Added Value Framework and Information Technology Capabilities of Enterprise Application Integration

A Study on ERP, CRM and Multi-Channel Commerce application integration in Fast Moving Consumer Goods (FMCG) Industry

Master Thesis Report by

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Added Value Framework and Information Technology Capabilities of Enterprise Application Integration

A Study on ERP, CRM and Multi-Channel Commerce application integration in Fast Moving Consumer Goods (FMCG) Industry

By Balakumaran Baskaran

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EXECUTIVE SUMMARY

This research deals with enterprise application integration with two new perspectives. The two perspectives are added value and information technology capabilities. Enterprise applications are a set of software packages that help organizations run their businesses. Enterprise applications have been used consistently in all industries. This wide usage resulted in new requirements from the users for functional specific and industry specific enterprise applications. This requirement made sure that the enterprise application market is filled with vendors who are developing many specialized enterprise applications. The result of the range of applications led to them becoming silo applications (applications that cannot communicate with other applications). Thus, the new problem came with respect to how to make sure these silo applications communicate with each other without changing the existing business and IT environment. This brought the concept of enterprise application integration (EAI). EAI is defined as the *unlimited sharing and coordination of data and business process between any connected application and data source in an enterprise*.

The two perspectives that this research focuses on addressing the core problem that is existing in integration - users of enterprise applications are neither aware of the value of integration nor are they aware of the capabilities they need to make sure the integration is implementable. Software vendors are also facing stiff competition from the market and are interested in developing integrated solutions. But with a lack of knowledge of the adopter's requirements, they lack a clear strategy for improving their product offerings. External consultants also face challenges from dealing with different applications and making them communicate as stand-alone systems. Thus, there is no clear focus on why EAI should be done and what capabilities are needed to do it. This research focuses on this knowledge gap by having the following objectives:

- Develop a framework that can be used to assess the added values of enterprise application integration.
- Identify the information technology capabilities needed to implement enterprise application integration.

The three applications that form the focus of this research for EAI are Enterprise Resource Planning (ERP), Customer Relationship (CRM) and Multichannel commerce. The research also focuses on Fast Consumer Goods (FMCG) industry since the use of digital channels for shopping is increasing among customers. Another reason why FMCG is a fitting industry for this research is that the important processes in the industry such as logistics, supply chain, customer relations are dealt with by the three applications. These two factors make FMCG an ideal industry for this research. Two theoretical models were used to develop the added value framework namely, Enterprise Application Benefit Framework and Value Creation for E-Business Model. The added value framework developed can be positioned as a aggregation of these two models with the perspective of enterprise application integration in FMCG industry which has not been done before. The research operationalized enterprise application integration using three business Customer_Order_Online, Customer_Complaint_Call_Canter processes namely and Marketing_Compaign_Management. All the business processes are developed loosely based on SAP ECC, SAP CRM, SAP-Hybris applications. The business processes were developed keeping



in mind that all the three applications under the research have to be involved with each other and must include the stakeholders in the process flow.

Information technology capabilities were measured using two dimensions namely human and hardware capabilities. Human capabilities refer to the technical and managerial skills needed and hardware capabilities refer to the hardware storage and speed of computation.

Research Method

The research technique used for the research is Analytic Hierarchy Process (AHP) and Likert Scale. Data was collected from four stakeholders namely software vendors, software adopters, external consultants and academic professionals through an online survey.

Conclusions

The developed framework determine added value from two dimensions derived from the two existing models. The two dimensions represent two constructs of added values. The first dimension which represents the importance of the added value is categorized as *novelty, efficiency, lock-in and complementarities.* The second dimension represents the intensity of the added values and is categorized as *strategic, managerial and operational.* Based on the framework and the business processes that were used to operationalize enterprise application integration, nine added values were identified namely, *Improved Business Planning, Increased IT alignment with business, Better Customer Experience Increased Company Common Vision, Improved on time Delivery, Accurate Sales Forecasting, Streamlined business processes, Increased Data Quality, Increase in Sales.* These added values were then fitted into the framework based on the business processes previously defined. The developed framework was then tested using the online survey.

The results for the second objective indicate that the highest capability needed is cross departmental interaction between IT and business units. This capability is also related to the increase in business IT alignment added value. The need for IT technical employees to gain managerial skills was also the second highest capability needed. The capabilities that were not required were business managers learning IT technical details and more hardware storage for integration.

Generalization of the research

The framework was developed with the SAP applications and hence the business processes were developed from these applications' modules. But using this framework for other business processes would not be an issue at all since the framework itself does not rely on the business processes and only the added values are dependent on the business processes. The information capabilities identified are applicable to any type of company irrespective of whether they treat IT as a support or a strategic tool. The framework can also be used to determine the added values of other industries based on the business processes.

Future Research

More research can be carried out for the validation of the framework and fill the empty slots for combinations of added values that are novel and operational. Other factors that affect the concept of capabilities apart from IT, such as organizational, financial and regulations have to be investigated. Future research must include another important stakeholder in the framework



which is the end customers since they are important in the adopter's strategy. And the framework must be tested in other industries and with other enterprise applications products apart from SAP to make the framework more robust.

Limitations of the research

The research has five limitations. First, the framework is developed based on business processes suitable for SAP applications. Although the framework is not dependent on the business processes, in order to improve the external validity, more research has to be done on how it changes to other vendor applications and business processes. Second, the list of added values is limited to nine since increasing added values will affect computation of Analytic Hierarchy Process and increases the survey length. Third, the list of business processes is also limited to only three but they are some of the most commonly used business processes. But future research can be done to see if the framework works for other business processes. Fourth, due to the small sample size, this research serves as exploration and first validation of the constructed framework and further research can be conducted to do more extensive validation by means of survey research, mainly through in depth interviews. Finally, the adopters' size can maybe be a limiting factor for using the framework. Since it clearly distinguishes the organizational levels within a company, SMEs and other smaller companies may not be the most suitable firms to use this framework.

