Uruguay, Guadeloupe, Martinique and French Guiana, and South America such as Brazil, Colombia, Argentina, Peru, Venezuela, Chile, Ecuador, Bolivia and Paraguay (Atlas.com, 2019).

According to the national economic census conducted for the National Institute of Statistics and Censuses in period 1994-2000 only in Peru, Colombia, Argentina and Chile there are in total have being 149,312 small companies and 45,290 medium enterprise (Cepal.com, 2000). These countries are called developing countries, it means a group of countries with “a less developed industrial base and a low Human Development Index (HDI) relative to other countries” (O'Sullivan A, 2003).

Small and Medium Enterprises SMEs of this region need to incorporate technology into their business strategies in order to be more productive and increase their efficiency. These SME's make up close to 50% of the income of any country within this region, which places them in a position of considerable importance because by achieving company’ modernization, they will contribute to the modernization of their countries. However, several obstacles prevent the development of technology projects in companies, including resistance to change and low technological knowledge.

Nevertheless, some companies produce ICT tools and provide technological solutions to SMEs. These companies have a focus on Latin America’ SMEs as a potential market. One of these companies is the Internet. It plays a significant role in the development of the SMEs and, due to its versatility, which contributes to meeting their requirements.

The motivation of performing this work is to contribute with the identification of significant ICT implementation’ factors in a regional level. Thus, to incentive a common understanding between the companies of this region, so they are able to choose only relevant implementations requirements according to the need of their companies in a Latin America context.

1.1 Background and research questions

ICT implementation involves a high investment for a company. Therefore, it is challenging to implement this tool in Small and Medium Enterprises (SMEs). The implementation requires extra activities like training of staff or payment of regional and international licenses. ICT contributes to organizational restructuring with a focus on efficient collaboration between members of the supply chain, but it also needs modernization of existing facilities, equipment, and acquisition of ERP systems (Ghobakhloo, 2011; Tan, 2010). Despite the high implementation cost, ICT is an essential priority in the North American and European markets. However, due to financial limitations and lack of knowledge of SMEs, developing countries still have difficulties in adopting this technology (Chapman, James-Moore; Szczygiel, 2000; Nasco, 2008; Thong, 2001).

In Europe this situation occurs most frequently in countries such as Greece and Indonesia, and in Latin American' countries such as, Argentina, Peru, Ecuador, Bolivia, Colombia, and Venezuela. In these countries, formal and no formal SMEs dominates the regional economic activities. For example, Peru, a country with the best economy of this group, with an economic growth of approximately 5.6% per year from 2009, and a stable exchange rate and meager inflation (CIA USA, 2019), it still has very few formal SMEs that implement ICT. These countries still have a low ICT implementation level and very little participation in e-commerce compared to Europa (European Commission, 2016). Therefore, there is a need to share the experience and knowledge of emerging countries as the USA and Europe to motivate the use and implementation of these tools, with studies that contribute to build a successful technology strategy in developing countries.

In order to perform a study that contributes to improve ICT implementation in SME of developing countries, the question arises:

What are the Information and communication technology implementation' significant factors of the current small and medium companies of developing countries in Latin America?

2. Literature Review

This chapter involves relevant themes that are further divided into four sub-sections. Each section aims to find the main factors required to implement Information and Communications Technology (ICT) in small and medium enterprises (SMEs) of developing countries of Latin America. However, there is a special focus on ICT used by SMEs to improve their supply chain macro processes.

Relevant definitions are presented in section 2.1, to standardize the terminology and to improve the knowledge interchange between the reader and researcher. Section 2.2 aims to clarify the knowledge about supply chain macro processes, by describing the advantages and disadvantages of use ICT in the three-supply chain macro process: Customer relationship management, Internal supply chain operation management, and supplier's relationship. Following, section 2.3 describes the ICT implementation phases of this technology, and section 2.4 explores the factors required to implement ICT tools in SMEs of developing countries of Latin America. The chapter concludes with a theoretical ICT implementation framework, which will be used to design the next method section.

2.1 General definitions used in this chapter

Because the study is about the implementation of ICT in developing countries of Latin America, some terms must be defined in order to standardize the terminology used in this study. Information and Communications Technology (ICT) is a set of software and internet applications that converges the features and advantages of telecommunication and computer technology, with the goal of optimizing communication, data storage, data analysis and information exchange between two or more stakeholders (Harry Bouwman, 2005). Likewise, ICT is designed to contribute with the study, design, development, promotion, maintenance, and management of information through computers, cell phones, tablets, smart television, digital newspapers, social networks, storage clouds, artificial intelligence, big data analysis, and storage cloud (Correa, 2008).

Latin America is a Hispanic region made up of twenty-four sovereign states and several territories. This region includes all Portuguese and Spanish-speaking nations in the south of the United States. The countries share significant similarities because Spain or Portugal colonized them. The region includes a North American country (Mexico) other Central American countries such as Guatemala, Cuba, Haiti, Dominican Republic, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Puerto

Rico, Uruguay, Guadeloupe, Martinique and French Guiana, and South America such as Brazil, Colombia, Argentina, Peru, Venezuela, Chile, Ecuador, Bolivia and Paraguay (Atlas.com, 2019) .

According to the national economic census conducted for the National Institute of Statistics and Censuses in the period 1994-2000 only in Peru, Colombia, Argentina and Chile there have been a total of 149,312 small companies and 45,290 medium enterprises (Cepal.com, 2000). These countries are called developing countries, meaning a group of countries with "*a less developed industrial base and a low Human Development Index (HDI) relative to other countries*" (O'Sullivan A, 2003).

These small companies perform operations that involve knowledge about supply chain management (SCM). SCM can be defined as a model which connects a set of entities as suppliers, manufactures, distributes, retailers and customers to coordinate and organize the general information flow, and the feedback information flow, with resources, products and services (Ma Shihua, 2007; Chopra and Meindl, 2007). The authors state, that SCMN involves three decision phases, Supply Chain Strategy, Supply Chain Planning and Supply Chain Operations which need to work fully integrated with a common goal.

Supply chain management involves several strategies. Supply Chain Strategy (SCS) is as a set of a long term and high investment decisions about operations as where to fabricate the products, which locations will be used, and how much capacity the company will have to meet the market requirements. To develop competitive advantage, companies need a strategy able to seamless network connections, and to improve information sharing in every node of the chain. This process integrates activities to fulfill the customers' needs, and it reduces the total landed costs (Chopra and Meindl, 2007). The authors state that the decisions taken at the strategic level have a relevant influence about how the operations will be planned and performed in the supply chain planning (SCP).

SCP involves decisions to optimize the outcome of supply chain' results. These decisions are made approximately one year in advance, considering the limitations established in the previous phase. For example, after analyzing issues such as uncertainty in demand, exchange rates and competition in a time horizon, the enterprise decides: The market sector of the product, the selection of suppliers, manufacturing' subcontracts, defines inventory policies, determines production size and marketing strategies (Chopra, 2017).

Within supply chain macro processes is performed The Supply Chain Operations (SCO). It is a stage which sets focus on fulfilling customers' orders. The operations performed in this phase have a time

interval from one day to one week. For example, during this phase, companies make sure they have enough products to fulfill an order, defines the deadlines for the supply of order, produce picking lists in a warehouse, decide the shipping mode, and produce repositioning orders.

It is also relevant to keep in mind that a common supply chain includes elements as customers, retailers, distributors or wholesalers, manufactures, and raw material or components which must work integrated with the common objective of efficiently meet the customer requirements. These elements are performed in several processes which can be described from two different perspectives: From a cycle perspective, a supply chain divides its processes into four cycles performed between the interface of two successive stages of a supply chain. It means, the cycle starts with the operations needed to receive the customer's order during the first phase, then continues with the replacement operations, manufacturing operations, and finally, the procurement operations carried out in the last manufacturing-supplier interface. On the other hand, the push/pull view of supply chain groups processes according to the scheduling of a customer's order. For example, pull processes are performed in response to an order, and push processes are performed in anticipation of customer orders.

Currently, most part of large companies in industrialized countries use ICT inside their macro processes as for example in Customer Relationship Management (CRM),which involves all processes that focus on the interface between the firm and its customers, or Internal Supply Chain Management (ISCM) where all processes that are internal to the firm are grouped, and Supplier Relationship Management (SRM) which describes all processes that focus on the interface between the firm and its suppliers (Chopra, 2017).

Another relevant concept used in the ICT field is E-Business (EB), it could be defined as the digital enabling of transactions and processes within a firm through information communication technology systems (ICT). E-business does not involve an exchange of value, while E-Commerce (EC) transactions involve an exchange of value across organizational boundaries (Traver, 2017). However, Vlachar et al. (2014) point out that the larger the company, the more important is e-business to improve their supply chain operations, customer service, and product quality. The authors added that e-business (EB) solutions can improve supply chain efficiency in both large companies and small and medium enterprises (SMEs); in large firms EB solutions improve the information flow in their internal and external processes; while in SMEs of online sales and new firms it contributes to open access to the information and entrance to new markets.

Finally, it is also important to define E-supply Chain Management (ESCM), it blends e-business, e-commerce and e-supply strategies using online tools to connect customers and suppliers. Several authors consider currently that revenues and logistics processes more often use digital solutions; and adding that, as a consequence of globalization, the international sourcing and shipping also benefit the SMEs because it performs commercial import and export transactions with potential markets worldwide (Ilias, 2018).

2.2 The tree Supply Chain Macro Processes (SCMP)

As is explained in part above, SCMP involves all the relationship between customer, suppliers and managers needing to meet successfully the customer requirements. It includes a positive and productive integrative work between managers and stakeholders. The relevance of using Information Communication Technology (ICT) to improve supply chain integration and as resulting improving also supply chain performance is no doubt (e.g., Lee, 2001; Leuschener, 2013; Schoenherr, 2012). For example, Chopra (2016) argues that information is a crucial driver in a supply chain because it joins other supply chain drivers, such as facilitates, inventory, transportation, sourcing, and pricing to work integrated, with the common goal of creating a robust framework able to build a successful supply chain. The author stress that information provides the basis on which supply chain managers make decisions and improve the supply visibility.

ICT are these tools that improve information exchange. It is defined as a set of tools used to collect and analyze information to make decisions that improve supply chain performance (Chopra, 2003). Likewise, the author adds that ICT involves the hardware, software, and people that collect, process, analyze and execute the information in a firm. Even in the literature exist a trend of performing researches that confirm the positive role of IT in a supply chain, different perspectives must be analyzed in this chapter.

To understand the impact of ICT in supply chain performance, it is crucial to know how these tools are used in the different supply chain drives. In the following, it is analyzed how the ICT is used in three supply chain macro processes: Customer Relationship Management (CRM), Internal Supply Chain Management (ISCM), and Supplier Relationship Management (SRM) (Chopra, 2016). In the last part of this chapter. Table 1 and 2 show where the main ITC tools are used in supply chain systems and e-commerce with explained applications.

2.2.1 Customer Relationship Management (CRM) processes

With the developing of ICT to support CRM, the firms are able to manage heterogeneous group of customers more efficiently (Zablah, 2004; Payne, 2005). These technological tools are contributing to increment organizations information about their customers before the development of a relationship (Ramesh, 2013). Results from researches show that improving customer relationship is directly linked with the increment of customer loyalty which is beneficial to firms in form of a competitive advantage over other companies (Ngai, 2005; Brun, 2014; Sayani, 2015). CRM involves the downstream interactions between customer and enterprises, and its goal is to increment the demand through improvement of the customer experience (Chopra,2016). It can also be defined as the set of activities performed between an enterprise and its customers downstream in the supply chain, which has the target of incrementing customer demand, and facilitates data exchange through an efficient tracking order system (Chopra, 2013). The author adds that weakness in this process can affect customer experience and as a consequence decrease the demand.

ICT can improve the different crucial processes of CRM, improving data transmission through the parties. For example, in the marketing strategy area, it can be used in performing data analysis to decide a customer sector to offer company products or decide which product development could meet the customer requirements, analyzing customer preferences. It means, ICT contributes with data analysis to make the correct decisions.

In contrast with the marketing strategy that focuses on planning what to sell to whom, the selling strategy focuses entirely on selling as much as possible every day. The information flow is a crucial issue also in the selling processes. The sales force needs updated knowledge to be able to configure customer orders and chooses between different features of a product or check the viability of the product. An efficient IT support system sales force automation, configuration, and customization is contributing to improve the sales process, reduce the work time, and increment the flow of information.

Likewise, the order management processes, and call service centers are benefiting with the use of ICT. For example, the order management process involves the management of customers' orders from customer order to the delivered product. Therefore, a tracking system is necessary to obtain visibility

for both the customers and the suppliers involved in this process. An excellent ICT gives visibility in the supply chain and improves supply chain performance.

However, in a call-service center, which is a primary point of contact between the company and customers, ICT also benefits the flow of operations, which contributes to optimize customer satisfaction and increment the customer loyalty and demand. According to Gartner (2012), the five most significant CRM software existing until 2012 were Salesforce.com 14.0%, SAP 12.9%, Oracle 11.1%, Microsoft 6.3%, and IBM 3.6 %.

However, companies which invest in ICT systems are still questioning the impact of this technology in the customer-enterprise relationship. For example, Zhang (2016) introduces the concepts of inter and intra organizational supply ICT to explain this connection. The author argues that these two types of relationship play different roles in supply chain performance. Inter-relationship is related to the electronic link between organizations, and therefore, this relationship has not a direct effect in the supply chain performance, but it affects the supply chain integration, and as a bullwhip effect, the supply chain performance is improved. In contrast, the author adds that intra organizational ICT involves the use of for example ERP systems to directly improve the information quality, which is a crucial requirement to obtain an efficient supply chain integration.

Likewise, Prajogo (2012) finds that the role of ICT in a long-term supplier relationship has direct and indirect significant effects on supply chain performance. Even the opinions that favor the implementation of IT to improve CRM, it is necessary to clarify that information is only one of the five drives of the supply chain, therefore, it is crucial that another four drives are smoothly integrated to improve the supply chain performance.

However, some authors state that companies which decide to use ICT support to manage the CRM need to achieve before a general maturity level to support this investment adequately. For example, Maklan (2011) argues that many large, well-managed and well-resourced companies fail to see an adequate return on their CMR ICT investments because these companies rush too quickly into large-scale IT based CMR investments with the target of obtaining the best results in a short time, and these forget that these technological resources need be supported by firm capabilities. The author adds that the top team should be patient to find an adequate model after the marketing capabilities are developed enough to justify these investments.

2.2.2 Internal Supply Chain Management (ISCM) processes

ISCM focuses on planning the internal operations, and the decisions that firms must make to fulfilling a customer order (Chopra, 2016). The author adds that ICT can contribute to improving the information flow and decisions in several supply chain decisions phases, for example, during the strategic planning companies make long- time decisions about the location and capacity planning of facilitates. One of the most critical decisions in the strategic planning area is the network design of the supply chain which includes definitions of the network distribution structure, location of facilitates and capacity demand allocations (Chopra, 2016).

Likewise, ICT contributes to collect information of customers preferences and the cost of meeting these requirements helping with this information to decide the more profitable network model to companies. For example, if the information system shows significant economies of scale, the firm will need a few capacity locations, while if facilitates have a lower fix cost, many locations can be installed to reduce transport cost Several authors agree ((Tayur,1999); (Daskin, 1995); and (Dredger,2004)) that quantitative models, algorithms and simulation models contribute optimizing the decisions about the capacity plant, potential locations or minimum number of plants needing to meet the demand efficiently. These authors present some decisions models as, “The capacity plant optimization model”, “The local gravity models”, “The network optimization model”, and “The capacity model” as a tool to take strategic decisions.

In the demanding planning area ICT has a significant function in making preventive decisions of the demand. This process is performed very frequently and requires high-quality results. Forecasting software can predict the demand for a wide variety of products at real-time by updating the demand information accordingly. Managers use this tool to respond quickly to fluctuations in demand and avoid significant losses of money as a result of late reactions.

White, 2007 stems that an efficient demand planning software includes the most current sales and order data from customers in order to accurately predict changes in the market, select the correct forecast model, and make early decisions. The author asserts that these planning tools should also are able to perform hypotheticals analyses, e.g., the effect on demand when changing the price of a product, which improves decision making in this field.

However, Sony (2001) adds that companies that invest in excellent ERP software increase visibility at all levels of the supply chain and improve the integration of information benefiting from better

forecasts. However, it is crucial that companies develop their organizational capabilities to benefit from these improvements. The error of some firms is that managers trust too much in these tools in decision-making, and some firms eliminate the sense of humans a result of the experience and knowledge of the cultural environment (Chopra, 2016)

In the supply planning area, the demand forecast, and the capabilities are the starting point to build a plan to meet this demand. ICT provides factory planning and inventory planning capabilities to design a plan to fulfill the forecasting demand. The aggregate planning also uses ICT as a vital tool to analyze and select viable production plans with focus on increasing production and reducing costs. This tool uses linear programming to solve aggregate planning problems in order to obtain a production plan of products at different time intervals. In the case of non-linear constraints, this software can create linear approximations of nonlinear functions in order to efficiently handle a large amount of data included in the production of aggregate programs (Chopra, 2016).

Chopra also argues that within the commonly used software are SAP and Oracle. These programs offer advanced planning systems (APS). The challenge in using these tools is that the results can be quite sensitive concerning inputs. Therefore, a minimal change in demand can produce a new aggregate plan different from the original, and as a consequence, it loses credibility because these results can increase the number of cost and dissatisfaction.

With the same positive results, ICT tools also have a positive impact on sales and operation planning (S&OP). It is the process that involves creating a general supply plan for production and inventories, developing a previously agreed sales, production, and inventory plan (Chopra, 2016). ICT contributes to this process by collecting sales and marketing information and transferring these needs to the supply chain, where the relevance and cost of these needs will be analyzed and decided. The sales planning benefits the satisfaction of supply chain parties, the production of income, and also contributes to increase profits. The sales and operation plan become a critical piece of information to be shared throughout the supply chain. These decisions also affect the demand from suppliers, and the supply to their customers.

Likewise, ICT helps companies to improve their inventory visibility and optimize coordination in the supply chain. As a consequence, companies improve product availability for the customer without increasing their inventories (Chopra,2013).