Keywords:

Enterprise application integration, added values, multichannel commerce, ERP, CRM, FMCG industry, information technology capabilities

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CHAPTER

INTRODUCTION

1.1 Background

nterprise Applications (ES) can be defined as "large scale organizational applications built around packaged enterprise application software (ESS)" (Shang & Sheddon, 2002, p.272). Enterprise Application Software (ESS) refers to groups of software modules with an integrated architecture. Firms make use of ESS to integrate data and business processes in real-time between their internal and external business environment. In the last decade (2003-2013), there has been an increase in investments made in enterprise applications from \$230 billion invested in 2003 (Gartner, 2008) to \$304 billion in 2013 with a growth rate of 6,4% from 2012 (Gartner, 2013). The need to use enterprise applications could have come out of competitive pressure in the market or from identifying foreseeable strategic value that can be achieved. Thus, in order to improve and support their core business capabilities, organizations began using enterprise applications both as a strategic tool (Trninic & Durkovic, 2008) and as a commodity (Carr, 2003). Within the organizational structure of a firm, different categories of enterprise applications can be used to gain value (Lam, 2005). The increasing demand for this variety in enterprise applications opened a business opportunity for new firms to develop and commercialize enterprise applications. These firms are known as software vendors. Currently, the software vendors leading the enterprise applications market are SAP, Microsoft, Oracle. The variety in enterprise application depends on the software vendors, the business logic behind the enterprise application and the customers who will be implementing the application. Some of the most widely used enterprise applications are Enterprise Resource Planning, Supply Chain Management (ERP), Customer Relationship Management (CRM), Product Lifecycle Management (PLM), E-Commerce and Supply Chain Management (SCM).

As more and more applications were developed, their disadvantage became apparent, which was their incompatibility. That is to say, these applications were developed with different programming languages which operated on different hardware and were available on different platforms. In essence, these applications began to act as *stove pipes or silos* (Linthicum, 2000) which meant they did not have the ability to open up to communicate with other applications. They had their own data and operated independently. In order to overcome this setback, the concept of *Enterprise Application Integration (EAI)* was developed. Integration is a *coordination process* which has been applied in different domains. The main idea of integration is coordination. For example, in

strategy, integration is defined as: coordination of activities and management of dependencies between them (Glouberman & Mintzberg, 2001). In production and logistics, it is defined as coordinated management of information, material flows, plant operations and logistics through a common set of principles (Barki & Pinsonneault, 2002).

But as in the domain of information technology, this research defines integration as a strategic approach to bind information applications together, the extent to which process and technologies of the entire organization constitute a singular process (Barki & Pinsonneault, 2002). This research views integration as a *coordinated process* that combines elements of enterprise applications in a firm, not from a technical perspective but with regard to *information sharing and business processes* (Barki & Pinsonneault, 2002) (Welker, Van de Vaart, & Van Donk, 2008). Information sharing is extremely valuable to users of enterprise applications because their business process is dependent on the applications. To have a synchronized business process, the applications must be integrated/synchronized as well (Linthicum, 2000). With the growth of Web 2.0, EAI gained more importance as the enterprise application users can have the capability to acquire and use more customer related information which can act as a strategic tool to become a market leader or support them in achieving other business strategies.

Some of the key questions that are raised by users of enterprise applications are related to the value offered by them. For example: 'Will our investments pay off?', 'Did our investments pay off?', 'How much improvements did we have after adopting?'. The payoff refers as the perceived additional value that these applications provide to the users. Adopting enterprise applications must offer an extensive value to make sense for investing in them. The values offered are dependent on the type of users. But, from the perspective of the users, the perceived values are dependent on their own business strategy and their perceptions on the importance of enterprise applications to their business strategy and processes. Some of the factors that can affect the value of implementing enterprise applications include the business strategy of the firm, customization of the application, willingness of the organization to learn the application's functionalities and the business process changes. The value of implementing an independent (silo) application can be quite straight forward (Bradley, 2008) (Henricks, Singhal, & Stratman, 2007) although research has shown that the values offered by them are not proven beyond doubt (Henricks, Singhal, & Stratman, 2007) (Rettig, 2007) (Poston & Grabski, 2001). Several researches have shown that some enterprise applications did not create the expected or in some cases no value (Robey, Ross, & Boudreau, 2002). From this, we see that there is an inherent uncertainty in implementing a single enterprise application itself. Therefore, the values from integrating them cannot be taken for granted. Additionally, there can also be a difference between the promised value, the perceived value and the achieved value from the integration between the different stakeholders.

1.2 Enterprise Applications Background

This sub section will provide a brief overview of the three enterprise applications which are the focus of this research.

Enterprise Resource Planning (ERP) applications are commercial software packages used for standardizing business processes by allowing a synchronized flow of information between business processes in the back end sections of an organization (Barki & Pinsonneault, 2002).



ERP applications consist of subset of applications that have the ability to automate all the back end operations like finance, purchasing, supplier management and scheduling. These operations are referred to as the back end operations; hence *ERP is the solution to manage the back end operations of a firm.* A detailed explanation about SAP ECC (which is an ERP application) is provided in Section 2.1.1.

Customer Relationship Management (CRM) covers the broad topic of organization wide efforts to acquire and retain customers. It became an interest to software vendors around the early 1990s and came to be known academically as *information enabled relationship marketing* (Turban, Leidner, McLean, & Wetherbe, 2006). CRM was developed from the recognition that customers are key for any business and a firm's success is based on effective management of their customers and their needs (Greenberg, 2002). From an information technology perspective, CRM is managed using CRM applications that are used by firms to automate marketing, selling and after sales service modules of their business. The primary objective of CRM applications is to achieve the business goal of the firm with respect to its customer relationships (Wu, Bin, & Yongjiang, 2013). Hence, CRM is the *solution to manage the front end operations of a firm*. A detailed explanation about SAP CRM (which is a CRM application) is provided in Section 2.1.2. Figure 1.1., provides the pictorial representation of the operations which are supported by ERP and CRM applications. A detailed explanation about SAP ECC (which is an ERP application) is provided in Section 2.1.2.