Chopra and Meindl (2016) state that the location of inventories in shops or warehouses also contributes to improve their visualization because it allows them to have in-site access to the product. The authors argue that the continuous replenishment program (CRP) and RFID systems are essential tools for greater transparency in stored stocks. These tools help in fulfillment, field service and post-sale internal processes to be sure that the demand plan will be executed, and the information will be able to be tracked or transported to the final customer. To manage these internal processes, companies usually use transportation and warehouse software to fulfillment processes and inventory management software to field service (Chopra, 2016).

The objective of the ISCM processes is to fulfill the demand efficiently at the correct time and to the right customer. It involves the integration of several processes and high level of coordination between the customer relationship and internal supply chain management. Therefore, a strong information system is crucial to have an efficient information exchange able to show updated information through the different levels of the supply chain. Likewise, ISCM needs to be fully integrated to the supplier relationship management (SMR) to be able to fulfill the demand. However, ISCM software contributes to improve decision-making in companies. Despite the wide use of these software, the relationship between ISCM and SMR lacks integration at organizational and software levels (Chopra, 2013). Therefore, there is still opportunity to improve these tools to achieve a strong supply chain integration.

2.2.3 Supplier Relationship Management (SRM) - Supply Chain Integration

SRM involves the processes between companies and suppliers which have as target to achieve an integrated supply chain able to understand, analyze and execute the demand efficiently. The major SRM processes are: Design collaboration, source, negotiation, buy, and supply collaboration (Chopra, 2016). Collaboration is a valuable organizational capability because organizations cannot stand alone to manage the business (Lee, 2012). It is defined as the ability of companies to work cooperatively between all supplier chain parties (Yang, 2013). Yang asserts that there exist two types of collaboration, an external collaboration which coordinates actions and sharing information between suppliers, customers and partners, and internal collaboration which focus on helping workforce to communicate across organization departments to develop practical solutions. However, "value co-creation provides a resource to create value through interaction between consumers and firms towards establishing deep engagement and collaboration" (Salam, 2017; Janteng, 2017).

Furthermore, several authors assert that ICT contributes to increase internal collaboration capabilities, which has a direct positive impact on organizational performance (Ping, 2018; Lew, 2013; Sanders,2007) as well as on manufacturing firm performance (Cao, 2011). The better information exchange, the more significant the results of the collaboration, and as a consequence, the performance of the organizations will be incremented significantly (Burkel, 2012), e.g. increasing market share, asset utilization, decrease production cost, and enhance skills or knowledge (Amin, 2014).

Ping (2018) argues that large organizations have to communicate and integrate with the internal and external people to operate the business effectively and efficiently. IT helps to increase collaboration connecting employees, suppliers, customers, business partners, and competitors to enhance the performance which is documented in various studies (Lew, 2013; Burkel, 2012). Design collaboration software improves the design products facilitating an interactive work between manufacturers and suppliers. This software selects the best products with excellent references about manufacturability and commonality across several end products, and also design sharing of engineering change order between companies and suppliers contributing with elimination of delays or wasted time designed duplicate components or products (Chopra, 2016).

Another significant ISCM sub-process is sourcing. It involves diverse decisions to purchase products from suppliers, e.g. purchase order processing, making logistical agreements, goods receipting, and warehousing (GS1, 2008). Phelps (2006) argues that the sourcing process has a relevant function inside an organization because companies depend on these decisions to fulfil the demand, it could be providing raw material or parts to supply the business. Vivek (2009) adds that supplier performance is directly related to organizational performance. Software sourcing contributes to contract management and performance analysis of suppliers, such as during the selection, evaluation, and qualification process. It also determines how much money a company uses for each supplier. This information helps to identify trends or improvement areas. The relevance of using ICT to manage the sourcing area is undoubtable, researches show that “The competitive performance of the organization is directly dependent on the Supply Chain Sourcing and Delivery performance. The making function helps internal improvisation, but directly does not impact the company's performance. This data can help companies focus on these functions of supply chain and better performance in these areas. During the tough times in the market, the study results will enable decision-makers to take an informed decision on the areas to focus” (Satish, 2014).

The internal negotiations and buying also benefit from the implementation of ICT. Modern software is able to automate the Request for Quote (RFQ) processes and the design-execution of auctions to produce an effective contract which includes price and delivery parameters for a supplier in a way that synchronize smoothly with the company needs (Chopra, 2016). The authors add that “buy software” contributes with save in cost and time to firms because these tools can share in real time the procurement of material, creation, management and approval of purchase orders with the suppliers.

Chopra and Mandel (2016) consider that ICT contributes to facilitate collaborative forecasting, production plans and inventory levels in the supply chain which can improve the supply collaboration and supply chain performance. However, all the beneficial consequences of ICT application inside the three macro processes described above, there is not enough companies which buy the more sophisticated and modern software if a company has not developed capabilities to support this technology, and as a consequence, it has not a supply chain integration.

Mackelprang (2014) and Gimenez (2012) argue that supply chain integration involves a set of exchange processes and great coordination tactics between supply chain partners, such as transactions, procedures, materials, and communication intending to design well-coordinated information flows between all the supply chain tiers, and thereby enable firms to create smooth processes throughout the extended supply chain.

However, the question here is what is so important to achieve a supply chain integration? Lee (2001) affirms that ICT and internet play a crucial role in crucial goals of the supply chain, and these will increase their impact in B2B interaction in the future. ICT integration is defined as "a system that positively impacts supply chain flexibility and supply chain agility" (Swafford, 2008). The author adds that integration systems have a "domino effect" because the increment of supply chain flexibility improves supply chain agility and competitive advantage of a firm.

Likewise, a smooth information and material flow shorten bridges between supply chain parties creating a bullwhip effect, which contributes to reduce supply chain uncertainties (Lee, 1997). It means for example that an efficient information system contributes to reduce and improve order cycles, then firms could have an inventory reduction (Prajogo, 2012). Other studies that found a positive relationship between supply chain integration and performance were performed by Frohlich (2001), Flynn (2010) and Schoenherr (2012) who state that integration has a positive effect in supply

chain performance, and these effects are visible only when firms achieve high degrees of supply chain integration, but even a small scale supply chain integration benefits the firm's efficiency. For Gunasekaran (2004) and Caniato (2009), supply chain integration is linked to efficiency in processes, therefore, companies which use ICT to optimize their processes are benefitted with reduction cost, higher responsiveness and a flowing information exchange within the supply chain parties.

The effect produced with the application of ICT to improve processes and reducing the lead time benefits information sharing in buyers-suppliers relationship (Picolly, 2005; Vreecke, 2016; Drnevivh, 2013). Likewise, a large number of studies agree on that the effect of strategic IT on supply chain integration and competitive advantage depends on other constrictors (Carroll, 1992; Clemons, 1991; Kettinger, 1995; Kettinger, 1994; Li, 1999; Lindsey, 1990; Mann, 1991; Powell, 1997; Reich, 1990; Schwarzer, 1995). It means, to achieve competitive advantage, companies must develop a robust supply chain integration, and it cannot be achieved only with the use of IT. However, supply chain integration of all supply chain drives is necessary to become a competitive enterprise. In contrast with the major part of authors, Warner (1987) and Wade (2004) argue that from the resource perspective, ICT has a direct negative effect in supply chain performance. Likewise, Venkatraman (1990) and Sager (1988) asset that strategic ICT has no impact on the competitive advantage of an enterprise because the resources of IT are not linked with the high levels of operational performance.

Table 1: Main software ICT in Supply Chain Systems.

Nr.	Tool	Name	Function
1	ERP	Enterprise Resource Planning	Contributes to collect and share data in all the areas of a company, planning of resources.
2	EDI	Electronic Data Interchanging	Electronic data conversion
3	CPRF	Collaborative Planning Forecasting and Replenishment	Planning of sales and replenishment
4	VMI	Vendor Managed Inventory	Inventory, orders and delivery management
5	ECR	Efficient Customer Response	Holistic information of all the supply chain activities
6	SCEM	Supply Chain Event Management	To manager events within the supply chain
7	CRM	Customer-Relationship Management	Planning of customer relationship
8	DFM	Design for Manufacturing	Tool set to improve design of pieces or parts
10	SCP	Supply Chain Planning	Planning of supply chain

2.3 E-commerce and SMEs

The current opportunities for public access to the internet give birth to electronic commerce known as e-commerce. This type of trade helps smaller companies to expand their sales opportunities and develop using the tools of larger companies (Kalakoda and Whinston, 1996; MOC, 1998). Figure 3 displays the commonly used e-commerce tools. Today, global companies use this type of commerce to reduce costs, increase sales, and optimize communication and customer service (MOED, 2000).

Different researchers agree with Poon (1999) in defining e-commerce for SMEs as a business activity that uses technology and the internet to carry out its commercial activities. The author states that the even the type of trade could have different objectives, the electronic commerce is the most used by SMEs because it contributes to increase the business competitiveness, and also open access to the world markets using low investments (Poon and Swatman, 1995).

Likewise, other authors affirm that in most developing countries, these transactions avoid tariff and tax expenses and diminish the effect of demographic activities (Abell & Lim, 1996; Cameron & Massey, 1999; MOC, 1998; Peters & Paynter,1999). This assertion is reinforced by other authors who add that companies which not use this type of trade loose the opportunity to benefit and grow at the same pace as innovative companies (Blili & Raymond, 1993).

From the perspective of SMEs as social groups, these companies are slower to adopt electronic solutions, for example, the researcher Castleman (2004) affirms that initially, it was the big companies that adopted electronic commerce techniques within their different areas, while the SMEs were less active to adopt these tools in their businesses. Several authors have researched this topic in the literature, and according to Castleman, the reasons for this delay include lack of resources, lack of qualifications, and lack of commercial power. In contrast, Castleman states that it is not about irrationality or lack of interest in improving the skills of small companies, but that these companies develop within a more complex socio-cultural context than large companies, and therefore, their decisions are generally affected by this context.

Table 2: Main ICT tools in e-commerce.

Nr.	Tool	Name	Function
1	CC	Cloud Computing	Storage
2	SM	Social Media	Communication, sales
3	OCS	Online Conference System	Communication
4	MT	Mobil technology	Communication
5	ECM	Enterprise Content Management	Management
6	AI	Automatic Identification	Security
7	GPS	Geographical Information Systems	Information, localization, tracking
8	VSAT	Very Small Aperture Terminals	Distribution
10	WBT	Web Based Tracking	Control, tracking
11	AGVS	Automated Guided Vehicle Systems	Transport
12	IDS	Information Detected Systems	Security

Adding, some authors such as Ratnasingam (2004) argues that the limited power of companies in the supply chain and the scarcity of their resources influence the difficulty that these companies have to implement advanced planning systems. The author states that for example, in the case of mass customization, these companies cannot adapt their production planning and meet the requirements of their customers or their suppliers. Table 2 above show the 12 main internet applications using in e-commerce.

2.4 How ICT improve supply chain performance in Small Medium Enterprises?

In section 2.2, it has been explained from the perspective of supply chain macro processes how ICT generally impacts companies that adopt this new technology. This section is exploring in the literature how this technology impacts explicitly supply chain operations on SME performances. This commercial sector plays a vital role in poverty reduction and job creation in developing countries (Higon, 2011).

Matthews (2007) classifies the use of Information Technology in three levels: primary level (minimum use, e.g. computers, essential software), substantial level (machinery, some applications), and sophisticated level (use of integrated systems and constant use of technology to predict situations and make decisions). The author argues that SME, in general, are progressing and raising their technological levels progressively in line with their growth and market presence. Similarly, Higon (2011) considers that the positive impact of the use of new technologies such as ICT is strongly linked to the infrastructure conditions, organizational capacities, and human resources of enterprises.

However, Mochirhri et al. (2012) state that this business sector benefits just like large companies in improving business visibility, streamlining information exchange, facilitating financial transactions between companies, and overcoming geographical barriers. Furthermore, as a consequence of greater access to information on customer preferences and market changes, these companies increase their flexibility and responsiveness.

The authors add that e-commerce technology tools also help to reduce transportation costs, such as replacing traditional paper communication with emails and using free social media to make direct product recommendations. They also stress that in order to benefit from the use of this technology, companies must take into consideration that they must adjust the organizational structure of their firms to work integrally with these digital tools.

In contrast, some authors consider that the level of impact of this technology does not benefit all sectors of the enterprise with equal intensity and this depends on the sector where it is used (Lopez et al., 2012). For example, although it is true that the use of ICT has a positive impact on workforce productivity and economic growth (Sannagh et al., 2012), both in manufacturing and in companies (Manochehri et al., 2012), it is also true that it affects negatively to not skilled workers. However, according to Harindranath et al. (2008), the use of ICT benefits the operational field more than a strategic level in a company. The authors add that business owners believe that ICT investment can

be replaced by consultants and vendor organizations with better or similar results with lower investment.

In the literature finds, Consoli argues that the impact of ICT in companies can be categorized into four groups: performance, growth, expansion, and new products (Consoli, 2012). The author considers that each group consists of a set of operational dimensions. In the field of performance, this technology reduces the effort of the labor force and the time of operations, thus, increasing productivity (Sannagh et al., 2012). Furthermore, as far as the contribution to economic growth is concerned, several studies show that companies that use ICT in industrialized countries, such as the USA and countries in Europe, grow economically faster than those that do not use these digital tools (Lau, 1992).

This also applies to SMEs where small companies which use ICT increase their demand level faster than those without technological tools (Matthews, 2007). However, according to Consoli (2012), for SMEs, it may take a long time before they can see the benefits of ICT in measurable results. Therefore, the author proposes that this commercial sector could assess the benefits of this technology from an indirect perspective using indicators, such as changes in efficiency, effectiveness, innovation capacity, and increased competitiveness of enterprises.

From the perspective of company performance dimensions, the impact of ICT on SMEs can be measured according to Santos et al. (2012) by the level of economic and strategic performance of the company within the market. The author proposes a framework in which financial performance is determined by profits, company growth, and the value of the company in the market, while strategic performance is measured through employee satisfaction, environmental performance, and social performance. The author argues that all of these sectors must be fully integrated to have a positive impact of ICT on a company's performance (Figure 2). Santos' proposal is interesting because the impact of ICTS on SMEs can be measured indirectly from different dimensions as profits are measured through profitability obtained in different sources, such as assets, investments, net income, and own funds. The combination of these gains produces an improvement in financial performance and consequently in the company performance.

Many studies corroborate the results of Santos et al. For example, Meti et al. (2012) state that in a specific situation there is a 1% increase in ICT in GDP, which as a consequence increases the competitiveness of a company by 4.2%. In addition, Alan et al. (2009) assert that empirical studies

demonstrate the positive effect of ICT on factual increases in productivity, profitability and market value, but there are also equally important indirect effects.

However, with the intention of standardizing the elements of competitiveness that grant a competitive advantage, twelve elements have been defined to evaluate the degree of competitiveness of a company (Matei et al., 2012). The elements consider the direct or indirect impact of ICTs on performance companies, these are: financial market development, technological availability, higher education and training, efficiency in the goods market, efficiency in the labor market, macroeconomic environment, infrastructure, institutions, innovation, health, primary education, business sophistication, and market size. The author adds that these elements are interrelated in such a way that the functioning of one affects the others, and as a result, they have a relevant impact on the competitiveness of a company.

The type and degree of technology adoption also affect the level of ICT performance in a firm (Liang et al., 2010). Likewise, studies conducted by BayoMoriones et al. (2013) show that ICT has a positive impact on the communication and internal and external coordination of a firm which directly contributes to improve the operational performance and performance of companies. Furthermore, there are many security issues to consider avoiding filtration of, for example, strategic information.

Therefore, it can be concluded that the implementation of ICT in SMEs has several positive effects that directly or indirectly contribute to improvement of the performance of a company. However, strategic changes and security systems must be considered together with a restructuring of organization and extra-investments in highly qualified workers or training, before deciding to implement this technology to benefit from its use.

2.5 Relevant factors and implementation phases of ICT in SMEs

To examine what factors should be considered to adapt or implement ICT is essential for this research because it allows to explore the different perspectives found in the literature, and also to define the factors that will be used to construct part of the hypotheses that will be investigated in this study. However, is also relevant explorer how the new technologies implementation process can be performed from several drives and perspectives (Grandón, 2011; Lee,2006). Olivera (2011). This author assert, that the best models to adopt a new technology should consider the individual characteristics of the organization related to technology, the relevance of innovation and technology implementation inside these firm and the easy implementation of these technological tools to the

company systems. However, there are two commonly applied theories to develop technology implementation models: the theory of diffusion on informatic (DOI) developed by Rogers (1995), and the technology organization framework (TOE) created by Tornatzky (1990).

The DOI considers the internal organization of companies as a critical characteristic to adopt new technologies (Rogers, 1995), while the TOE framework focuses on the impact of the environmental context as a decision factor in implementing technological information in a company (Tornatzky, 1990). The environmental context involves e.g. the analysis of company capacities, competitors, international policies, or social ideology. Both perspectives are widely used to develop models for the adoption or implementation of new technologies.

An example of a mix of these two models is Giotoplous (2017) model, who argues that there are four main factors to consider before deciding to adapt new technology systems in an organization: the technological competency, the human resources, internal organization, environmental situation and firm characteristics. The author describes the technological competence as the set of skills and technological capabilities, processes and activities, which identify a company performance and determines its innovation level.

Moreover, several studies assert an efficient Research and Development department of a company generate the need of implementing new technology in a company because of the great quantity of innovative projects these firms develop (Alshamaila, 2013; Arvanitis, 2001; Cohen, 1989; Hollenstein, 2004; Khalifa, 2016). The results from these studies are reforzed for other investigations that highlight the importance of R&D in the increment of innovation projects in firms, e.g. Battisti (2003 and 2009) who asserts that when a firm develops its innovation technology, it impacts other dimensions inside the company, creating the adequate conditions to for example adopt e-business tools in all the processes of a firm. Then it can see that the efficiency of R&D is highly related with the need of adoption or implementing new technology in an organization.

Human resources have also a great relevance in the implementation and benefit of new ICT because this process involves an understanding of specific knowledge and technique training (Schultz, 1975). Several authors agree that highly educated workers are in better qualified to adopt new technologies in the different areas of a company, e.g. to respond to a new product development opportunity or use e-business software to make decisions (BayoMoriones, 2007). Likewise, several authors affirm that companies with a high human capital start early and successfully the use of ICTs (Luccheti, 2004).

The author Thong (2001) agrees that deficiencies in human resources could be a significant obstacle to the implementation of ICTs, particularly in SMEs. However, the author highlights that the costly investment to get skilled workers could also be a significant constraint to the implementation of ICTs in SMEs. Therefore, companies with a pre-existing high skilled labor force have significant probability of having a better advantage in implementing ICTs (Forth, 2004)

Another crucial factor in ICT adoption is also the adequate internal structure of a company (Brynjolfsson, 1994; Daft, 1986). In the literature, many authors recommend a decentralized organizational design as the most appropriate structure to get a successful implementation of ICTs because in this type of organization-structure the decisions are performed in teams formed by all the work force. Furthermore, these teams perform continually several innovative projects, which contribute to increase the innovation capacity of employees, and improves the empathy between work force and company (Chen, 2011; Hopper, 1990; Pérez, 2005).

In contrast, although a decentralized organization speeds up communication by empowering workers; the implementation of communications and information technology increases the need for processing this information and the costs of coordination. Hence, the decision of the type of organization also depends on the cost-benefit implied by this decision (Galbraith, 1983; Tushman, 1978; Bolton, 1990; Gurbaxani, 1991).

However, in the case of SMEs with less than 50 employees, the increment of information is reflected in the complexity of the information exchange processes. Therefore, ICTs contributes to improve several aspects, such as transparency, efficiency in decision making, and the agility to exchange information (BayoMoriones, 2007; Montazemi, 1988).

There are results in the literature that confirm the importance of the internal organization of a company to determine the success in the use and implementation of ITCs, for example in the research carried out by Chatzoglou et al. (2010), using data based on surveys of 278 employees of SMEs in Greece, provides evidence of the importance of the existence in enterprises of adequate management support for the adoption of computerized systems.

The results of other interviews plied to 3500 SMEs in Greece for Giotopoulos et al. (2017) found, regardless of the size of the SMEs, the more decentralized the organization structure is, the higher the likelihood that ICTs will be adopted. It is interesting to look for cases in Greece because this country

has two things in common with the countries of Latin America: The level of technological development and the fact that both are countries with limited resources.

The positive impact of an adequate internal organizational structure on the success of the ICT application is also demonstrated by several empirical studies carried out for example by Alshamaila (2013), Giunta (2007), Hollenstein (2004) and Pontikakis (2006). These authors affirm that companies that have a decentralized structure, innovative strategy and previous experience in the handling of technology are the best candidates to the early ICT implementation and successful adoption of digital information systems compared to inexperienced companies.

The existing governmental policies to ICT adoption minimize the relevance of implementing these tools in SMEs setting focus only in large companies (Feindt, 2001). According to the author the biggest mistake of the most part of governments is thinking that e-business is concerning more to technology than strategy and this is not correct, because the use of ICT contributes to improve the strategy of SME in the global market.

The company's own elements must also be considered to evaluate ICT implementations factors in SME. Among which are mentioned their purchasing policies, strategic planning, and organizational structure. For example, companies have policies for investment and renovation, as equipment wears out, is damaged or obsolete due to technological progress.

However, investment for expansion or modernization are more related to the operational efficiency of the business, because it is invested to reduce costs or increase revenues, which is a part of strategic planning of a company (Estallo, 2010). In this sense, the variety of products ICT has a place in each of the motivating factors for investment in the different sectors. The areas mentioned above and can be replaced by technological evolution and by how quickly some computers become obsolete, especially computers.

Concerning to the firm' organizational structure. The size of the company is one of the factors the adoption of ICTs, as small businesses are the most vulnerable to have different characteristics to those of large companies (Sanchez, 2006). In addition, the former is more reluctant to initial investment which represents the acquisition of equipment in comparison with the large companies that have greater financial resources, and therefore so much larger budget for equipment. This comparison includes mention that small businesses have less training a factor that also influences the adoption of ICTs.

Other authors, as Durand (2003) also believe that every day, the challenge faced by companies in the area of information technology is growing, due to the need to generate proper management of the cost of their products and services resources being one of its main challenges, how to achieve greater efficiency in the use of technology through the proper identification of its costs in order to maximize its benefits (Durand, 2003). The author argues that despite the use of Information and Communication Technology (ICT), means saving money, in processes, personnel, administration, and being up to date with technology can mean the company's success.

Nevertheless, this cost of ICT is not only composed of tangible elements, such as hardware, software, and applications, among others. However, it also includes intangible costs that originate from people, processes, and technology itself. Based on the knowledge presented in this chapter, Figure 3 below displays a framework of the main issues to consider before implementation of ICT tools.

From the above explained, arise the following hypotheses to explore:

H0: There is a direct correlation relationship between ICT implementation in supply chain macroprocesses and the factors cost, the environmental organization/governmental policies and adaptability.

H1: There is a relation between CEO experience and the use of ICT tools in SMEs and at least one ICT implementation factors.

H2: There is a strong relation between company size and ICT implementation in SMEs of developing countries in Latin America.

H3: The cost is a constrain to ICT implementation in SMEs of developing countries of Latin American.

H4: Technological training is a constraint to ICT implementation in SMEs of developing countries in Latin America.

H5: All SMEs of developing countries in Latin America use ICT to manage supply chain macroprocesses.

H6: The environment and policies are a constraint to ICT implementation in SMEs of developing countries in Latin America.

Table 3: Relevant ICT implementation factors to SMEs of developing countries in Latin America

	Factor
1	Adaptability
2	Cost
3	Easy implementation
4	Short time training
5	Technological knowledge
6	Environmental organization/governmental policies
7	Rapid processes
8	Information Interchange
9	Optimization processes
10	Flexibility
11	Control
12	Evaluation
13	Several languages
14	Easy Manual of Instructions
15	Rapid Results
16	Planification
17	Technic support

3. Methods

This investigation is a descriptive-exploratory study, which has the purpose to describe and explore the ICT implementation factors in SMEs of developing countries. The aim is to improve the understanding and relevance of these ICT implementation factors based on the results of previous investigations, and apply this knowledge to analyze, whether there is a correlation between theory findings and the implementation priorities found in a real SME sample in Latin America. This study is realized in a time interval of four month, it means eighty-eight workings day.

The knowledge collected from the literature review is used to design a guide or framework to build the experimental part of this research. This review is performed using secondary sources as books, scientific reports and relevant websites. The material is gathered in English and Spanish, and with a time interval 2000-2019. First a general perspective is made to obtain a macroscopic understanding of the theme to select relevant definitions, followed by a more focused searching is made on ICT implementations factors in SMEs of developing countries. The first searching words are Information Communications Technology, Supply Chain Technology, Supply Chain macro processes, Small and Medium Enterprise Technology, SMEs in developing countries, SMEs in Latin America and ITC implementation factors in SME. The output of this phase is a resume of the main variables needing to design the interview.

The interviews are conducted in Spanish. The original emails with the answers are stored and transcribed to English. All these materials are included in the appendix part as probatory material with the aim of validate the information. Several open and closed questions are used in the interview. In the first part of the interview there are presented two tables with closed questions contained a list of supply chain software and Internet applications respectively. For example, the participant is interrogating: Is this tool relevant in supply chain performance in a Small and Medium Enterprises? Why? The participant answers setting a “x in the correct column:

SD= Strong agree/Excellent experience
A= Agree /good experience
D= Disagree /bad experience
SD= Strongly disagree/ very bad experience
U= Undecided/ doesn’t use/Not answer

See example below in Figure 1. The participant has answer strongly agree about ERP software, then according to Figure 4 below, the answer get 2 points in the answers' quantification.

	Tool	Strongly A	Agree	Disagree	Strongly Dissagre	Undecided	WHY?
		SA	A	D	SD	U	
1	ERP	X					
2	EDI						
3	CPRF						
4	VMI						
5	ECR						
6	SCEM						
7	CRM						
8	DFM						
9	SCEM						
10	SCP						

Figure 1: Example of interview closed questions

In the second part the participant should answered twenty-three open questions relevant to supply chain macroprocess and ICT implementation requirements. This part is quantified direct from the original version in Spanish, because the interpretation can be affecting for the traducing. For example: Question 17: *Do you use any Information technology to support negotiation with suppliers in your company? How was your experience?*

Possible answers:

- Yes, we use a software which is includes in the ERP packet. It helps so much to improve negotiations with suppliers. (This answer gets 2 points)
- Yes, we use occasionally a software which is includes in the ERP packet. The results are good. (This answer ger 1 point)
- We do not use more this software because it is not relevant for us or just the participant does not respond this question (This answer gets -1point)
- We do not use more this software because we had a very bad experience with it (This answer gets -2 points)

The last part of the interview is about ITC implementations factors. In this part the answer gets cero points if the participant does not answer, and one point for each factor the participant considers relevant. The sample of the experimental part is nine CEOs of SMEs of different companies with locations in Latin America. The snowball sampling technique is used to choose the companies participants. In this technique an expert recommends to another expert, based in their success and good reputation, this modality is validated for several researchers (Knokke, 1994).

Twenty companies are contacted through telephone call and e-mail, and nine answered positively to perform an interview via e-mail. The sample includes directors and owners from various types of formal industry or services, who makes decisions about different areas within supply chain macro processes. The answers are received via e-mail. The exploratory nature of the study matches with the "Transcription and coding technique" of Miles and Huberman,1994 (Miles and Huberman, 1994, p. 56). The author asserts that qualitative analysis can be conducted through the use of coding techniques.

The data from the interview are grouped in quantified variables, using the codes present in Figure 2 and 3. The values given to each answer are displayed in Figure 4. The code was divided into five categories, Supply chain software, Internet Applications, ICT implementation factors, ICT used in Supply chain Macro Processes and as extra variables are company size (workers #) and CEOs' ICT experience (years).

	CODE	Name
1	COMSIZ	Company size (# workers)
2	CEOEXP	CEO ITC experience (years)
		Supply Chain Softwares
1	ERP	Enterprise Resource Planning
2	EDI	Electronic Data Interchange
3	CPRF	Collaborative Planning Forecasting and Replenishment
4	VMI	Vendor Managed Inventory
5	ECR	Efficient Customer Response
6	SCEM	Supply Chain Event Management
7	CRM	Customer Relationship Management
8	DFM	Demand Forecasting Management
9	SCP	Supply Chain Planning
		Internet Applications
1	CC	Could Computing
2	SM	Social Media
3	OCS	Online Conference System
4	MT	Mobil technology
5	ECM	Enterprise Content Management
6	AID	Automatic Identification
7	GIS	Geography Inform Systems
8	VSAT	Very-small-Aperture-Terminals
9	GPS	Geographical Position Systems
10	WBT	Web Based Tracking
11	ASGV	Automated Guided Vehicle Systems
12	IDS	Information- detected Systems
		ICT Implementation factors
1	ADTY	Adaptability
2	COST	Cost
3	ESIM	Easy Implementation
4	STIK	Short time training
5	TEKL	Technological knowledge
6	ENPO	Environment/ policies
7	RAPR	Rapid Processes
8	ININ	Information interchange
9	OPPR	Optimization processes
10	FLEX	Flexibility
11	CONT	Control
12	EVLT	Evaluation
13	SLAN	Several Language
14	EMAI	Easy Manual of instructions
15	RARE	Rapid results
16	PLAN	Planification
17	TESU	Technic support

Figure 2: Research codes

			Supply chain macroprocess coding					
Customer RelationshipManagement			**Internal Supply Chain Management**				**Suppliers Relationship Management**	
Code	**Name**		**Code**	**Name**			**Code**	**Name**
CMDA	Data Analyse		**IMCP**	Capacity Planing			**SMPD**	Product Design
CMSP	Sales Planing		**IMLD**	Local Decisions			**SMCS**	Contract Supliers
CMDP	Delivering Planning		**IMFP**	Forecasting Planing			**SMSB**	Suppliers business
CMTS	Tephone Service		**IMIM**	Inventory Management			**SMBM**	Buyer Management
CMTO	Traking Ording		**IMTP**	Transport planning			**SMSF**	Suppliers Feedback

Figure 3: ICT used in Supply Chain Macroprocesses coding

Code	Description	Value
SD	Strong agree	-2
D	Disagree, undecided, not use	-1
A	Agree	1
SA	Strong Agree	2

Figure 4: Answers quantification

The result generates five general tables which displays the full data. This modality to present the total information collected is a mandatory requirement to scientific investigations (Miles and Huberman, 1994). The full data is present in figures 5 to 9.

COMSIZE(WORKERS #)	CEOEXP (Years)
10	30
50	20
10	30
10	23
40	13
50	30
50	50
10	20

Figure 5: Full data company size and CEOs experience

Supply chain softwares full data									
ERP	EDI	CPRF	VMI	ECR	SCEM	CRM	DFM	SCIM	SCP
2	1	2	2	2	1	2	2	1	2
2	-1	-1	-1	-1	-1	2	-1	-1	-1
1	1	1	1	1	1	1	1	1	1
2	-1	-1	1	1	1	2	-1	1	2
2	-1	-1	2	-1	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
2	2	2	-1	-1	-1	-1	-1	-1	-1
2	2	2	2	2	2	2	2	2	2

Figure 6: Full data Supply chain software used for SME in Latin America

	CC	SM	OCS	MT	ECM	AID	GIS	VSAT	GPS	WBT	ASGV	IDS
A	2	2	1	2	2	2	2	1	2	2	1	2
B	-1	2	2	2	-1	2	2	-1	-1	-1	-1	-1
C	2	2	2	2	2	2	2	1	2	1	1	1
D	2	2	1	2	2	2	2	-1	1	1	-1	1
E	1	2	2	2	2	1	-1	-1	-1	2	-1	-1
F	2	2	2	2	2	-1	2	-1	2	-1	2	2
G	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
H	2	2	2	2	-1	2	2	-1	2	2	-1	-1
I	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

Figure 7: Internet Applications used in SME of Latin America- Full data

Supply Chain Macrprocesses full data														
CMDA	CMSP	CMDP	CMTS	CMTO	IMCP	IMLD	IMFP	IMIM	IMIP	SMPD	SMCS	SMSB	SMBM	SMSF
1	2	-1	2	-1	2	0	-1	-1	-1	-1	-1	-1	2	-1
1	2	1	2	-1	2	2	2	2	2	-1	-1	-1	-1	-1
2	2	-1	-1	-1	-1	3	-1	-1	-1	-1	-1	-1	-1	-1
2	2	2	-1	-1	-1	1	1	-1	1	-1	-1	-1	1	1
2	2	2	-1	-1	-1	-1	-1	-1	2	2	-1	-1	-1	-1
-1	2	2	-1	-1	2	2	2	2	-1	-1	-1	-1	2	-1
2	2	3	2	-1	2	2	2	2	-1	1	-1	-1	-1	-1
-1	1	1	-1	-1	-1	-1	2	-1	-1	-1	-1	-1	1	-1
1	2	1	-1	-1	1	1	2	2	-1	-1	-1	1	-1	-1

Figure 8: ICT used in Supply Chain Macroprocesses in SME of Latin America Full data

Relevant ICT implementations factors to SME of Latin America																	
ADTY	COST	ESIM	STIK	TEKL	ENPO	RAPR	ININ	OPPR	FLEX	CONT	EVLT	SLAN	EMAI	RARE	PLAN	TESU	
1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	
1	0.6	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	
1	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	
0	0.6	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	
0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	1	0	
0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	

Figure 9: Relevant ICT implementations factors in SME of Latin America

The next step is to perform the data analysis. This phase has two parts: The statistical analysis and the inferential analysis. In the descriptive analysis following factors are calculated for each variable: Frequency, media, mode and standard deviation. In the inferential analysis, the hypothesis contrasting is made using lineal regression, correlation factor and p-value. The results of both analyses are later compared to obtain a final conclusion. Finally, each one of the resting variables are mutual compared with the three most relevant factors found in the descriptive analysis. However, there is a possibility that these factors might not be included in the hypothesis. The analysis of all the parameters includes a discussion of each result. The total findings are displayed in the conclusion section. The experiment design is summary below in Figure 10.

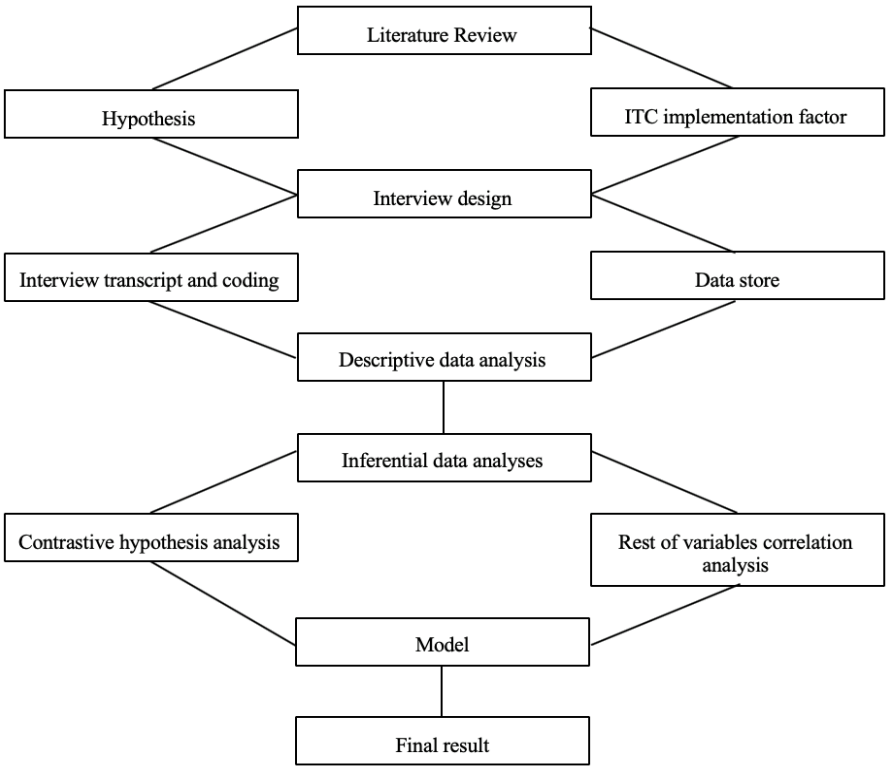


Figure 10: Experiment design

4. Data analysis and results

Three hundred ninety-six dates from nine SMEs of different developing countries of Latin America were collected and grouped into forty-four variables. The full data is presented above in section two, Figures 5 to 9. The independent variables in this study are: The CEOs management experience years, the company size, and the ICT implementation factors, while the supply chain software, internet applications, and supply chain macro processes are considered as dependent variables. Figure 2 and 3 above shows the name and coding of these variables.