Figure 1.1: Generic View of ERP and CRM modules and their relationships

Interchanging use of the terms e-business and e-commerce has led to misunderstanding between the two concepts (Trninic & Durkovic, 2008). For the purpose of providing more clarity in this research, literal meaning of 'commerce' is used to define e-commerce. Commerce is defined as the exchange of merchandise on a large scale across geographical locations. Thus, E-commerce can be defined as *the front-end commercial process of buying and selling goods over the internet*, as internet makes communication between different locations possible. E-commerce affects both macroenvironment and micro economic level incorporating socio-technical and telecommunication technologies (Yanjing, 2009). Macro-economic means involving customer, the firm, suppliers and its partners while microeconomic refers to the communication involving the internal process of the company itself. Telecommunication applications play a vital factor in developing e-commerce process. The degree of its development gives access to new technologies that can be used in ecommerce. Now, e-commerce has evolved to *multi-channel commerce* where customers have the ability to reach firms through more than one channel. A channel is defined as the customer contact point or a medium through which the customer and the firm interact (Montoya-Weiss, Voss, & Grewal, 2003). The advent of mobile technology has allowed customers to change their shopping dynamics, thereby empowering them to access more information with a finger's touch. Multichannel commerce is one of the innovative trends in the shopping environments (Scott, et al., 2006). The current channels through which customers get in touch with a firm are offices, online web sites, direct mail, kiosks, brick-and-mortar stores, catalogues, ATMs and call centers (Montoya-Weiss, Voss, & Grewal, 2003). This new innovation for the customers has provided an opportunity for firms to attract and create value by treating customers and customer information as a strategic tool. Therefore, understanding what the driving forces are behind the customer's relative evaluation and usage pattern among the different channels is the most important step in creating value out of the synergies between the different channels. The synergies between the different channels are particularly important in terms of the information exchange between different channels of the same firm. Multi-channel commerce has been already implemented in various industries such as consumer products, insurance, healthcare, telecommunications etc., (Falk, Schepers, Hammerschmidt, & Bauer, 2007). Hence, there is a recognized market for using multi-channel commerce applications. A detailed explanation about Hybris (which is a multichannel commerce application) is provided in Section 2.1.3.

In this research, a framework to assess the added values of integrating ERP, CRM and multichannel commerce applications will be developed. The framework will be developed from three perspectives, which are strategic, managerial and operational (Shang & Seddon, 2002). The three perspectives represent the different organizational levels where decisions are made. Apart from developing the added value framework, this research also explores the information technology capabilities that are required by an organization to implement the integration. The information technology capabilities will be explored through two perspectives, which are human infrastructure and technical infrastructure (Broadbent & Weill, 1997) (Henderson & Venkatraman, 1999). At the end of the research, the differences between the perceived values of four different stakeholders will also be explored. The stakeholders are adopters, vendors, consultants and academic professionals. Adopters are firms which use the enterprise applications in their business. Vendors are firms which develop the enterprise applications. Consultants are firms which help the adopters to customize their business processes to the enterprise application functionalities. Academic professionals include university professors and researchers who are involved with studying and conducting research on information systems, their integration, business value of IT and information system capabilities. By developing the framework, which is comprehensive since it includes many perspectives, we will aim to provide insights into the difference in opinions that each of the stakeholders has on the integration. Also, the framework can be used as a tool to assess the added values of integration before and after the integration. The integration of the three applications is

conceptualized using a business process approach. Three business processes are defined in which different modules of the three applications share information. The three business processes are Customer_Order_Online, Customer_Complaint_Call_Center and Marketing_Campaign_Management. The three business processes are common in FMCG industry. Academically, this research will fill the knowledge gap that exists between understanding the difference between the promised and the perceived added values and information technology capabilities of enterprise application integration between stakeholders and providing a framework from which more research can be done to understand how different integration procedures offer different values.

We continue this chapter by presenting the research problem in Section 1.3. This research problem outlines a knowledge gap that acts as the motivation for this thesis research, aims at developing a comprehensive added value framework for integrating ERP, CRM and multichannel commerce applications. Section 1.4., discusses the scope of the thesis. The research objectives, main research questions and the related sub questions are introduced in Section 1.5. Further, section 1.6., explains the scientific and social relevance of this thesis. Subsequently, the research methodology is briefly discussed in Section 1.7., followed by Section 1.8., which outlines the structure of this report.

1.3 Research Problem

Prevalent use of enterprise applications has led to an increasing demand for integrating them so that same business rules can be maintained across all enterprise applications (Liu, Liu, & Xu, 2013). With the rising popularity for integrating these valuable resources, problems lie at both sides of the process: From an *investment perspective*, adopters have to understand the information technology implications required when integrating the applications. Will they have to modify or upgrade the information technology hardware infrastructure of the company? Should additional training be given to employees? Should firms concentrate more on aligning their business and information technology strategy? These are some challenges that adopters face when they wish to integrate the three applications. These challenges are extremely crucial since improper decisions to these questions can have a counter-productive effect. Hence, this is the first knowledge gap that will be addressed in this thesis. At the same time, from the outcome perspective, they are also unaware of the potential values from integrating the applications. Research already exists on different benefits about adopting ERP and CRM individually (Shaul & Tauber, 2013) (Bradley, 2008) (Mithas, Krishnan, & Fornell, 2005) but there is no proper research on what added values arise when ERP, CRM and multi-channel commerce applications are integrated. This is the second knowledge gap that will be addressed in this thesis. Hence understanding both sides of the integration process will help firms to grasp a better overall scenario before proceeding with the integration. Apart from the understanding that is gained through identifying the added value of integrating the applications and identifying the information technology capabilities that are required, the problem also lies in the differences in the perceived and proposed values of the integration between different stakeholders which will result in higher/lower expectations from the adopters leading to poor outcomes from the integration. The framework developed in this thesis will help understanding this difference in perspective of the stakeholders.

From the above discussion, we define the research problem statement as:

Adopters do not have a *clear understanding of* whether integrating their enterprise applications *can add value or be an inhibitor* to their business and other stakeholders *are not aware* on what the adopters *expect from the integration*. Additionally, the adopters *are not aware* of what information technology capabilities they *need to improve/develop* to get *maximum value* out of the application

1.4 Research Demarcation

Enterprise applications and their integration are broad concepts to study in a research such as the one undertaken in this thesis. In order to remain focused, we define a set of demarcation which will be described below. Figure 1.2., provides an overview of the demarcations.

Choice of applications

The research will concentrate only on three types of enterprise applications namely Enterprise Resource Planning (ERP), Customer Relationship Management and Multi-Channel Commerce applications. ERP and CRM have been chosen for integration because they are contrasting applications which are responsible for completely different functionalities and are widely used. Multi-channel commerce applications are becoming more valuable because it changes the way how firms respond to the customers. With the growing popularity of multichannel shopping, it is vital that these three applications are integrated.

Choice of industry

The research will consider only one market to determine the added values for the adopters. The chosen market is Fast Moving Consumer Goods (FMCG) industry. The reason for choosing FMCG is because the effect of multi-channel commerce is important for the industry with customers increasingly using mobile and internet for shopping (Accenture, 2014). Hence, the impact of integrating the three applications is expected to be substantial in FMCG industry where the three applications will be extensively used.

Type of research

This research is based on two types of research namely descriptive and explorative. The descriptive nature of the research comes from the fact that the integration is based on the Linthicum model (Chapter 3). Next, the research objectives offer a comprehensive qualitative understanding of what this research is trying to achieve; but the added values are measured? It is very difficult to state this in a quantitative and measurable way in advance, even before the integration is actually done practically. Also,But how can one validate if the right added values are found even before the integration is implemented? Measuring the perceived and the promised added value is easier with assumptions, but the amount of added value that is *actually* achieved is out of the scope of this research. Therefore the information technology capabilities identified and the added value framework developed in this research must be treated as a starting point for further analysis and discussion. Hence, this research is of *an explorative nature*. This means that the research approach must be scientific and have a broad exploration in both theory and practice. Although the integration will be conceptualized based on the Linthicum model, the main objective of this research is to develop a framework, which is still explorative.

Sampling

The data will be collected only from certain adopters in the FMCG industry and vendors from SAP but not the others and also only to some academic professionals and not the others.



Figure 1.2: Research Demarcation

1.5 Research Objectives and Research Questions

Section 1.3 explained the research problem that will addressed in this thesis. We have concluded that there is a lack of research on how enterprise application adopters understand application integration, whether it is an advantage or an inhibitor to their business and their strategy and also they are uncertain on what the required information technology capabilities are for integration. Regardless of many researches that have been done on individual enterprise applications and their business value for adopters, there is a limitation in understanding the difference in perceived and promised values between different stakeholders when it comes to the integration of these applications. Hence, based on this, we derive our **research objectives** as:

- Develop a framework that can be used to assess the added values of enterprise application integration.
- Identify the information technology capabilities needed to implement enterprise application integration.

From the above research objectives, we define the following **main questions**:

RQ1: What framework can be used for assessing the added value of enterprise application integration in FMCG industry?

RQ2: What information technology capabilities are needed for the enterprise application adopters to implement enterprise application integration in FMCG industry?

From this main research questions, we generate six different sub-questions which will help in obtaining elaborate practical and scientific arguments to answer the main question:



- 1. Who are the stakeholders in the FMCG industry and what are their interests towards enterprise application integration? *[Literature Study]*
- 2. How to operationalize Enterprise Application Integration? [Literature Study]
- 3. What are the relevant theories and different perspectives to analyze enterprise application values? *[Literature study]*
- 4. What are the relevant theories and different perspectives to analyze a firm's information technology capabilities? *[Literature study]*
- 5. How to measure the *added* values? [Literature Study & Questionnaire]
- 6. How can the added values be understood from the perspective of different stakeholders? [Questionnaire & Literature Study]

Aligning with the research problem described in Subchapter 1.1, the first sub-question will be used to explore the interests of the stakeholders towards enterprise application integration. The different interest will provide the basis to understand the potential differences in the perception of added values. The second sub-question explores the concept of enterprise application integration and its approaches to help us understand the different ways to integrate the applications and the limitations of the integration from a technical perspective. The answer to this question is the foundation to determine the added values. The third sub-question will substantiate the theoretical background for this research and provide focus to determine the added values. The perspectives will be relevant to the applications that are integrated. The added values that will be explored are also determined based on the theoretical perspectives. The fourth Sub-question will identify key information capabilities from theories that are appropriate to the integration approach followed. The fifth Sub-question will help us to arrive at suitable data analysis tools which can measure the added values; it will also help us develop the online survey. The sixth Sub-question will be of use to gain the final concept of how the stakeholders differ in the perception of the values offered by application integration and why there is a difference in their perception.

1.6 Relevance

1.6.1 Practical

Vendors need to know whether integrating their enterprise application solution will be of any value to the adopters. Developing new enterprise applications which provide different strategic advantages to their customers will be a source of value to the vendors themselves as they can sell the products with much more value specification. Hence, vendors need to understand the views of the adopters towards the concept of integration of enterprise applications. If the adopters do not see much value in integrating the applications then the providers have to re-think their strategy for new applications. At the other end, the adopters need to gain more knowledge on how these can be integrated and whether there are any real value to them through this process which will help them manage their information technology investments. Getting insights into their value expectations will help the vendors and adopters save time and money on key decisions whether they should invest in developing or implementing the integration. Even if they agree on the integration, post-implementation collaboration between them will be smoother if they have a clear idea on what the expectations and promises that each of them provides.



1.6.2 Academic

This research contributes to the enterprise application integration field which refers to the approaches for information sharing between independent enterprise applications in organizations (Linthicum, 2000). Many literatures (Barki & Pinsonneault, 2002) (Madapusi & D'Souza, 2012) (Mithas, Krishnan, & Fornell, 2005) exist to describe the values of using these applications to its users and this research contributes to that existing values and theories by analyzing the effect of integrating the applications. In a nutshell, this research can be seen *as an aggregating effort* of analyzing the existing values of enterprise applications and seeing their effect when the applications are integrated at an organizational level. This research will help future research to understand the behavior of these added values at a critical stage in the lifecycle of the enterprise applications which is their integration.

There are many perspectives of value creation and theories which explain success factors and utilization of values of enterprise applications. This research will contribute to the two models used by combining the organizational structure of the adopter with the value generated through integration. Secondly, both the models used have never been used to address the issue of integration. Multi-channel commerce applications can be positioned as a Web 2.0 innovation hence, this research can be seen as a link to how organizations can gain more benefits from Web 2.0.

Finally, the research will be executed using analytic hierarchy process (AHP). Though AHP has been widely used in many researches related to decision making, the fact that the source for the method is from enterprise applications and its values is novel. Hence, this research will contribute to the AHP literature as one more additional field in which AHP is applied and tested.