This chapter is divided in two parts. Part 4.1 presents a descriptive analysis of all variables, including central trend measures to see how the data are grouped. The media is calculated to evaluate the symmetry of the data, and mode is calculated to discover which information is most repeated. Other dispersion measurements such as variance and standard deviation are also considered. Finally, frequencies in percentage of the ICT tools use of each SME are displayed, with the intention of explaining the results more clearly.

Part 4.2 involves the inferential analysis. Here the hypothesis presented in the last part of the literature review is evaluated trough a contrastive hypothesis analysis. The results from the descriptive statistics are compared with the evaluation results of correlations factors, lineal regression and p-value, to take the decision about reject or no reject the hypothesis. Finally, with the aim to explore further results, a double check correlation test of the variables that were not included in the hypothesis is performed.

4.1 Descriptive analysis

The results show that 33.33% of companies have in average two to ten workers. In this research these will be considered as small firms, while 66.67% are medium firms with 11 to 50 workers. The 56% of CEOs participating range from 21-40 years of management experience, 33% have 2-20 years of management experience and 11% have 40-60 years of management experience. See the results displayed in Figure 11 and 12.

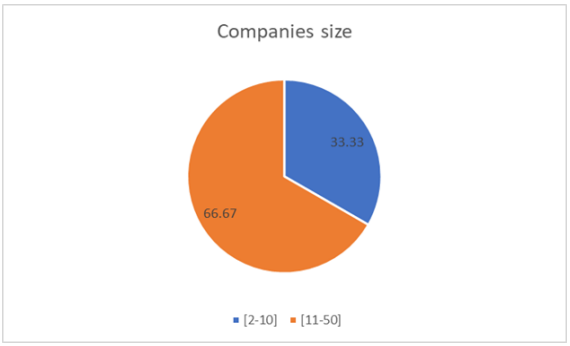


Figure 11: Company size frequency

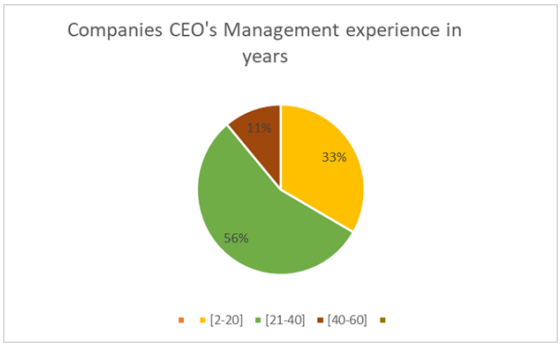


Figure 12: CEOs ICT tools use management experience in years

According with the descriptive statistics results of Figure 13 below, these managers have an average experience of 27 ± 10 years; it is therefore assumed that they must have some ICT knowledge, since this technology exists for approximately the last two decays. The group median is located in twenty-five years and the mode shows that most part of this group has thirty years' experience. Concerning to the company size the results shows that these company have a mean of 31± 10. The most part of the firm's participants have ten workers, which characterize them as small enterprises.

Statistics

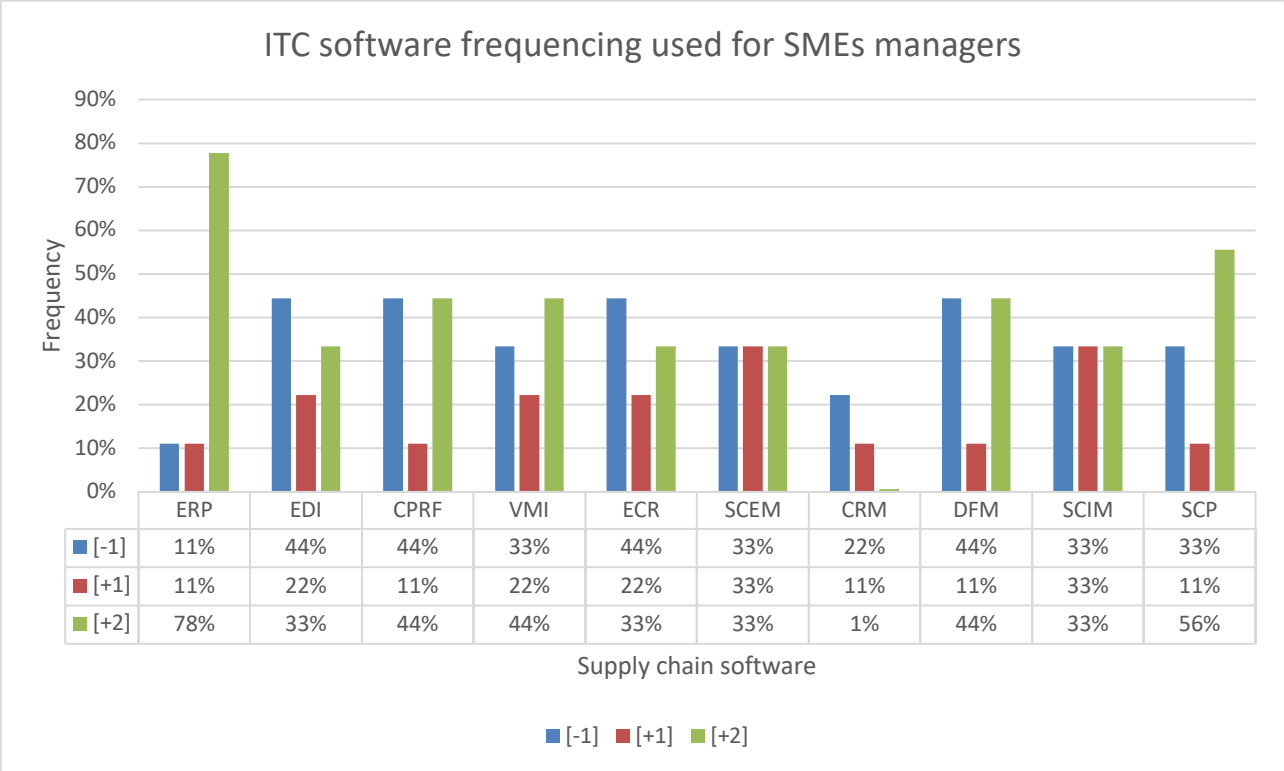
		COMPSIZE	CEOEXPER
N	Valid	9	9
	Missing	0	0
Mean		31.1111	27.3333
Std. Error of Mean		6.75863	3.48409
Median		40.0000[a]	25.8000[a]
Mode		10.00[b]	30.00
Std. Deviation		20.27588	10.45227
Variance		411.111	109.250
Skewness		-.192	1.113
Std. Error of Skewness		.717	.717
Kurtosis		-2.495	2.442
Std. Error of Kurtosis		1.400	1.400
Range		40.00	37.00
Minimum		10.00	13.00
Maximum		50.00	50.00
Sum		280.00	246.00

a. Calculated from grouped data.
b. Multiple modes exist. The smallest value is shown

Figure 13: Company size and CEOs ICT tools use management experience

The Figures 14 and 15 shows the results of frequency and descriptive statistics analysis in the use of supply chain software in SMEs. The aim of this analysis is firstly to know what technology is familiar to these managers and secondly to assess how many of them have had some good experience using them in real life. A list of ten different software options were given. Here all enterprises reported that they have used 50% of the software' presented, while they didn't have knowledge to the remaining 50% of the software. Furthermore, there were not any results that describes any deficient experience in the use of these tools.

The three most used supply chain software are Enterprise Resource Planning with 89%, Customer Relationship Management with 78% and Supply Chain Planning with 67%. However, 20% of firms thinks that ERP is not significant to a SME, 30% share the same opinion respect to CRM and 33% considers that SCP software is not relevant to supply chain management. 44% of the firms finds the three following software less relevant: Collaborative Planning Forecasting and Replenishment, Vendor Management Inventory and Demand Forecasting Management. In general, the enterprises assign 70% of the software as significant for the supply chain management.



	ERP	EDI	CPRF	VMI	ECR	SCEM	CRM	DFM	SCIM	SCP
[-1]	11%	44%	44%	33%	44%	33%	22%	44%	33%	33%
[+1]	11%	22%	11%	22%	22%	33%	11%	11%	33%	11%
[+2]	78%	33%	44%	44%	33%	33%	1%	44%	33%	56%

Figure 14: Frequency of supply chain software using in SMEs

As previous mentioned in the mythology chapter and as showed in Figure 4, the highest punctuation for each software is 2, this means that scores above >1 indicates that the CEO have assigned the software to be relevant in supply chain management. The descriptive statistical results are displayed in Figure 15, and the results confirms the findings showed above (Figure 14). Here, ERP and CRM are the most used software by the CEOs, with has a score mean of 1.55 and 1.22 respectively. However, SCP software is not part of the most used software, with a mean of only 0.88. Furthermore, it is observed that eight out of nine software has a mean over 0.5, indicating that a big percent of software is not used adequately by SMEs participants.

Likewise, the results show that there are three software that are not use by any of the enterprises. Furthermore, the Figure 15 shows, that the majority of CEOs know and/or have used some of the software with good results in their professional life. ERP, CRM and SCP share the same median score of 2. It means the data trends to be located in the right side, meaning that they are placed in the highest relevance punctuation. Likewise, six of nine business share the same mode value of 2, indicating that the majority of these executives has given an excellent experience with the software presented.

	ERP	EDI	CPRF	VMI	ECR	SCEM	CRM	DFM	SCIM	SCP
Mean	1.555556	0.444444	0.555556	0.777778	0.444444	0.666667	1.222222	0.555556	0.666667	0.888889
Standard Error	0.337931	0.474667	0.503077	0.464811	0.474667	0.440959	0.433903	0.503077	0.440959	0.484322
Median	2	1	1	1	1	1	2	1	1	2
Mode	2	-1	2	2	-1	1	2	2	1	2
Standard Deviation	1.013794	1.424001	1.509231	1.394433	1.424001	1.322876	1.301708	1.509231	1.322876	1.452966
Sample Variance	1.027778	2.027778	2.277778	1.944444	2.027778	1.75	1.694444	2.277778	1.75	2.111111
Kurtosis	6.337473	-2.28046	-2.46129	-1.81574	-2.28046	-1.71429	0.183822	-2.46129	-1.71429	-1.81816
Skewness	-2.50597	-0.02336	-0.13621	-0.56493	-0.02336	-0.46281	-1.39431	-0.13621	-0.46281	-0.69989
Range	3	3	3	3	3	3	3	3	3	3
Minimum	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Maximum	2	2	2	2	2	2	2	2	2	2
Sum	14	4	5	7	4	6	11	5	6	8
Count	9	9	9	9	9	9	9	9	9	9
Largest(1)	2	2	2	2	2	2	2	2	2	2
Smallest(1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Confidence Level(95.0%)	0.779271	1.094584	1.160098	1.071856	1.094584	1.016852	1.000582	1.160098	1.016852	1.116849

Figure 15: Statistical result of supply chain software use for SMEs CEOs in developing countries of Latin America

In contrast to the privious positive results presented in Figure 14 and 15, the Figure 16 shows that the executives do not use Internet applications with the same frequency as software. There are nine companies, and if an application were given the maximum score of 2 points by each CEO, then total points that an application can obtain is 18. The approval threshold to consider an application relevant for supply chain, is a total score greaten than >9 points. The results displayed in Figure 16 shows that only three applications are above the approval threshold: Social media (12 points), Online conference system (10 points), Mobil technology and Geography inform (12 points). In contrast, seven out of the twelve applications evaluated did not achieve the minimum acceptance score of >9 points, thus these seven applications have been assigned by executives as not being relevant for supply chain.

Furthermore, the applications Very Small Aperture Terminal and Automates Guided Vehicle System have a total negative total score of -5 and -2 respectively, meaning that a group of companies does not have knowledge about these applications or that the companies does not find these tools relevant.

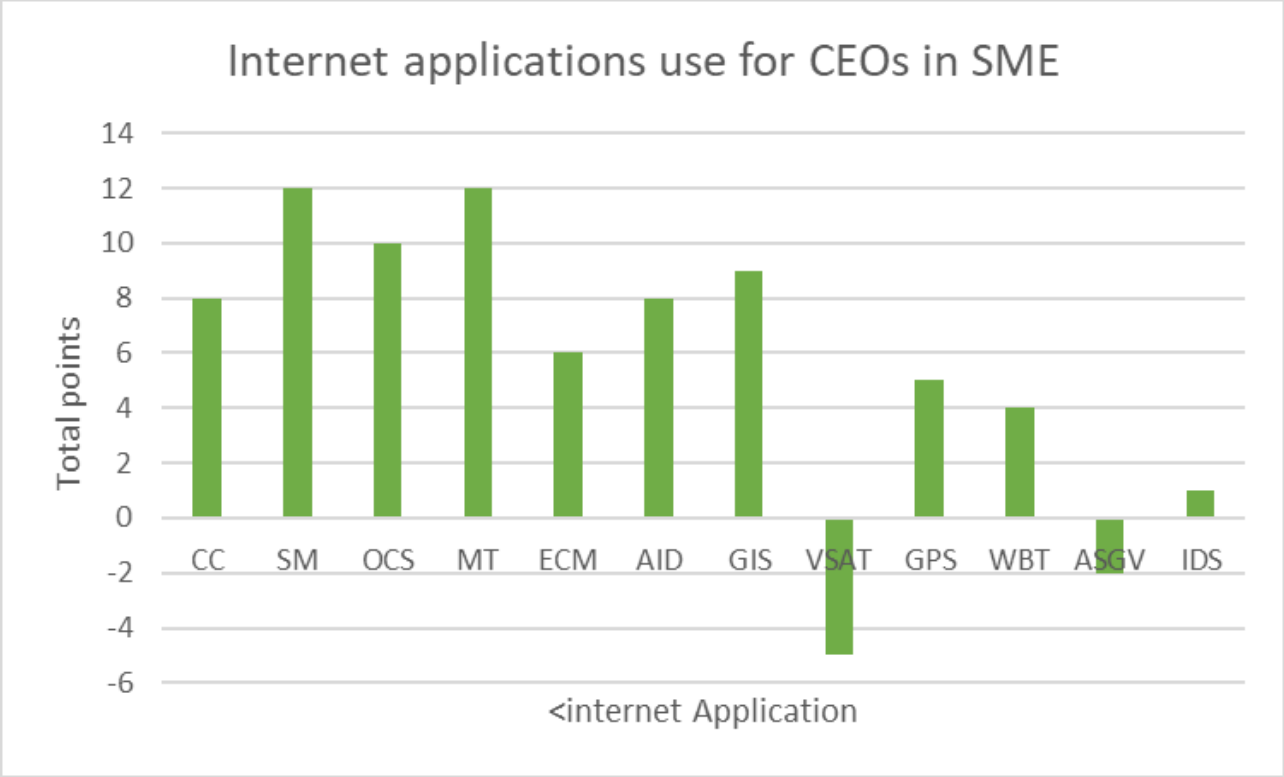


Figure 16: Internet applications used by CEOs in supply chain.

The internet applications Social Media (SM), Mobil Technology (MT), Online Conference System (OCS), and Geography Inform System (GIS) are the most relevant applications used by the CEOs for supply chain. These have also a mean bigger than one (see figure 17), meaning that these applications are used with high performances by executives. In addition, the negative means -0.55 and -0.22 corresponding to Very small aperture terminal (VSAT) and Automates system guided vehicle (ASGV) respectively, indicates that majority part of CEOs does not use these tools.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
CC	9	-1.00	2.00	.8889	1.45297
SM	9	-1.00	2.00	1.3333	1.32288
OCS	9	-1.00	2.00	1.1111	1.26930
MT	9	-1.00	2.00	1.3333	1.32288
ECM	9	-1.00	2.00	.6667	1.58114
AID	9	-1.00	2.00	.8889	1.45297
GIS	9	-1.00	2.00	1.0000	1.50000
VSAT	9	-1.00	1.00	-.5556	.88192
GPS	9	-1.00	2.00	.5556	1.50923
WBT	9	-1.00	2.00	.4444	1.42400
ASGV	9	-1.00	2.00	-.2222	1.20185
IDS	9	-1.00	2.00	.1111	1.36423
Valid N (listwise)	9				

Figure 17: Descriptive statistical results of Internet Applications used by SMEs CEOs developing countries in Latin America.

Figures 17 to 20 display descriptive statistical results of ICT application in SMEs supply chain macroprocesses of developing countries in Latin America. Figure 18 shows that the enterprises who used ICT tools as a decision-support tool with a satisfaction level of < 50% are: Data analysis (CMDA), tracking order (CMTO), telephone service (CMTS), capacity planning (IMCP), local decision (IMLD), forecasting planning (IMFP), inventory management (IMIM), transport planning (IMTP), and buyer management (SMBM). However, only 55% of SMEs use forecasting planning software, with a positive satisfaction level equal to 51%. Furthermore, there are several negative scores in the following processes: Tracking order (CMTO) (100%), telephone services (CMTS) (66%), inventory management (IMIM) (55%), transport planning (IMTP) (66%), product design (SMPD) (77%), contract suppliers (SMCS) (100%), suppliers' business (SMSB) (100%), buyer management (SMBM) (55%) and suppliers' feedback (SMSF) (88%). The negative scores are an indication for the majority of SMEs do not use ICT in over 50% of supply chain macroprocesses. See Figure 18 below.

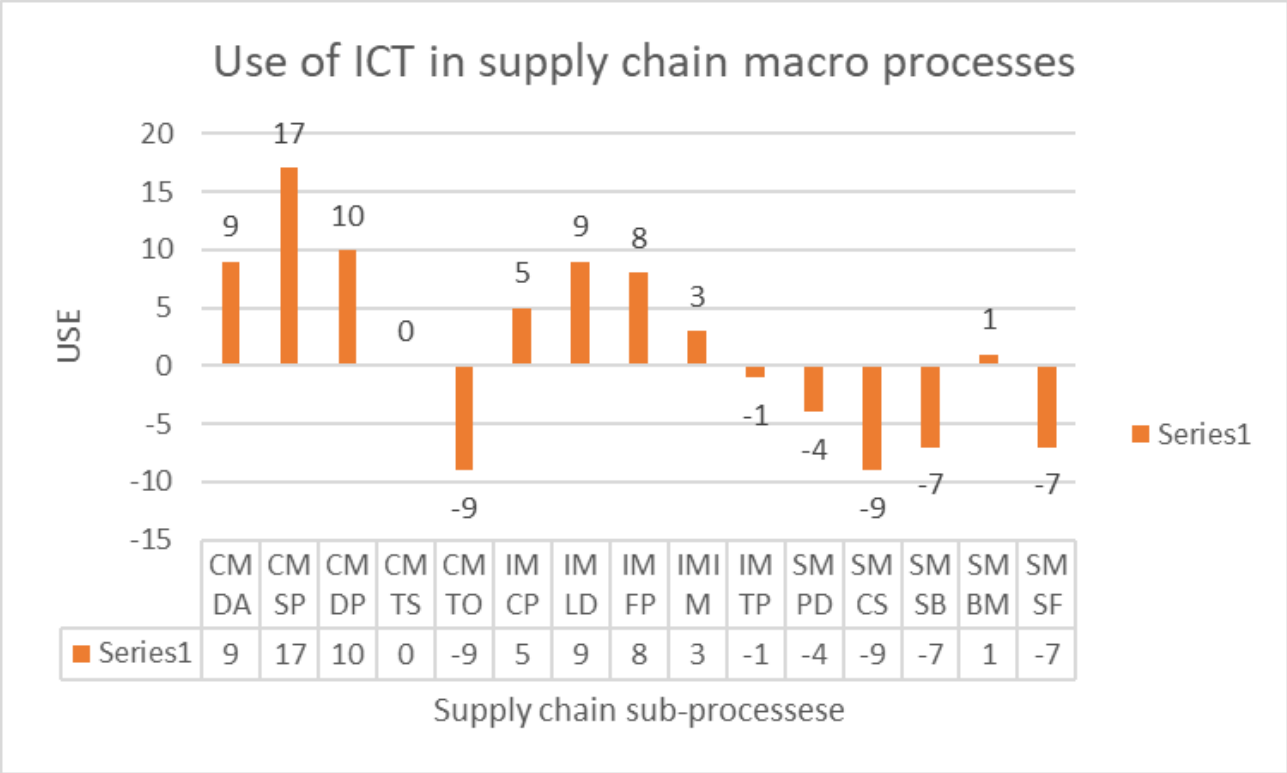


Figure 18: Current use ICT in SMEs' supply chain macroprocesses of developing countries in Latin America

		[-1]	[1]	[2]
	CMDA	22.22%	33.33%	44.44%
	CMSP		11.11%	88.89%
	CMDP	22.22%	33.33%	44.44%
	CMTS	66.67%		33.33%
	CMTO	100.00%		
	IMCP	44.44%	11.11%	44.44%
	IMLD	33.33%	33.33%	33.33%
	IMFP	33.33%	11.11%	55.56%
	IMIM	66.67%		33.33%
	IMIP	55.56%	11.11%	33.33%
	SMPD	77.78%	11.11%	11.11%
	SMCS	100.00%		
	SMSB	100.00%		
	SMBM	55.56%	22.22%	22.22%
	SMSF	100.00%		
Average		62.70%		

Figure 19: Supply chain sub- processes frequencies in SMEs

The results presented in Figure 20 show following sub-processes have a score mean > 1: Data analyses (CMDA) (1.00), sales planning (CMSP) (1.89), delivering planning (CMDP) (1.11) and local decisions (IMLD) (1.00). A score mean >1 state that ICT use in the previous mentioned process have given good results for the SMEs. In contrast, there are another areas where the SMEs do not use ICT at all, these are: Tracking order (CMTO) (-1), transport planning (IMTP) (-0.11), contract suppliers (SMCS) (-1.00), suppliers business (SMSB) (-1.00), buyer management (SMBM) (-0.11) and suppliers feedback (SMSF) (-0.78). In total, data shows that 40% of supply chain subprocess are managed without the used any technology. However, there are four supply chain sub-processes which have ta mode equal to 2, these are: Data analyses (CMDA), sales planning (CMSP), local decisions (IMLD) and forecasting planning (IMFP). The results from the ICT implementations processed collected are presented in Figure 19 and 20.

Statistics																
		CMDA	**CMSP**	**CMDP**	**CMTS**	**CMTO**	**IMCP**	**IMLD**	**IMFP**	**IMIM**	**IMIP**	**SMPD**	**SMCS**	**SMSB**	**SMBM**	**SMSF**
N	Valid	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
	Missing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mean		1.00	1.89	1.11	0.00	-1.00	0.56	1.00	0.89	0.33	-0.11	-0.44	-1.00	-0.78	0.11	-0.78
Std. Error of Mean		0.41	0.11	0.45	0.50	0.00	0.50	0.47	0.48	0.53	0.45	0.38	0.00	0.22	0.45	0.22
Median		1.286a	1.8889a	1.3333a	.0000a	.a	1.0000a	1.2000a	1.3333a	.3333a	-.1429a	-.5000a	.a	-.7778a	.1429a	-.7778a
Mode		2.00	2.00	1.00b	-1.00	-1.00	-1.00b	2.00	2.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
Std. Deviation		1.22	0.33	1.36	1.50	0.00	1.51	1.41	1.45	1.58	1.36	1.13	0.00	0.67	1.36	0.67
Variance		1.50	0.11	1.86	2.25	0.00	2.28	2.00	2.11	2.50	1.86	1.28	0.00	0.44	1.86	0.44
Skewness		-1.05	-3.00	-0.63	0.86		-0.14	-0.34	-0.70	0.27	1.01	1.83		3.00	0.51	3.00
Std. Error of Skewness		0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Kurtosis		-0.29	9.00	-0.37	-1.71		-2.46	-1.09	-1.82	-2.57	-1.09	2.11		9.00	-1.92	9.00
Std. Error of Kurtosis		1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Range		3.00	1.00	4.00	3.00	0.00	3.00	4.00	3.00	3.00	3.00	3.00	0.00	2.00	3.00	2.00
Minimum		-1.00	1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
Maximum		2.00	2.00	3.00	2.00	-1.00	2.00	3.00	2.00	2.00	2.00	2.00	-1.00	1.00	2.00	1.00
Sum		9.00	17.00	10.00	0.00	-9.00	5.00	9.00	8.00	3.00	-1.00	-4.00	-9.00	-7.00	1.00	-7.00
a Calculated from grouped data.																
b Multiple modes exist. The smallest value is shown																

Figure 20: Descriptive statistical analysis of ICT using in SMEs supply chain macroprocesses

Figure 21 shows that for 70% of the participating companies', environmental organizations/governmental policies are the most ICT implementations factor for SMEs of developing countries in Latin America, for the 50% is the cost and adaptability for the 45% is the adaptability. These factors will be analyzed individually in the section 4.2.

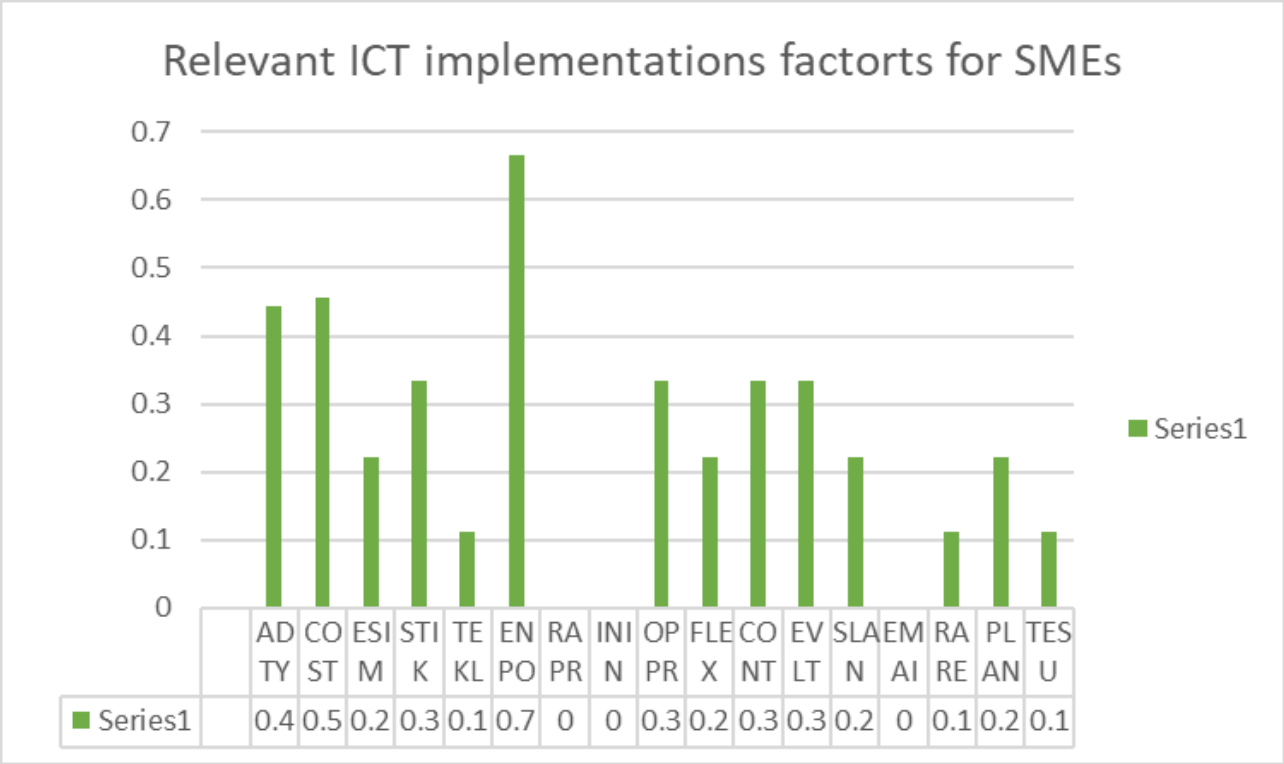


Figure 21: ICT relevant implementations factors to SMS from developing countries in Latin America

The figure 22 below shows that following implementation factors: Variants adaptability (ADTY), costs (COST) and environment/policies (ENPO), have the highest degrees of influence with an average of 0.44, 0.47 and 0.67 respectively, while the rest of the evaluated factors are well below those averages. Furthermore, data shows, that the rapid process variants (RAPR), information interchange (ININ), and easy instructions manual (EMAI) have no relevance in the decision of implementation of ICT tools in their enterprises, since they have obtained a total average score equal to zero. In contrast, the results show that the most repeated factor is ENPO, with a mode equal to one, which means, that it is considered as a significant ICT implementation factor for SMEs in developing countries of Latin America. The data from the seventeen ICT implementation factors are presented in figure 22.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ADTY	9	.00	1.00	.4444	.52705
COST	9	.00	1.00	.4667	.46904
ESIM	9	.00	1.00	.2222	.44096
STIK	9	.00	1.00	.3333	.50000
TEKL	9	.00	1.00	.1111	.33333
ENPO	9	.00	1.00	.6667	.50000
RAPR	9	.00	.00	.0000	.00000
OPPR	9	.00	1.00	.3333	.50000
ININ	9	.00	.00	.0000	.00000
FLEX	9	.00	1.00	.2222	.44096
EVLT	9	.00	1.00	.3333	.50000
SLAN	9	.00	1.00	.2222	.44096
CONT	9	.00	1.00	.3333	.50000
EMAI	9	.00	.00	.0000	.00000
RARE	9	.00	1.00	.1111	.33333
PLAN	9	.00	1.00	.2222	.44096
TESU	9	.00	1.00	.1111	.33333
Valid N (listwise)	9				

Figure 22: Descriptive statistical analysis of ICT implementations factors of SMEs for developing Countries of Latin America

4.2 Inferential Analysis

In order to obtain valid, meaningful, and useful conclusions to support our final deduction, an inferential analysis is performed based on the results of the descriptive statistical studies presented in section 4.1 and analysis of correlation factors, linear regression and p-value. Following the experimental design presented in the methods sections, a contrastive hypothesis analysis of the six hypotheses presented in chapter are first defined.

H0: There is a direct correlation relationship between ICT implementation in supply chain macroprocesses and the factors cost, the environmental organization/governmental policies and adaptability.

H1: There is a relation between CEO experience and the use of ICT tools in SMEs and at least one ICT implementation factors.

H2: There is a strong relation between company size and ICT implementation in SMEs of developing countries in Latin America.

H3: The cost is a constrain to ICT implementation in SMEs of developing countries of Latin American.

H4: Technological training is a constraint to ICT implementation in SMEs of developing countries in Latin America.

H5: All SMEs of developing countries in Latin America use ICT to manage supply chain macroprocesses.

H6: The environment and policies are a constraint to ICT implementation in SMEs of developing countries in Latin America.

Hypothesis 1 states: "There is a relation between CEO experience and the use of ICT tools in SMEs and almost one ICT implementation factors"; The results show that there are three strong correlations between the COEs and the following ICT implementation factors: Easy implementation (ESIM) (0.687), Optimization processes (OPPR) (-0.694) and Technic support (TESU) (-0.687). Figure 23 and 24 display the lineal regression equations for the CEOEX-TESU relation described with the line y= 0.3075x+11.958 with a significance coefficient p= 0.493979. The regression function has a high p-value.

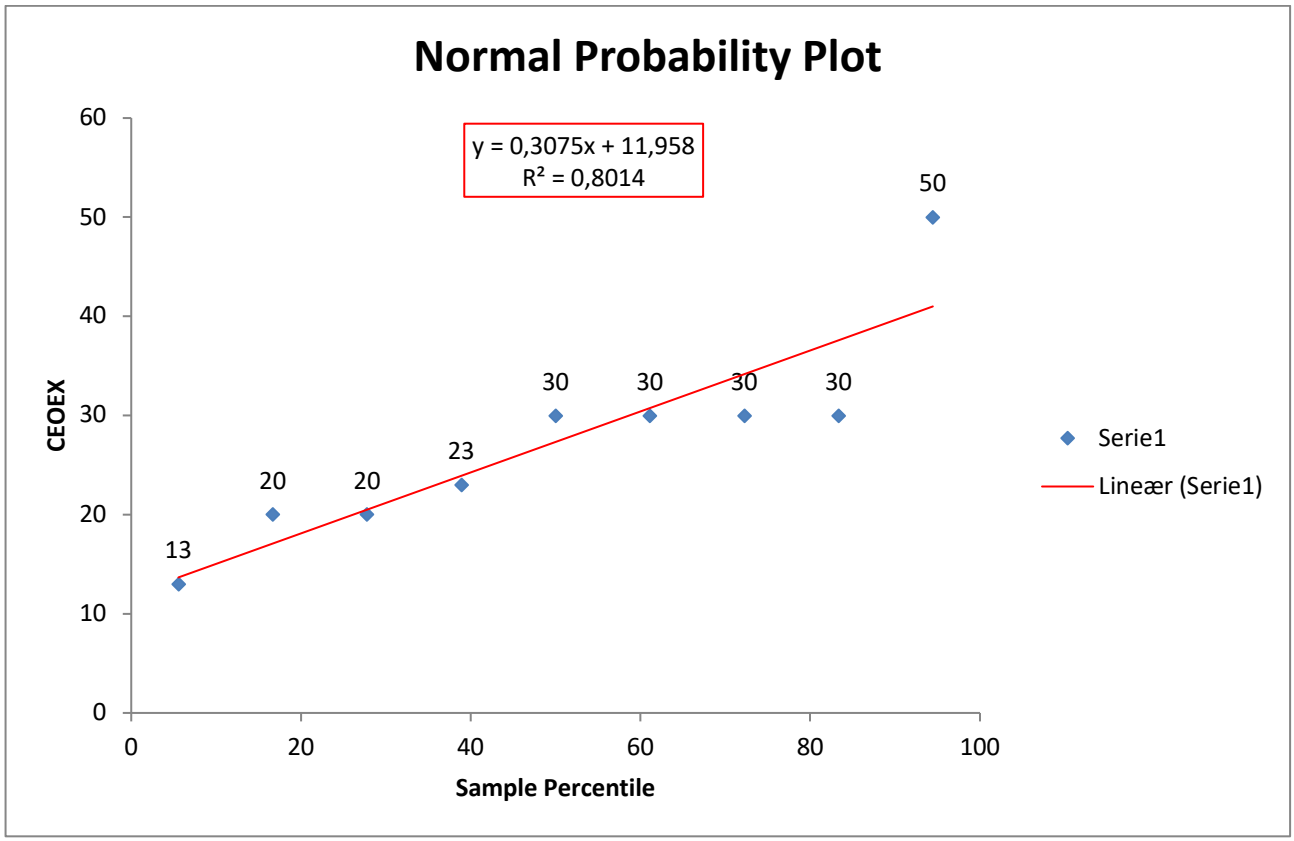


Figure 23: Regression plot of CEOEX-TESU

	Coefficients	andard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	pper 95.0%
Intercept	28.25	3.811402	7.411971	0.000148	19.23747	37.26253	19.23747	37.26253
TESU	-8.25	11.43421	-0.72152	0.493979	-35.2876	18.7876	-35.2876	18.7876

Figure 24: Coefficient analysis CEOEX-TESU

The relation between CEO management experience (CEOEX) and optimization processes (OPPR) also has a negative correlation of -0.694. Figures 25 and 26 display the lineal regression equations for the CEOEX-OPPR relation described by the line y=0.3075x+11.958 with a significance coefficient p= $2.4617*10^{-05}$. These variables have a very low significance coefficient, indicating that this relation is not significant.