1.7 Explorative Research

This section describes the type of research, the research methods that will be used (section 1.7.1.), methods used for data collection and analysis (Section 1.7.2.) and the conceptualization (section 1.7.3.). Figure 1.3., provides an overall view of the research process.

Following from Section 1.3., exploratory research is a kind of research that is conducted for a problem that has not been clearly defined. It depends entirely on reviewing literature and collected data. The results that are generated using the explorative research are not suitable for decision making by them but they offer a detailed insight into a given problem. The goal of exploratory research is to find out what is going on in a phenomenon without any pre-defined expectations. Explorative research is a starting point which will lead to more descriptive and explanatory research. This thesis will address an area that is comparatively less explored and whose concepts are not presented in existing theories. Hence, this research is classified as an explorative research.



Figure 1.3. Research Approach

1.7.1 Research Methods

The main research method is online survey. The collected data will be analyzed using descriptive statistics, analytic hierarchy process and factor analysis. The analysis will be supported by literature studies.

1.7.2 Data Collection and Analysis

Data is collected through literature studies and survey. The data that are collected include existing values of using enterprise applications which is done using literature studies. Once the values are collected, a framework which is clearly positioned in the existing theories is developed. The framework is then tested through an online survey. The online survey is sent to four different samples: vendors, adopters, consultants and academic professionals in the field of information applications. The reason for collecting data from the academic experts is due to the nature of this research. Exploratory research must always be grounded well in theory and also data collection from the academic experts can act as a mediator to answer sub-questions related to differences in perceptions among stakeholders.

Data analysis will be done through a multi-criteria decision making tool called Analytic Hierarchy Process (Saaty T., Decision Making for Leaders; The Analytical Hierarchy Process for Decisions in a Complex World, 1982). It is a mathematical procedure which helps decision makers facing a complex problem with multiple criteria and alternatives to make effective decisions qualitatively by asking the decision makers to rate the alternative based on their importance (Saaty T., Decision Making for Leaders; The Analytical Hierarchy Process for Decisions in a Complex World, 1982).

1.7.3 Conceptualization

In order to effectively measure and analyze each concept of the research, this thesis has operationalized those using existing theories. A brief description is provided here. We have conceptualized the term Enterprise Application Integration using three business processes that are widely used by retailer companies and is based on Linthicum's guideline. The three business processes are Customer_Order_Online, Customer_Complaint_Call_Center and Marketing_Campaign_Management. The three business processes will be used to develop the framework. The framework is conceptualized using two models: Value Creation Model in Ebusiness developed by Amit and Zott (Amit & Zott, 2001) and Enterprise Application Benefit Framework by Shang and Sheddon (Shang & Sheddon, 2002). According to Value Creation Model in E-business, there are four perspectives to value creation through E-Business which are novelty, complementarities, efficiency and lock-in. This model is used to derive the importance of the added *values.* The Enterprise Application Benefit Framework categorizes values that can be achieved by applications such as ERP and CRM based on the dimensions: strategic, managerial and operational. These dimensions represent the organizational level of the adopters. This framework is used for determining the intensity of added value. We have defined *intensity of the added value as the degree of* added value. The reason for using two frameworks in our research is because there is no existing theory which explains values gained from enterprise application integration. We use the value creation framework of Amit and Zott because integration of ERP and CRM has been researched exhaustively, hence the expected added values will come more from the integration of E-business than from the integration of ERP and CRM. We grounded our conceptualization of the



information technology capabilities required by the adopters on the research by Anandhi S. Bharadwaj (Bharadwaj, 2000) and Henderson and Venkatraman (Henderson & Venkatraman, 1994) who found a positive relationship between information technology capabilities and firm performance. According to (Bharadwaj, 2000), information technology capabilities can be measured through two perspectives namely *human capabilities and infrastructure capabilities* where human capabilities are divided into technical and managerial skills whereas infrastructure capabilities is divided into hardware storage and hardware speed.

1.8 Thesis Outline

The thesis is divided into 7 chapters and the outline is provided below. Table 1.1., gives an outline of the thesis with respect to the sub-questions.

Chapter 1 gave a detailed introduction of the various topics of the research followed by the problem statement; we then present the research questions and objectives of the research. The chapter concludes with the relevance of the research, a brief description of the research and the thesis outline.

Chapter 2 will describe the domain of enterprise applications, specifically ERP, CRM and ecommerce applications with a focus on SAP ECC, SAP CRM and SAP-Hybris applications. This chapter will also include stakeholders involved in the enterprise application market followed by a brief market analysis of the applications along with recent trends in the market. We also motivate the reason behind choosing FMCG industry for this research. The chapter will answer the **first sub-question** of understanding the perceptions of the stakeholders towards integration.

Chapter 3 will provide the operationalization of enterprise application integration. It begins with two approaches to enterprise application integration in order to operationalize it. We follow a business process approach to operationalize enterprise application integration. This chapter will answer the **second sub-question**.

Chapter 4 will describe two frameworks to operationalize the added values namely, the Value Creation Framework and Benefit Framework of enterprise applications. This section also identifies the added values that will be addressed in this research. The added values are based on the business processes developed in the previous chapter. Also, we will operationalize Information Capability using literature study. From this chapter, we will answer the **sub-questions three and four**. At the end of this chapter, we will have the conceptual added value framework to validate using an online survey.

Chapter 5 will provide the research methodology followed for this research. The methodology is online survey and the analysis tools are descriptive statistics, analytic hierarchy process (AHP) and factor analysis. This chapter will answer **the fifth sub-question**.

Chapter 6 will discuss the results from the survey conducted. It will answer the sixth subquestion.

Chapter 7 will answer the main research questions. Also, provide recommendations and reflect on the research done.