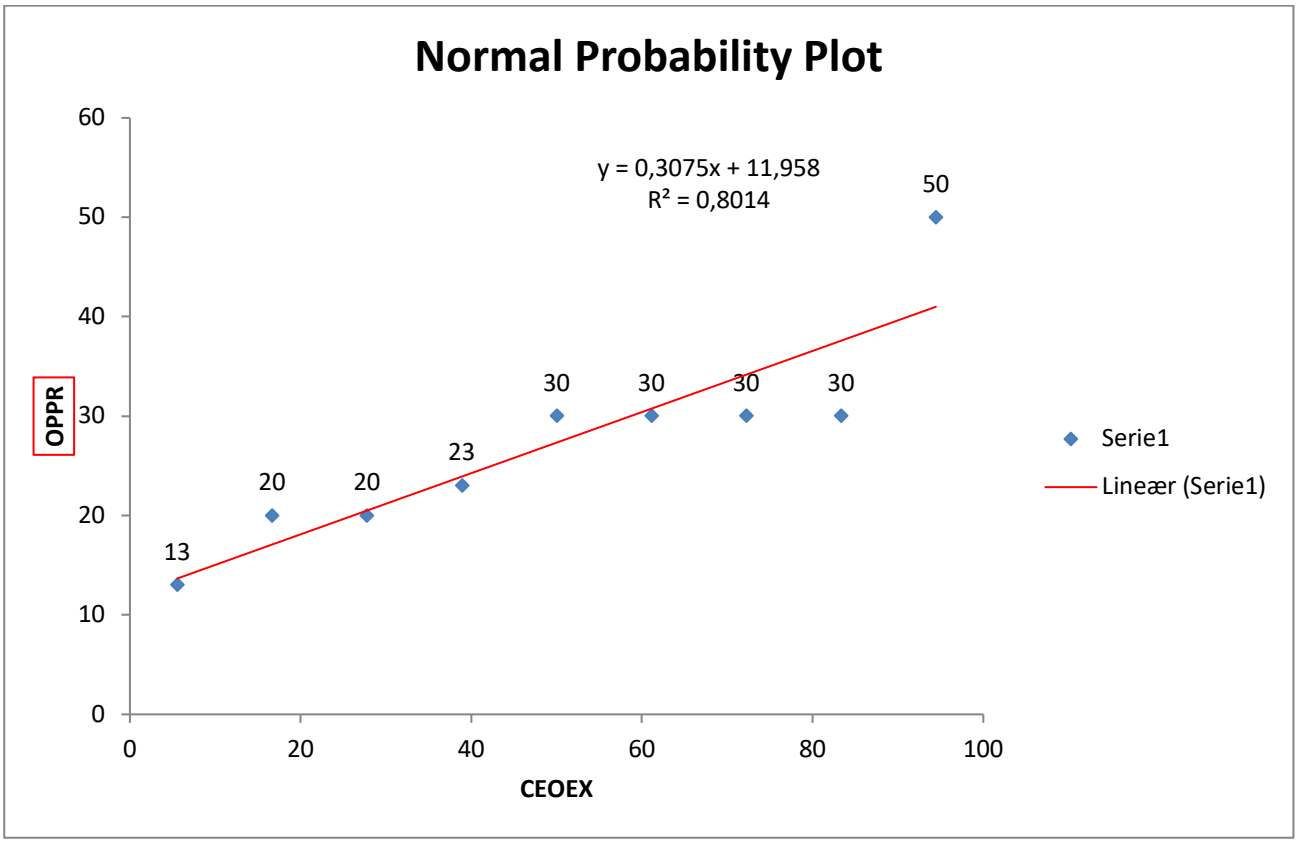


Figure 25: Normal P-p plot of regression CEOEX-OPPR

	Coefficients	andard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	pper 95.0%
Intercept	32.16667	3.285973	9.789084	2.46179E-05	24.39658	39.93676	24.39658	39.93676
OPPR	-14.5	5.691472	-2.54767	0.038233362	-27.9582	-1.04181	-27.9582	-1.04181

Figure 26: Coefficient p-value CEOEX-OPPR

The correlation between CEOs ICT use in management experience (CEOEX) and Easy implementation (ESIM) (0.687), has a positive correlation of 0.687. Figures 27 and 28 display the lineal regression equations for the CEOEX-ESIM relation, described by the line y=0.0105x-0.3028 with a significance coefficient p= 0.134218. These variables have a high p-value, meaning that the relation is considered significant.

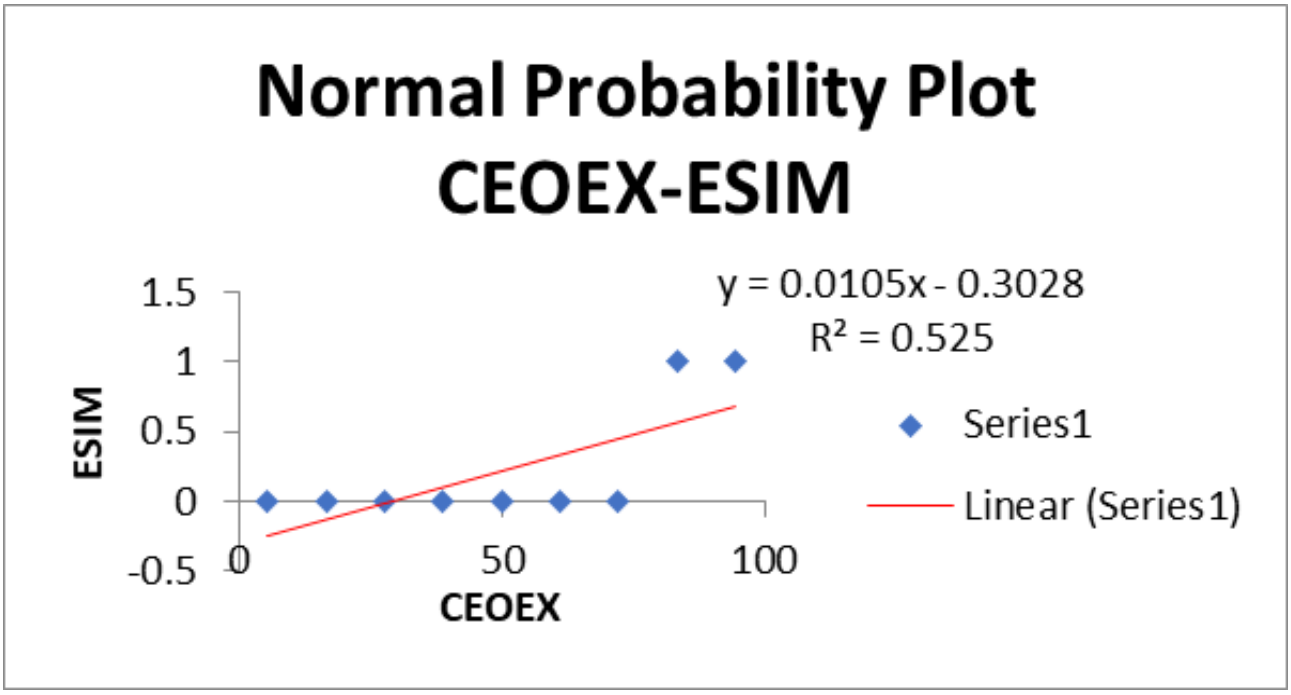


Figure 27: Lineal regression CEOEX-ESIM

	Coefficients	*ndard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	-0.57005	0.336638	-1.69336	0.134218	-1.36607	0.225974	-1.36607	0.225974
CEOEX	0.028986	0.011586	2.501764	0.040887	0.001589	0.056382	0.001589	0.056382

Figure 28: Coefficient p-value CEOEX-ESIM

The results show that the SMEs of developing countries in Latin America find significant that the software must be easy to implement in their enterprise in order for them to incorporate this tool in their system. The results also show that there are two correlations. First, there is seen a correlation between the CEOs experience and the application of ICT in optimization processes (OPPRs), and second there is a correlation between CEOs experience and the use of ICT in easy implementation (ESIM). However, only a significant correlation is seen between the CEOs experience and the use of

easy implementation (ESIM). Because there still is the possibility that exist more relevant factors that have not been included in this research, the hypothesis 1 cannot be rejected.

Hypothesis 2 states: "There is a strong relation between company size and ICT implementation in SMEs of developing countries Latin America ". Figure 29 shows that there is a strong negative correlation of -0.699 between Company size (COMSIZE) and the ICT implementations factor Environmental organization/governmental policies (ENPO). This means, the smaller the company size (COMSIZE), the higher is the effect of Environmental organization / governmental polices decisions (ENPO). This relation between COMSIZE and ENPO is described by the lineal regression equation y=0.0135x-083 with R^2=0.675 and a p-value= 0.03265. The p-value is under 0.05, meaning that the relation is not significant, and the hypothesis must be rejected.

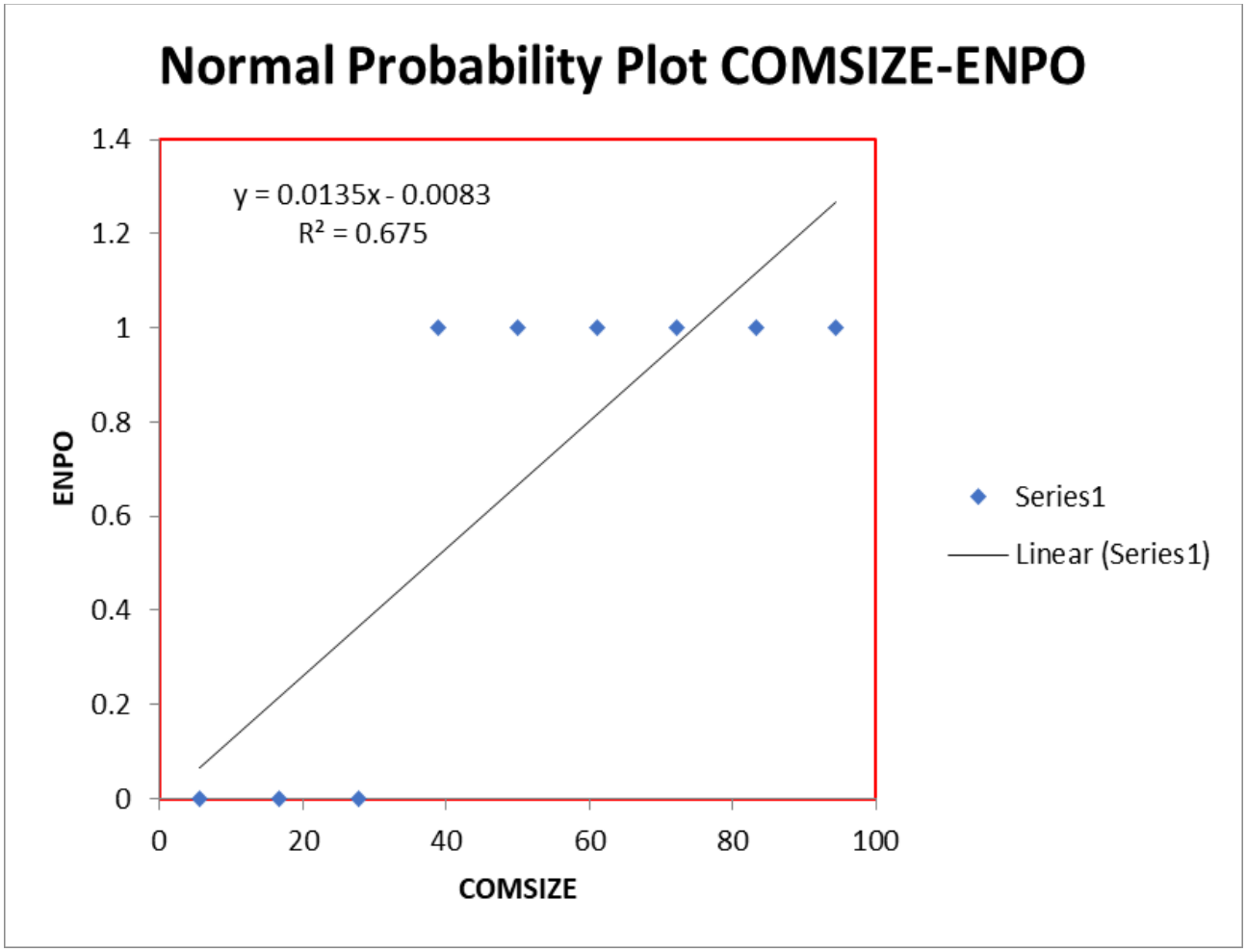


Figure 29: Lineal regression COMPSIZE-ENPO

	Coefficients	tandard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	pper 95.0%
Intercept	1.202703	0.243484	4.939547	0.001676	0.626953	1.778452	0.626953	1.778452
COMSIZE	-0.01723	0.006668	-2.58391	0.036265	-0.033	-0.00146	-0.033	-0.00146

Figure 30: Coefficient p-value COMSIZE-ENPO

The hypothesis 3 states: "The cost is a constrain to ICT implementation in SMEs of developing countries of Latin American". The results show that there is a positive correlation between the cost and the use of a software, with positive correlation factor 0.71112. This means that for SMEs, the cost of the software is a relevant factor when deciding on the implementation of Demand Forecasting Management (DFM). The descriptive results show that 44.4% of the enterprises experienced excellent results when they have applied DFM, and further 10.11% of the enterprises did have knowledge of DFM and they did also experience positive results when they have applied the software. In contrast, 44% of the enterprises did not know DFM or they have chosen not to use this tool. The degree of reliability p=1 confirms the strength of this deduction. The regression equation for this relationship is described by the line y= 2.4242x-0.5758, with a residue R^2=0.5676 and a p-value= 0.868123774. See Figure 31 below.

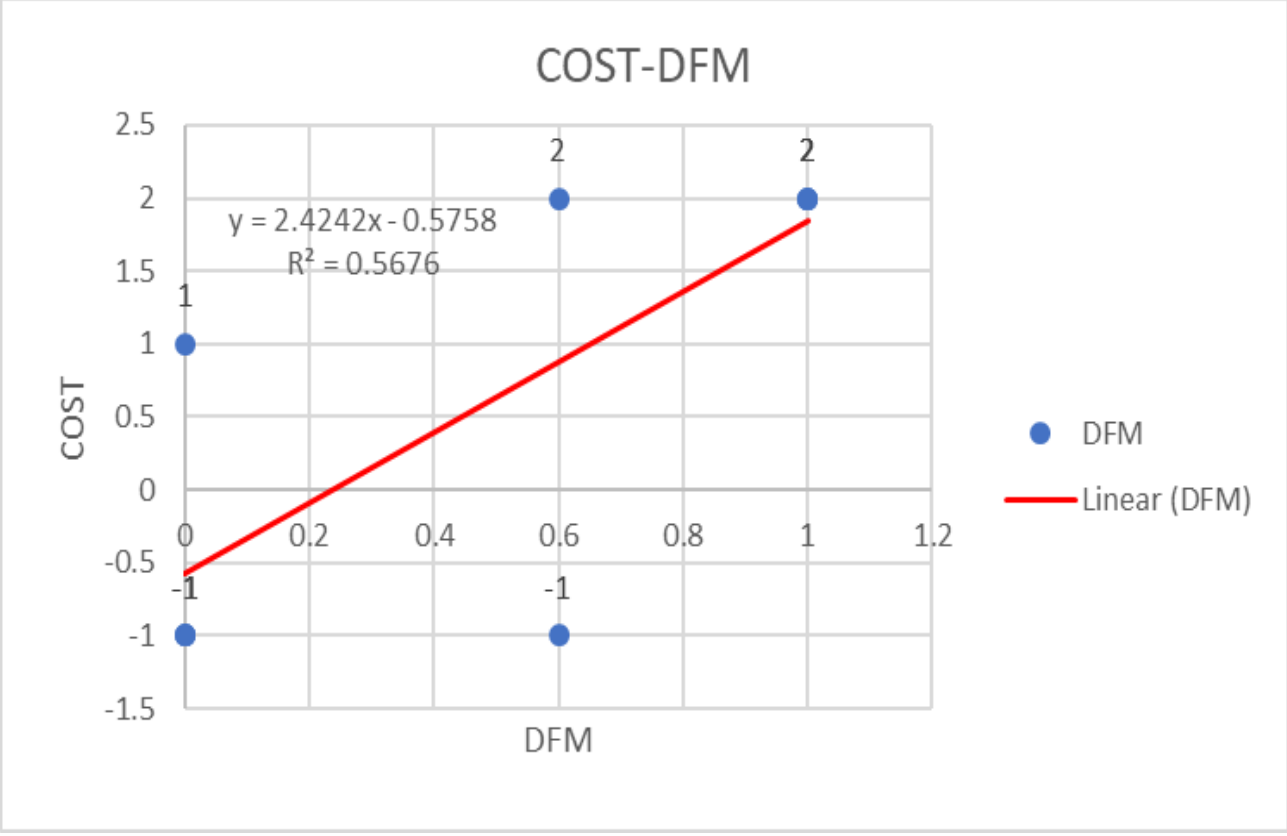


Figure 31: Lineal regression Cost-DFM software

A further correlation that supports previous findings is following statement: “There is a strong correlation between cost and the use of Vendor Management Inventory”. The correlation factor is 0.8664. p-value = 0.6711. However, the cost is also a relevant factor when deciding on the ICT implementation as Vendor Management Inventory software. The descriptive results show, that a total of 55% of the companies studied know this tool and the used of the software have given them positive results. Figure 36 below displays regression equation is y=2.5758x-0.4242, with a residue of R^2= 0.7506.

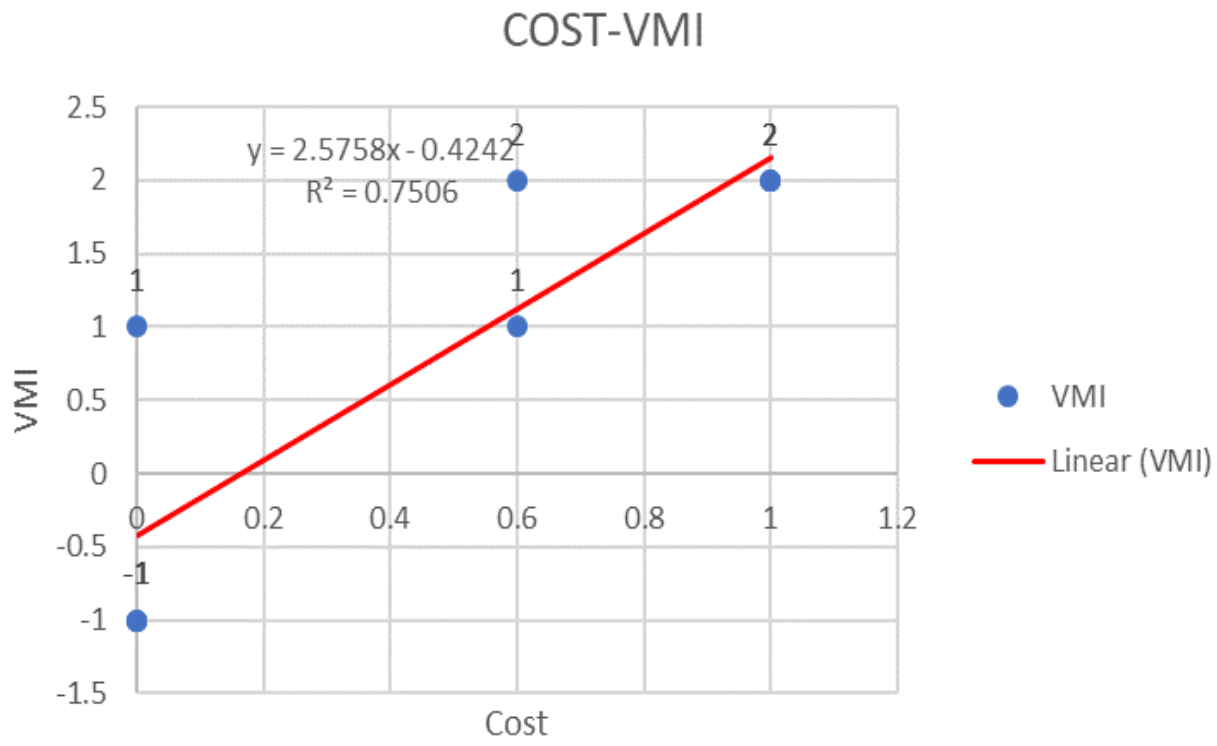


Figure 32: Lineal regression equation cost-VMI

The results show that there is a big percent of SMEs choose not to use ITC software’s because they have a high cost. For example, 44% of SMEs do not use Demand Forecasting Management software (DFM), even though 54.55% of the enterprises consider DFM as a relevant tool to supply chain management. Another example is the software Vendor Management Inventory (IVM), here 55% of the enterprises studied do have knowledge of this tool and have experienced positive results when

they have applied IVM. However, 33% of the SMEs choose not to use this tool. Based on these observations, it can be concluded that the hypothesis 3 cannot be rejected.

Hypothesis 4 states: "Technological training is a constraint to ICT implementation in SMEs". To evaluate this hypothesis a correlation test of following sets was made: Technological training and Supply chain software's, Technological training and Internet applications, Technological training and ITC implementation in supply chain macro processes, and Technological training and ICT implementations factors. The results show that there is not any strongly correlation between technological training and the mentioned variables. In the descriptive statistical analysis technological training was only relevant for the 10% of the SMEs. Therefore, the hypothesis 4 can be rejected.

Hypothesis 5 states: "The use of ICT in all the supply chain macro process is relevant to SMEs of developing countries in Latin America". To evaluate this hypothesis a correlation test was performed between the supply chain software and ICT use and supply chain macro processes, the correlation between internet application and ICT use in supply chain macro processes was also evaluated. The results show that there exists twelve strong correlation, which only involves seven supply chain sub-processes. These relations are present be in Figure 33. Based on the results, it cannot be concluded that the SMEs evaluated in this study do not find the use of ICT tools relevant for all fifteen-supply chain sub-processes.

	H05 Correlations			
1	CMDA	EDI	-0.717	x
2	CMDA	CRRF	-0.676	x
3	IMTP	CPRF	-0.744	x
4	IMTP	VMI	-0.756	x
5	SMSF	CC	0.071	xx
6	SMSF	VSAT	0.756	x
7	SMSF	IDS	0.731	x
8	IMTP	AID	-0.737	x
9	IMFP	GIS	-0.744	x
10	IMFP	GPS	0.962	xx
11	IMLD	GPS	-0.683	x
12	CMSP	VSAT	-0.877	xx

Figure 33: Correlations between supply chain macro processes -supply chain Software-Internet applications
x: p-value=0.05
xx: p-value = 0.01

The hypothesis 6 states: "The environment organization and governmental policies is a constraint to ICT implementation of developing countries in Latin America". The results of inferential analysis performed to the ICT implementation factor ENPO and the current use of ICT in supply chain

macroprocesses shows two inverse correlations ENPO-IMCP = -0.7178 and ENPO-IMIM =-0.7906 with a significance coefficient p=0.029

	IMCP	*ENPO*
IMCP	1	
ENPO	-0.717804919	1

Figure 34: Correlation test ENPO-IMCP

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9.388888889	9.388889	7.440252	0.029437053
Residual	7	8.833333333	1.261905		
Total	8	18.22222222			

Figure 35: Anova test results ENPO-IMCP

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2	0.648563737	3.083737	0.017722	0.4663905	3.53360954	0.466390459	3.533609541
ENPO	-2.166666667	0.79432511	-2.72768	0.029437	-4.044947	-0.2883862	-4.044947086	-0.28838625

Figure 36: Significance coefficient ENPO-IMCP

	ENPO	*IMIM*
ENPO	1	
IMIM	-0.790569415	1

Figure 37: Correlation test ENPO-IMIM

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2	0.597614305	3.346640106	0.012307235	0.586866722	3.413133278	0.586866722	3.413133278
ENPO	-2.5	0.731925055	-3.415650255	0.011201433	-4.230727735	-0.76927227	-4.230727735	-0.769272265

Figure 38: Significance coefficient test ENPO-IMIM

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regressio	1	12.5	12.5	11.66666667	0.011201433
Residual	7	7.5	1.071428571		
Total	8	20			

Figure 39: Anova test ENPO-IMIM

H0: “There are a direct correlation between ICT use in supply chain macroprocesses and the factors cost, the environmental organization/governmental policies and adaptability”

With the aim to verify our findings from hypothesis 1 to 6, the three most relevant ICT implementation factors: Cost, environmental organization/governmental policies and adaptability, are direct correlated tested with the ICT use in supply chain macro processes. The results show that there does

not exists any significative direct correlation between the use of ICT supply chain macroprocesses and the variables mentioned in the hypothesis. Furthermore, a correlation between adaptability (ADTY) and the supply chain transport planning (IMTP) is observed with a correlation factor of 0.7726. However, the regression significance factor is 0.01464, thus this correlation is not significant. Figures 40 and 41 display these results.

	IMTP	*ADTY*
IMTP	1	
ADTY	0.772667409	1

Figure 40: Correlation ADTY-IMTP

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1	0.414039	-2.41523	0.046416	-1.979047454	-0.020952546	-1.979047454	-0.020952546
ADTY	2	0.621059	3.220306	0.014647	0.531428819	3.468571181	0.531428819	3.468571181

Figure 41: significance coefficient test ADTY-IMTP

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	8.888888889	8.888889	10.37037	0.014647192
Residual	7	6	0.857143		
Total	8	14.88888889			

Figure 42: Anova test ADTY-IMTP

Based on the results of the descriptive statistical analysis and the findings of six hypothesis in the inferential analysis inferential analysis, this study concludes that there are several correlations between the variable cost and the use of some software's such as Demand forecasting management (DFM) and Vendor management inventory (VMI). This investigation has been limited to investigate only a little sample of the SMEs of developing countries in Latin America, which means that the results are only representative for similar SMEs. Furthermore, this study does not include data that supports opposite finding. Based on these observations, it can be concluded that there is not enough arguments to reject the H0.

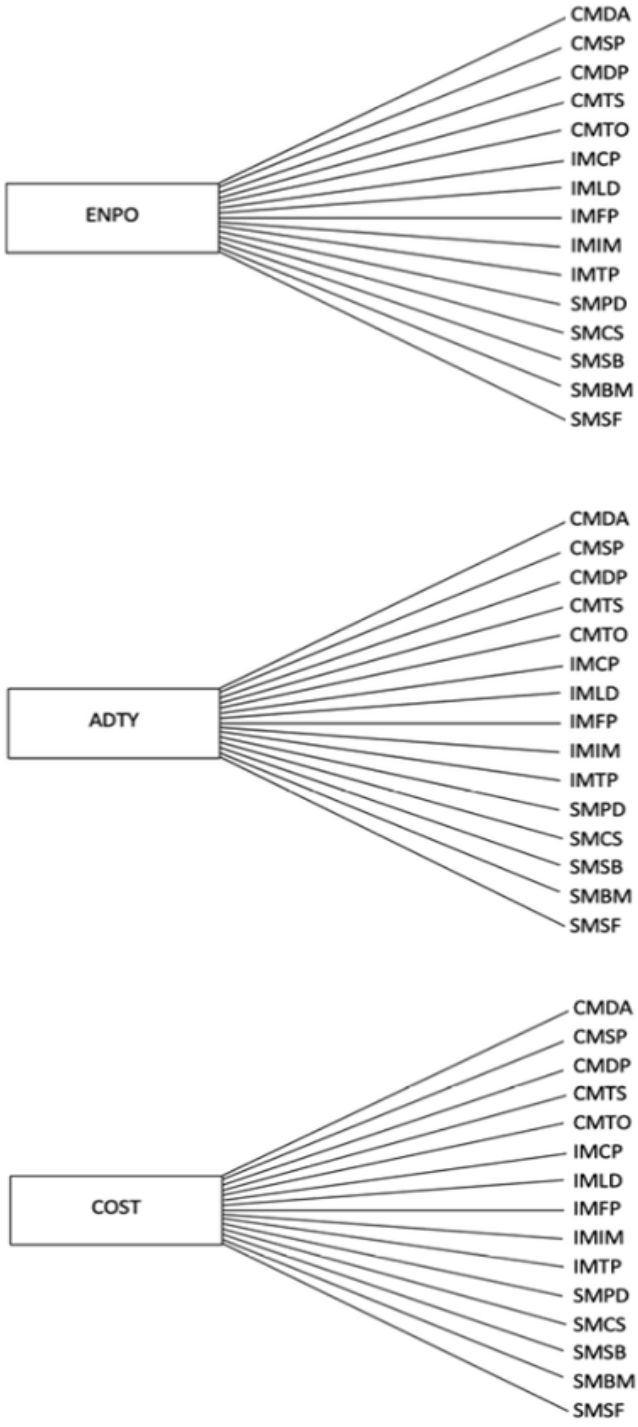


Figure 43: Inferential verification test ITC relevant implementation factors and ITC current use in supply chain macro processes

6. Conclusion

6. Discussion and Conclusions

The cost, adaptability, environmental organization/governmental policies are from the descriptive statistical perspective, the more significant ICT implementation factors to SMEs of developing countries in Latin America. The results of Figure 21 show that these implementation factors have a higher score for these enterprises. The 67% of SMEs think that the cost is the most significant implementation factor, while environmental organization /governmental policies have a second place with a 47% and adaptability the third place with a score of 44%. Furthermore. This studio has found some correlations that support this affirmation, for example, in figure 31 displays that exist a linear regression between the factor cost and the current use of Demand Forecasting Management (DFM) software. The correlation relation between these two variables is 0.71112. Moreover, these have a p-value of 0.8681, which means a high level of confidentially.

Another strong correlation that supports the significance of the cost as ICT implementations' factor is the relation between cost with the software vendor management inventory (VMI) displays in Figure 32. The results show that there is a decisive correlation factor of 0.8664 with a p-value equal to 0.6711 between these two variables. Whether the statistic results are translated to a regular expression, it can state that SMEs considering the cost as a relevant factor to decide the implementation of Dean Forecasting Management and Vendor Management Inventory software.

The results coincide with the findings obtained by Durand (2003). The author argued that every day, the challenge faced by companies in the area of information technology is growing, due to the need to generate proper management of the cost of their products, and services resources being one of its main challenges. Therefore, the cost is for this author a crucial factor in order to implement new technology in the company systems.

However, there is not finds a significative correlation factor between "adaptability" and the variables included in the group "ICT use in supply chain macro processes." Furthermore, there is not a correlation between the environmental organization/governmental and adaptability. In contrast, there is descriptive statistical results of the SMEs sample, which show that for 70% of the participating companies', environmental organizations/governmental policies are the most ICT implementations factor for SMEs of developing countries in Latin America, for the 50% is the cost and adaptability

for the 45% is the adaptability (see figure 21). This result confirm the findings of Giotoplous (2017) with argues that the main factors to consider before deciding to adopt new technology systems in an organization are: the environmental organization situation, the human resources, technological competence, and governmental policies (Giotoplous (2017).Furthermore, according to Feindt, (2001) the existing governmental policies to ICT adoption minimize the relevance of implementing these tools in SMEs setting focus only in large companies. Therefore, the biggest mistake of the most part of governments is thinking that e-business is concerning more to technology than strategy and this is not correct, because the use of ICT contributes to improve the strategy of SME in the global market

Besides, there is finding another interesting positive correlation between CEOs' experience in the use of ICT tools with the factor of easy implementation. The figures 23 and 24 show that exist a linear regression between these two variables describes the line y= 0.3075x + 11,859. correlation coefficient 0 0.687 and p-value 0.4939. It means that for SMEs of developing countries in Latin America is relevant to adopt this tool that the software will be easy to implement in their systems. The results are agree with the findings of Grandón, (2011); Lee (2006) and Olivera (2011) who author assert, that the best models to adopt a new technology should consider the individual characteristics of the organization related to technology, the relevance of innovation, technology implementation inside these firm and the easy implementation of these technological tools to the company systems. Besides, BayoMoriones, (2007) states that several authors agree that highly educated workers are in better qualified to adopt new technologies in the different areas of a company, e.g. to respond to a new product development opportunity or use e-business software to make decisions.

From the descriptive analysis is finding that from a list of ten different supply chain software options, all enterprises reported that they have used 50% of the software' presented, while they did not know the remaining 50% of these tools. (see Figure 14).

Figure 14 also displays that the three most used supply chain software is Enterprise Resource Planning with 89%, Customer Relationship Management with 78%, and Supply Chain Planning with 67%. However, 20% of firms think that ERP is not significant to an SME, 30% share the same opinion respect to CRM, and 33% consider that SCP software is not relevant to supply chain management. 44% of the firms find the three following software less relevant are: Collaborative Planning Forecasting and Replenishment, Vendor Management Inventory, and Demand Forecasting Management. In general, the enterprises assign 70% of the software as significant for supply chain

management. This information can help SMEs to prioritize the more valuable ICT at the moment of deciding to implement for the first time this software is in their organizations.

In contrast with figure 14, Figures 16 and 17 show that the executives do not use Internet applications with the same frequency as software. There are nine companies, and if an application were given the maximum score of 2 points by each CEO, then total points that an application can obtain is 18. The approval threshold to consider an application relevant for the supply chain is a total score higher than >9 points. The results displayed in Figure 16 shows that only three applications are above the approval threshold: Social media (12 points), Online conference system (10 points), Mobil technology, and Geography inform (12 points). In contrast, seven out of the twelve applications evaluated did not achieve the minimum acceptable score of >9 points. Thus, these seven applications have been assigned by executives as not being relevant for the supply chain. Furthermore, the applications Very Small Aperture Terminal and Automates Guided Vehicle System have a total negative total score of -5 and -2 respectively, meaning that a group of companies does not have knowledge about these applications or that the companies do not find these tools relevant.

Furthermore, Figures 17 to 20 display descriptive statistical results of ICT application in SMEs supply chain macro processes of developing countries in Latin America. Besides, Figure 18 shows that there are eight supply chain sub-processes in which SMEs use ICT tools with a satisfaction level of under 50%. These subprocesses are Data analysis (CMDA), tracking order (CMTO), telephone service (CMTS), capacity planning (IMCP), local decision (IMLD), forecasting planning (IMFP), inventory management (IMIM), transport planning (IMTP), and buyer management (SMBM). However, only 55% of SMEs use forecasting planning software, with a positive satisfaction level equal to 51%. Furthermore, there are several negative scores in the following processes: Tracking order (CMTO) (100%), telephone services (CMTS) (66%), inventory management (IMIM) (55%), transport planning (IMTP) (66%), product design (SMPD) (77%), contract suppliers (SMCS) (100%), suppliers' business (SMSB) (100%), buyer management (SMBM) (55%) and suppliers' feedback (SMSF) (88%). The negative scores are an indication for the majority of SMEs do not use ICT in over 50% of supply chain macro

All the findings obtained from this investigation indicate that there are different valuables types of relations between internal or external ICT implementation factors and supply chain information technology that can affect positively or negatively the decision and use of these tools in the evaluates

SMEs of developing countries in Latin America. Consequently, it will be relevant for these enterprises performing more specific research about this theme.

6.1 Limitations and implications of the investigation

One of the most critical limitations of this study was the location of the companies to be studied. All the companies are locating in different Latin American countries, so it was challenging to contact them and get them to agree to participate in the interview. The fact that the interviews were via e-mail reduced the quality of information collected because the researcher had to limit himself to e-mails without having the opportunity to expand "open-ended questions."

The lack of experience in the use of SPSS was another limitation since a significant amount of time was used to learn how to use it, thus reducing the hours of research. Furthermore, the number of interviews received was very small. One hundred invitations were sent, and only nine interviews were collected. It significantly reduced the opportunity to have at least one representative from each type of company for the study, so the variables location of the companies and the type of service offered had to be omitted.

The results of this research can use in different fields and interest groups, such as New entrepreneurs or investors who wish to enter the Latin American market to offer ICT tools. Furthermore, the CEOs of small and medium-sized companies who wish to learn about the factors that influence the decision of ICT in other similar companies and also the students and the general public interested in carrying out similar projects. Besides, it is recommended to expand the sample of this research so that the different types of companies and countries of Latin America are statistically representing. It would be an excellent contribution to the literature since there is no research regarding the factors that influence the implementation of ICT in these countries, considering the type of products or services offered by these companies.