Research Sub-Questions	Chapter answered
Sub Question 1	Chapter 2
Sub Question 2	Chapter 3
Sub Question 3 and 4	Chapter 4
Sub Question 5	Chapter 5
Sub Question 6	Chapter 6

Table 1.1. Thesis Outline corresponding to the research questions

CHAPTER

DOMAIN DESCRIPTION

he research problem has been discussed in the previous chapter along with the research questions and the objectives. In this chapter, we explore the domain of enterprise applications with a focus on SAP ECC, SAP CRM and SAP Hybris applications.. The reason to describe the domain is to get a practical view of what is happening in the enterprise applications market with respect to the stakeholders and how their strategic interest will affect enterprise application integration. We categorize this chapter into 4 main topics of discussion followed by the conclusion. First (Section 2.1), we briefly discuss the enterprise applications that will be researched in this thesis, namely Enterprise Resource Planning (SAP ECC), Customer Relationship Management (SAP CRM) and Multi-Channel Commerce applications (SAP-Hybris). The general modules of each application and their relationships will be discussed. Second (Section 2.2), we discuss about the different stakeholders in the enterprise application market to provide a view of all the actors involved in developing an enterprise application. Third (Section 2.3), we provide a short analysis of the enterprise application market and trends for each of the enterprise applications to add motivation to the practical relevance of this research. The analysis describes the market leaders in terms of revenue for two years (2006 and 2012) and also provides an insight into researches conducted by IT analysts based on the products and strategies of vendors. Fourth (Section 2.4), we briefly outline the Fast Moving Consumer Goods (FMCG) industry and its relevance to this topic. This research will analyze the enterprise application integration added values and information technology capabilities for the retailers in the FMCG industry from the perspective of all the stakeholders.

This chapter will answer the first sub-question:

Sub-Question 1: Who are the stakeholders in the FMCG market and what are their interests towards enterprise application integration?

2.1. Enterprise Applications

2.1.1. Enterprise Resource Planning Applications

Enterprise Resource Planning (ERP) applications are complex software solutions for supporting variety of business processes and activities within an organization. ERP is different from other software packages such as supply chain management, accounting applications from the fact that the goal of an ERP application is to fully integrate and support the business processes of an organizations through a single IT architecture (Beheshti, 2006). ERP packages consist of many generic modules which can be used by different types of business processes across industries. ERP supports business processes, which means information that is generated in one department need not be exchanged with all the other departments individually. Any new information from one department has to be updated in the central data store only once and it will be available for all the other departments to see. The information is generated in real time as well. If a customer pays an invoice, it gets updated immediately. ERP solutions are provided in the form of modules. Each software module is responsible for a specific business activity. For example, SAP, which is the leading software vendor for ERP solutions, contains four fundamental modules namely financial, logistics, supply chain and human resources. Each of the modules consists of their own functionalities which are specific to the business activity that they support. From the four basic modules, ERP applications evolved to include other important business activities such as planning, capacity management, sales & distribution, scheduling.

In the beginning, the companies that were most interested in adopting ERP applications were from the manufacturing. (Rashid, Hossain, & Patrick, 2002) But recently, more industries both private such as telecommunications, food, retail, consumer products, banks and public such as municipalities and insurance companies have begun adopting ERP applications (Rashid, Hossain, & Patrick, 2002). ERP applications are not only adopted by big firms but are also popular among the small and medium sized enterprises (SME) (Klaus, Rosemann, & Gable, 2000) (Everdingen, Hillegersberg, & Waarts, 2000). In fact, ERP market has not saturated yet because of the interest of SMEs in ERP applications. They see the benefit of adopting ERP and the vendors see this trend as a challenge to offer ERP applications to smaller companies as well since the initial ERP applications were developed with larger firms in mind.

ERP packages are released as versions and enhancement packages. For example, SAP started the ERP applications with the SAP R/2 which was released at the end of 1970. It was called the business application software suite and was popular among multinational Europe based companies up to the early 1990s. Then SAP developed the SAP R/3 version using the client/server technology which consists of four modules namely has Financial, Logistic, Supply Chain and Human Resource (The R in the name stands for real time data processing and 3 stands for three-tier architecture, the tier were database, application server and user interface) (Davenport, 1998) (Murray, 2006). SAP R./3 was developed to be used in Windows and Unix operating applications which led to a new customer base for SAP to exploit. SAP ERP was renamed as SAP ECC and later SAP developed more packages starting from SAP 5.0 to the latest SAP 6 Enhancement Pack 7. During the different versions that SAP released, it added more modules to the initial set of modules which are *warehouse management (WMT), Sales & Distribution*



(SD), Procurement, Quality Management (QM), Materials Management (MM) (Figure 2.1.). Some of the modules are quite extensive and contain sub-modules. A point to note is that when a company wants to adopt an SAP ECC application, they can choose the modules they want to use and customize it to suit their business process. Another alternative is to modify their business processes to how it is supported by the ECC application since the modules are built on best practices in the industry. This is has to be done after consulting with experts of SAP ECC applications which are usually consultants. No single ERP application is fit for all the firms in all the industries.

To get a clear picture of how ERP applications support a business process, we shall explain in terms of a process using SAP ECC as an example:

Let us assume a manufacturing firm operating in a B2B market, a customer firm orders a spare part they need to build their product. The order goes to sales department where the Sales and



Figure 2.1. SAP ERP application modules (Barki & Pinsonneault, 2002)

Distribution (SD module) of SAP is installed. They take in the order, develop an invoice. The production and the materials department where the production planning (PP module) and materials management (MM module) are installed, gets a notification that an order is in. Since the SD department already entered everything that the customer wants in the application, the PP and

MM can easily access this information. But they find out that they do not have the necessary materials to manufacture the spare part, hence they ask their supplier to send them the raw materials. Once the materials arrive, they need to be put through a quality inspection where the Quality Management application (QM module) is installed; this department will enter all the quality related details for the PP and MM application to see. Once the quality is sufficient, the suppliers have to be paid; hence the QM will update the finance department where the finance module is installed (FI module). Then the raw material will reach the warehouse where it has to be stored till it can be used by the production department. The warehouse management (WM module) module takes care of the processes in the warehouse. Once the production is ready to manufacture the spare part, the raw materials are taken to the production department managed by the PP module. Then once the production is done, it has to be sold to customer (SD module) after which an invoice is created by the FI module using the information provided by the SD module ask the customer to pay them (FI) for the spare part.

The above example illustrates a single business process and the information that is shared and coordinated between the different modules in an ERP application. It is an example of how ERP application can support a business process. In the absence of an ERP application, the sales department would have had to send the order information separately to the production department and the finance department and who in turn would have to ask the warehouses and the materials department for availability of materials all individually. ERP packages make the businesses function more efficiently.

2.1.2. Customer Relationship Management Applications

Customer Relationship Management (CRM) applications are another variety of software packages that tend to address business processes at the customer facing end of companies. Companies have to engage with their customers with different strategies to attract them to buy their products. CRM applications help companies do that effectively. They support the customer relationship strategy of companies. Although there is substantial evidence that ERP applications are the most important enterprise resource needed to run efficient businesses (O'Leary, 2004) (Pabedinskaite, 2010), firms are increasingly recognizing the importance of CRM software as well (Yanjing, 2009) (Liu, Liu, & Xu, 2013).

Two of the biggest evolutions of CRM industry were Sales Force Automation (SFA) management application and contact management application. The combination of these two concepts gave enough information for companies to automate their business activities involving their customers. In 1995, the evolution of these two applications led to the name Customer Relationship Management (CRM).

Similar to ERP applications, CRM packages also come in generic modules. The main modules of CRM are not as standardized as ERP modules since CRM technology is still developing. But some of the prominent modules that are offered by various vendors are sales, marketing, service, business intelligence, call centers, quote and order and interaction centers. Similar to ERP packages, each of the CRM modules have their functionalities and are used for specific business activities. During the initial years of customer management, CRM was offered as a module in ERP packages itself but its functionalities were limited. After recognizing the importance that

firms place on customers, vendors decided to develop a separate CRM application. Some ERP packages still offer CRM as a module which can be used by firms that are not interested to invest much in IT resources towards customer management.

CRM applications are not so industry-specific since they involve only the customer facing business activities but some of the earliest adopters of CRM packages were banking and telecommunications. Considering the industries that adopted enterprise applications, it is already clear that the industries that adopted ERP packages late were the early adopters of CRM packages. It shows that firms had different strategies within their organization depending on the business activity and there was less motivation to have an integrated business strategy. It can also be argued that telecommunications and banks are inherently customer oriented industries.

Recently, the CRM vendor market is growing to see new players such as Salesforce and NetSuite who are capable of developing innovative CRM packages (NetSuite, 2006) (Salesforce, 2010). The market also has leaders such as Oracle, IBM, SAP and Sage. Considering SAP CRM, it releases CRM packages in version similar to ERP packages. SAP CRM consists of 3 main modules namely *Services, Sales and Marketing*. Each of these modules also consists of sub modules. The Marketing module helps the business processes in the marketing department with respect to acquiring customers and retaining existing customers. It consists of the Campaign Management, Promotions and Segmentation sub modules. The Sales module uses the Order to Cash cycle without the logistics part which is in ERP package. Order to Cash cycle refers to all the business activities that are responsible from the moment customers order for a product till the moment they pay for the product after it is delivered. It consists of the Order Management and Billing sub modules. Service module supports the business activities in Service Management (SM) and Project management (PM) modules in the ERP package.

The CRM software packages help the marketing and the sales team to be well equipped with the information they need to gain new customers and retain old customers by tracking what each customer is buying, what their requirements are where their order is at the moment, what their social media activity level is, what the previous conversations they have had with the firm's employees are.

2.1.3. Multi-Channel Commerce Applications

With the development of Web 2.0, new channels have emerged through which customers communicate with companies to buy products they are interested in. Social networking and new technological developments have changed the very nature in which customers collect information and buy products (Pitney Bowes, 2012). They are in the driver's seat. They no longer have to trust the companies blindly; they have the power to get more information, compare between different products and choose the one that suits their needs the best. Hence, the challenge for companies now is to have a two-way communication where they listen to the customers more and make sure their businesses interact directly with the customers. The two way communication that companies need to incorporate faces a further challenge because of different digital means through which customers interact with them. For example, a customer may browse for a company's product online, call them up to place an order and would want to pick it up at the nearby store. This means, companies need to maintain a 360 degree view of the customers across all the channels which are touch points for customer interaction. They need a multi-channel



enterprise application to help them do that. The major channels through which customers interact with companies are mobile, physical store, in-store kiosk, Internet, social networks, catalogues, point of sale (POS). The multichannel commerce application must be able to manage data gathered through all these channels in real time efficiently.

The market for software vendors in ecommerce industry is still growing with a few leaders such as IBM, Oracle, SAP-Hybris and NetSuite (Forrester Research, 2013). Ecommerce software packages also consists of modules related to gathering data about customers from each of the touch points. Hybris is one of the top software vendors of multichannel commerce software packages. It was recently acquired by SAP to put the parent company at a strategic position to develop multi-channel commerce applications. Hybris multi-channel commerce package consists of six major modules namely, *customer service, high performance, print:comet integration, promotion, reporting and web content management modules*.

The Customer Service module is responsible for supporting employees who are involved in taking sales orders from customers and also for managing the customer profiles. The data that they are responsible for are the addresses, credit card details and contact preferences of the customers. The sales orders can be modified, created, deleted or checked using this module. It is useful for customers who cannot find what they need to complete forms or shopping carts online. The High Performance module is responsible for speeding up the loading time of the web pages of the company's website to avoid frustrating the customers. The print: comet integration module help firms to reduce the time-to-market of printed catalogues since usually printing catalogues is very time consuming and labor intensive. The module makes the process of printing reports and catalogues efficient by automating all the print publications such as flyers, catalogues, marketing materials. The promotion module is responsible for attracting customers online by offering discounts, gifts and vouchers. This module helps customers who visit the site regularly to become buyers. This process is called as the conversion rate. Most companies are happy to see that there are a high number of visits to their websites but what is essential is how many of the visitors eventually become buyers. The reporting module takes care of the performance monitoring aspects of the entire e-commerce business activities. It helps the employees to understand what is going on through graphs and visual presentations which are easy and quick to understand. Strategic employees can make effective decisions through the support of this module. The most important of all the modules is the Web Content Management module, which is a marketing tool that helps employees to manage and improve the customer experience of their website including mobile through a single user interface. Customers like to see a website which is well maintained website with clear navigation throughout the website easy to understand and allow which can be done through this tool across all the channels. This module also gathers data on what the customers are doing in the website, their purchase history, search history and uses them to offer deals and discounts in the future using the Promotion module.

The ability to deliver customer services through all the digital channels is a challenge that many firms are facing at present. Software packages that help firms achieve a competitive advantage by having a complete view of the customer will be a strategic tool to improve sales. Hence, multichannel commerce software package are important applications for firms at present and in the future.