References

Alshamaila, Y. P. S. A. L. F., 2013. Cloud computing adoption by SMEs in the north east of England. Journal of Enterprise Information Management, 26(3), pp. 250-275.

Arvanitis, S. &. H. H., 2001. The determinants of the adoption of advanced manufacturing technology. Economics of Innovation and New Technology, 10(5), p. 377–414.

Barret, W. M. R. a. P. T., 2019. The evolving B2B e-commerce and Supply Chain Management: A Chronological Memoirs. Journal of Business and Management, Volume 25 (1), pp. 49-67.

Battisti, G. a. S. P., 2003. Inter- and intra-firm effects in the diffusion of new process technology. Research Policy, 32(9), p. 1641–1655.

Battisti, G. C. A. a. S. P., 2009. E-business usage across and within firms in the UK: Profitability, externalities and policy. Research Policy, 38(1), p. 133–143.

BayoMoriones, A. &. L.-L. F., 2007. A firm-level analysis of determinants of ICT adoption in Spain. Tec novation, 27(6-7), pp. 352-366.

Bolton, P. &. F. J., 1990. Decentralization, duplication, and delay. Journal of Political Economy, 98(4), p. 803–826.

Bolumole, Y., 2001. The supply chain role of third-party logistics providers. The International Journal og Logistics Management, Volume 12 N¤ 2, pp. 87-102.

Brun, I. D. F. R. L., 2014. E-Relationship: a Cognitive Mapping Introspection in Banking Sector. European Journal of Marketing, 48(3/4), pp. 572-594.

Brynjolfsson, E., 1994. Information assets, technology and organization. Management Science, 40(12), 1645–1662. Management Science, 40(12), p. 1645–1662.

Caniato, F. C. R. K. M. B. R. a. S. G., 2009. Evolutionary patterns in e-business strategy. International Journal of Operations and Production Management, Volume 29(9), pp. 921-945.

Carroll, C. a. L. C., 1992. Executive Information Technology: A Strategic Necessity at Motorola Codex. Strategic Necessity at Motorola Codex," Information Systems Management, Volume 9(3), pp. 21-29.

CEPAL, E. C. f. L. a. C., 2018. CEPAL.org. [Online]

Available at: https://www.cepal.org/es/publicaciones/43964-estudio-economico-america-latina-caribe-2018-evolucion-la-inversion-america

[Accessed 1. July 2019].

Chapman, P. J.-M. M. S. M. &. T. D., 2000. Building internet capabilities in SMEs. Logistics Information Management, 13(6), pp. 353-361.

Chatzoglou, P. D. V. E. D. A. &. S. L., 2010. Computer acceptance in Greek SMEs. Journal of Small Business and Enterprise Development,17(1), p. 78–101.

Chen, W. E. M. &. H. T., 2011. Investigating knowledge management factors affecting Chinese ICT firm's performance: An integrated KM framework. Information Systems Management, 28(1), pp. 19-29.

Chopra, S. a. M. P., 2003. What Will Driver the Enterprise Software Shakeout? Supply Chain Management Review, pp. 50-56.

Chopra, S. a. M. P., 2007. Supply Chain Management: strategy, Planning and Operations. Sixth ed. s.l Pearson.

Chopra, S. a. M. P., 2016. Supply Chain Management Strategic Planning and Operations. Six ed. Boston: Pearson.

Clayton, C. I. K. a. G. R., 2005. Predicting the level of B2B e-commerce in industrial organizations. Industrial Marketing Management, Volume 34, pp. 221-234.

Clemons, E. K. a. R. M., 1991. Sustaining IT Advantages: The Role of Structural Differences. MIS Quarterly, Volume 15(3), pp. 275-292.

Cohen, W. M. &. L. D. A., 1989. Innovation and learning: The two faces of R & D. The Economic Journal, 99(37), pp. 569-596.

Correa, E. A. a. G. M., 2008. Tecnologías de la información en la cadena de suministro. Dyna, Volume 157, pp. 37-48.

Daft, R. L. &. L. R. H., 1986. Organizational information requirements, media richness and structural design. Management Science, 32(5), p. 554–571.

Daskin, M., 1995. Network and discrete location, New York: Wiley.

Davenport, T., 2001. Mission Critical: Realizing the promise of enterprise systems. Boston, MA, USA: Harvard Business School Press.

Davenport, T. a. B. J., 2004. Enterprise systems and supply chain. Journal of Enterprise Information Management, Volume 17 (1), pp. 8-19.

Drezner, Z. a. H. H., 2004. Facility Location: Application and theory, Berlin: Springer.

Drnevich, P. a. C. D. C., 2013. Information technology and business-level strategy: toward and integrated theoretical perspective. MIS Quarterly, Volume 37(2), pp. 483-509.

E U Recommendations, 2003. EURO-LEX. [Online]

Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003H0361

[Accessed 3 July 2019].

EU, c., 2007. http://www.itaa.org/. [Online]

[Accessed 3 July 2019].

Forth, J. a. M. G., 2004. Information and communication technology (ICT) adoption and utilization, skill constraints and firm- level performance: Evidence from UK benchmarking surveys, London: National Institute of Economic and Social Research.

Fulantelli, G. &. A. M., 2003. Small company attitude towards ICT based solutions: Some key-elements to improve it. Educational Technology and Society, 6(1), pp. 45-49.

Galbraith, C. &. S. D., 1983. An empirical analysis of strategy types. Strategic Management Journal, 4(2), p. 153–173

Ghobakhloo, M. S. S. M. S. H. T. a. Z. N., 2011. Ghobakhloo, M., Sadeghi Sabourin, Information technology adoption in small and medium-sized enterprises; an appraisal of two decades literature. Interdisciplinary Journal of Research in Business, 1(7), pp. 53-80.

Gimenez, A. a. N. E., 2012. Devoting sustainability and performance: the moderating effect of supply complexity. International Journal of Operations and Production Management, Volume 32(5), pp. 583-610.

Giotopoulos, I., Kontolaimou, A., Korra, E. & Tsakanikas, A., 2017. What drives ICT adoption by SMEs? Evidence from a large-scale survey in. Journal of Business Research, Volume 81, pp. 60-69.

Giunta, A. a. T. F. (., 2007. Understanding the determinants of information technology adoption: Evidence from Italian manufacturing firms. Applied Economics, , 39(10), p. 1325–1334.

Grandón, E. E. N. S. A. a. M. P. P., 2011. Comparing theories to explain ecommerce adoption. Journal of Business Research, 63(3), pp. 292-298.

GSI, 2008. Improving Supply Chain Operations Self-Assessment and Improvement using a Supply Chain Maturity Model, s.l: s.n.

Gunasekaran, A. a. N. E., 2004. Information systems in supply chain integration management. European Journal of Operational Research, Volume 159(2), pp. 269-295.

Gurbaxani, V. &. W. S., 1991. The impact of information systems on organizations and markets. Communications of the ACM, 34(1), p. 59–73.

Hansen, B. a. B. T., 2012. Toward creating competitive advantage with logistics information technology. International Journal of Physical Distribution and Logistics Management, Volume 42 (1), pp. 8-35.

Holland, C. L. G. a. B. I., 1992. Planning for electronic data exchange. Strategic Management Journal, Volume 13, pp. 359-550.

Hollenstein, H., 2004. Determinants of the adoption of information and communication technologies (ICT): An empirical analysis based on firm-level data for the Swiss business sector. Structural Change and Economic Dynamics, 15(3), p. 315–342.

Hollenstein, H., 2004. Determinants of the adoption of information and communication technologies (ICT): An empirical analysis based on firm-level data for the Swiss business sector. Structural Change and Economic Dynamics, 15(3), pp. 315-342.

Hopper, M. D., 1990. Rattling SABRE-new ways to compete on information. Harvard Business Review, 68(3), p. 118–125.

Ilias P., V. S. G., 2018. Electronic Supply Chain Management Tools in International Business: Evidence from Austrian Food Clusters. In: Springer, ed. Electronic Supply Chain Management Tools

in International Business: Evidence from Austrian Food Clusters. Texas: Springer International Publishing, pp. 3-21.

Janteng, J. C. a. F. Y., 2017. The impact of value co-creation on service supply chain performance: a proposal conceptual framework. Global Business and Management, 9(4S), pp. 239-249.

Kettinger, W. G. V. G. S. a. S. A., 1994. Strategic Information Systems Review: A study in Sustainability and Performance. MIS Quarterly.

Kettinger, W. G. V. G. S. a. S. A., 1995. Strategic Systems Really Pay off? MIS Quarterly, Volume 12(1), pp. 35-43.

Khalifa, M. &. S. K. N., 2008. Explaining the adoption of transactional B2C mobile commerce. Journal of Enterprise Information Management, 21(2), pp. 110-124.

Lee, G. a. X. W., 2006. Organizational size and IT innovation adoption: A meta-analysis. Information Management, 48(3), pp. 975-985.

Lee, H. L. a. W. S., 2001. E-business and Supply Chain Integration. Stanford, Stanford Global Supply Chain Management Forum.

Lee, H. P. V. a. W. S., 1997. The bullwhip effect in supply chains. Sloan Management Review, Volume 38(3), pp. 93-102.

Lee, S. O. a. T. S., 2012. Co-innovation: Convergenomics, and co-creation for organizational values. Management decision, 50(5), pp. 817-831.

Leuschner, R. R. D. a. C. F., 2013. A meta-analysis of supply chain integration and firm's performance. Journal od Supply Chain Management, Volume 49, pp. 34-57.

Li, M. a. Y. L., 1999. Information Technology and Firm Performance: Linking with Environmental Strategic and Managerial Contexts. Information and Management, Volume 35(1), pp. 3-51.

Lindsey, D. C. P. K. G. a. I. B., 1990. TELCOT: An Application of Information Technology for Competitive Advantage in Cotton Industry. MIS Quarterly, Volume 14(4), pp. 346-357.

Luccheti, R. a. S. A., 2004. The adoption of ICT among SMEs: Evidence from an Italian survey. Small Business Economics, 23(2), pp. 151-168.

Ma Shihua, L. Y. Z. X., 2002. Supply Chain Management. Beijing: Beijing: China Machine.

Mackelprang, a. R. J. B. E. a. W., 2014. The relationship between strategic supply chain integration and performance: a meta-analytic evaluation and implications for supply chain management research. Journal of Business Logistics, Volume 35, pp. 71-96.

Maklan, S. K. S. L. J., 2011. Why CRM Fairland How to Fix it. MIT Sloan Management, 52(4), pp. 77-85.

Mann, M. R. R. J. T. a. M. B., 1991. EPRINT: Levering Knowledge in Electric Utility Industry. MIS Quarterly, Volume 15(3), pp. 402-421.

Mayur, S. R. G. a. M. M., 1999. Quantitative Models for Supply Chain Managements. Boston: Kluwer Academic Publisher.

Montazemi, A. R., 1998. Factors affecting information satisfaction in the context of the small business environment. MIS Quarterly, 12(2), p. 239–256.

Nasco, S. A. T. E. G. &. M. P. P., 2008. Nasco, S. A., Toledo, E. G., & Mykytyn, P. P. (2008). Predicting electronic commerce adoption in Chilean SMEs. MEs. Journal of Business Research705., 61(6), pp. 697- 705.

Ngan, E., 2005. Customer Relationship Management Research. Marketing Intelligence and Planning, 23(6), pp. 582-65.

Oliveira, T. &. M. M., 2011. Literature review of information technology adoption of models at firm level. The Electronic Journal Information Systems Evaluation, 14(1), pp. 110-121.

Ongori, H. S. M., 2010. Information and communication technologies adoption in SMEs: Literature review. Journal of Chinese Entrepreneurship, 2(1), pp. 93-104.

Oteng E, P.-M., Y., 2015. Challenges Faced by SMES in Accessing Credit in Tamale. Global Journal of Commerce and Management Perspective, Volume 4(5), pp. 32-39.

Payne, A. G. P., 2005. A strategic Framework for Customer relationship Management. Journal of Marketing, 69(4), pp. 167-176.

Pérez, M. P. S. A. M. D. L. C. P. &. V. J. M. J., 2005. The differences of firm resources and the adoption of teleworking. Technovation, 25(12), p. 1476–1483.

Phelps, T., 2006. SCOR and Benefit of Using Process Reference Models Development, s.l.: s.n.

Picolly, G. a. I. B., 2005. IT- dependent strategy initiatives and sustained competitive advantage: a review and synthesis of the literature. MIS Quarterly, Volume 29(4), pp. 747-776.

Ping, T. A. C. C. V. Y. L. M. R., 2018. The Impact of Information Technology Capability, Business Intelligence Use and Collaboration Capability on Organizational Performance among Public Listed Companies in Malaysia. Global Business and Management Research, suppl. special issue, 10(1), pp. 293-312.

Pontikakis, D. L. Y. &. D. D., 2006. History matters in Greece: The adoption of internet-enabled computers by small and medium sized enterprises. Information Economics and Policy, 18(3), p. 332–358.

Powell, T. a. D.-M. A., 1997. Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources. Strategic Management Journal, Volume 18(5), pp. 375-405.

Prajogo, D. a. O. J., 2012. Supply chain integration and performance. The effects of long term relationships, information technology and sharing, and logistics integration. International Journal of Production Economics, Volume 135(1), pp. 514-522.

Ramesh, K., 2013. Role of Customer Relationship Management in Indian Banking System. International Journal of Applied Services, 2(4), pp. 645-650.

Rashid, M. A. a. A.-Q. N. A., 2001. E-commerce technology adoption framework by New Zealand small to medium size enterprises. Research Letters of the Information Mathematics and Science, Volume 2, p. 63–70.

Reich, B. H. a. B. I., 1990. An Empirical Investigation of Customer-Oriented Strategy Systems. Information Systems Research, Volume 1(3), pp. 325-347.

Rogers, E. M., 1995. Diffusion of innovations. 4th ed. New York: The Free Press.

Sager, M., 1988. Competitive Information Systems in Australian Retail Banking. Information Management, Volume 15, pp. 59-67.

Salam, M., 2017. The mediating role of supply chain collaboration on relationship between technology, trust and operational performance: An empirical investigation. Benchmarking: An International Journal, 24(2), pp. 298-317.

Satish, M. & Vivek, N., 2014. An empirical model relating supply chain sourcing performance. Making performance and Delivery performance to company. Journal of Contemporary Research in Management, 9(1), pp. 23-33.

Sayani, H., 2015. Customer Satisfaction and Loyalty in the United Arb Emirates Banking Industry. International Journal of Bank Marketing, 33(3), pp. 351-375.

Schultz, T., 1975. The value of the ability to deal with disequilibria. Journal of Economic Literature, , 13(3), p. 827–846..

Schwarzer, B., 1995. Organizing Global IS Management to meet Competitive Challenges: Experiences from the Pharmaceutical Industry. Journal of Global Information Management, Volume 3, pp. 5-16.

Schoenherr, T. a. S. M., 2012. Revisiting the arcs of integration: validations and extensions. Journal of Operations Management, Volume 30(1), pp. 99-115.

Singh, N. L. K.-h. a. C. T., 2007. Intra-Organizational Perspectives on IT Enabled Supply Chains. Communications of the ACM, Volume 50(1), pp. 59-65.

Spanos, Y. E. P. G. P. a. P. A., 2002. The relationship between information and communication technologies adoption and management. Information Management, 39(8), pp. 659-675.

Stevens, G., 1989. Integrating the Supply Chain. International Journal of Physical Distribution and Materials Management, Volume 19(8), pp. 3-8.

Swafford, P. G. S. a. M. N., 2008. Achieving supply chain agility through IT integration and flexibility. International Journal of Production Economics, Volume 116, pp. 288-297.

Tan, K. S. C. S. C. L. B. &. E. U. C., 2010. Internet-based ICT adoption among SMEs. Journal of Enterprise Information Management, 23(1), pp. 27-55.

Thong, J., 2001. Resource constraints and information systems implementation in Singaporean small businesses. Omega, 29(2), p. 143–156.

Tornatzky, L. G. F. M. a. C. A. K., 1990. Processes of technological innovation. 2nd ed. New York: Lexington, Mass. Lexington Books, ©1990.

Traver, K. C. L. a. C. G., 2017. Introduction to E-commerce: Business, technology, society. Thirteenth ed. Boston: Parson.

Tushman, M. L. &. N. D. A., 1978. Information processing as an integrating concept in organizational design. Academy of Management Review, 3(3), pp. 613-624.

Venkatraman, 1990.

Vreecke, A. a. K., 2016. E-business strategy: revising how companies shape their manufacturing and supply chains through the internet: a review and outlook. In: Springer, ed. A Journey Through Manufacturing and Supply Chain Strategy Research. s.l: Springer International Publishing, pp. 139-168.

Vivek, N. a. R., 2009. An Empirical study on the impact of supplier performance on organization. Journal of Management, 16(3).

Wade, m. a. H. J., 2004. Review: the resource-based view and information systems research: review, extension, and suggestions for systems research. MIS Quarterly, Volume 28(1), pp. 107-142.

Warner, T., 1987. Information Technology as a competitive burden. Sloan Management Review, Volume 29(1), pp. 55-61.

Yang, H. O. a. K. S., 2013. Managerial Capabilities of Information Technology and Firm Performance: Role of E-procurement System Type. International Journal of Production research, Issue doe: 10.1080/00207543.2013.867084.

Zabhah, A. W., 2004. An evolution on customer relationship management: Towards a common understanding of emerging phenomenon. Industrial Marketing Management, 33(6), pp. 475-489.

Zhang, X. v. D. D. a. v. d. V. T., 2016. The different impact of inter-organizational and intra-organizational ICT on supply chain performance. International Journal of Operations and Management, Volume 36(7), pp. 803-824.

Zhu, l. S. Q. Z. a. Y. L., 2017. Strategic IT investment in B2B e-commerce platform on user loyalty considering variable investment cost. International Journal of Networking and Virtual Organizations, Volume 17 (2-3), pp. 290-313.