2.2. Stakeholders in Enterprise Application market

The enterprise applications market can be described as a value chain with different internal and external stakeholders involved in the development and implementation of the applications. The entire market can be described as a value chain with many stakeholders. Figure 2.2 shows a simple enterprise application value chain with examples of some industry stakeholders. It consists of four main stakeholders namely, the software vendor, consultant, software adopters and the end customer of the enterprise application customer organization (Johansson & Newman, 2009). All the stakeholders have a role in the development of the enterprise applications. The software vendors develop the main or core application. Then, they sell their core product to the consultants. The consultants usually develop add-ons to the existing core product and these add-ons are customized/modified to make sure they are fit to be implemented in the software adopters (Johansson & Newman, 2009). Then, the software adopters use the enterprise application to help their end user customers and also develop their own business processes depending on the enterprise application they are implementing. Each of the stakeholders have a different role to play in the value chain and depending on their roles, they have different competitive advantages.



Figure 2.2: Stakeholders in Enterprise Application Market and Example Companies

The core competency of the vendors is to develop the application while the consultant's role is to implement the software at the end user's organization. The role of the adopter is to make sure the enterprise application fits their business process by finding whether they should modify their business process or customize the enterprise application. Table 2.1 describes the role and competitive advantage of each of the stakeholders and introduces specifications that will be tested in this research.



Table 2.1: Competitive advantage of stakeholders in enterprise application market adopted from (Johanss	on
& Newman, 2009)	

Stakeholder	Competitive Advantage	Gained Through	Specifications
Vendor	Revenue from the number of licenses and market share in the market	Competitive and attractive products which are easy to implement and use	S ₁ : Enterprise Application Integration will increase value to enterprise system adopters in FMCG industry.
External Consultant	Knowledge of the application and market share in the distribution/consultant market	Knowledge about the end user's business. Ability to change the enterprise application to suit the end user's business	S ₂ : Consultants play an important role in integrating ERP, CRM and multi- channel commerce applications
Adopter	Revenue fro2m its products and market share from the specific industry	Implementing enterprise applications to support their business process. Implementing enterprise applications that are hard to imitate. Being competitive in their respective market.	S ₃ : Integrated enterprise applications offer additional value to adopters.
End Customer	Better products to buy at a good price, more services.	Closer touch with the buyer. Increased awareness of the products that are offered and their own interests. Increase in buying power.	S ₄ : Popularity of digital channels will force business process redesigns for adopters in FMCG Industry.

2.3. Fast Moving Consumer Goods Industry

This sub-subchapter will substantiate the reason behind choosing a particular industry for this research. It also offers more support to the specifications introduced in Table 2.1.

Fast Moving Consumer Goods (FMCG) also known as Consumer Packaged Goods (CPG) is one of the biggest industries in the world. Companies in this industry deal with selling nondurable products which are consumed quickly by the customers unlike durable items which are long term usable products. Examples of CPG are soaps, washing powders, packaged drinking water, soft drinks, toiletries and dairy products. Some of the big companies in this industry are Nestle, Procter & Gamble, Coca-Cola, Unilever. There are two main actors in the CPG industry namely the manufacturer and the retailer. The manufacturer of the consumer goods can sell the products through its own physical stores or they can allow the retailers to sell the products to the end consumers. This research will concentrate on the added values and IT capabilities in the FMCG industry from the *retailers perspective*.



The growth of the CPG industry has been remarkable in the last decade (2000-2010) where companies have launched innovative products that have reached across countries through a strong global supply chain. In this rapid development, technology has played a key role and with the popularity of digital channels among customers, companies in the CPG industry must encapsulate this new popularity to stay ahead of competition and be able to keep serving their customers efficiently. Some of the strategic questions they must answer is what strategic steps should they take to build a business through online digital channels and connect with more customers and connect more often.

CPG companies have been using enterprise applications long before it was adopted by other industries but, with the growing customer base and technology savvy customers, companies look for integrated solutions from the software vendors that can support all their business processes and help them gain an advantage through the digital channels. For companies in the CPG industry, the difference between being a market leader and not a market leader depends on how they handle their logistics, their customer relations and channel management. All of the three core issues are dealt by each of the enterprise applications in this research. ERP applications are responsible for the logistics, CRM applications are responsible for the customer relations and multi-channel commerce applications take care of channel management. The critical point is that all of the above mentioned issues have to be taken care of simultaneously and in real time. This supports our third specification.

From a retailer's perspective, the industry is built on developing a powerful brand and a strong global supply chain because manufacturers usually prefer retailers who have these capabilities. The supply chain includes a collection of interrelated processes with external stakeholders such as suppliers, manufacturers, logistics, warehouses and wholesale distributors while a strong brand is dependent on conducting a strong market research, consumer research, product positioning, advertisements and promotions. Hence, for a retailer, there a primary need to have integrated enterprise applications to support all the business activities.

The motivation for choosing retail industry in this research is described using Figure 2.3. From the analysis done by IBM (Lobaugh, 2011), it is clear that there is an increase in the amount of retail product sales through the online digital channel. There is an increase in sales of retail products such as books, sporting goods, apparels which have gained cross channel importance where online channel has gained popularity. This supports our fourth specification and fifth specifications which is:

S₅: Enterprise Application Integration can be implemented in FMCG industry.



Figure 2.3. Category shift of cross-channel shopping by retail segment, 2006-2010 (Lobaugh, 2011)

2.4. Enterprise Applications Market & Recent Trends

This sub-chapter gives an overview of the current market scenario in the enterprise applications. There are three sections in this sub-chapter, each section describes the market for each of the enterprise applications included in this research. We draw sub-conclusions from this chapter at the end which adds to the practical relevance of the research.

2.4.1. ERP

According to the research conducted by Gartner, ERP market has been steadily declining till 2009 in terms of revenue (Gartner, 2010). ERP software industry has declined by 6% in 2009 to record total revenue of \$20.1 billion which is quite substantial (Gartner, 2010). Although there is a total of 6% decrease in total adoption in ERP applications, the midmarket (companies which have an employee number of 100-999) showed only a decrease of 1% which shows that ERP software are still an attractive investment for the midmarket companies (Gartner, 2010). In 2006 (Figure 2.4)., the market share in the ERP application was led by SAP (41%), Oracle (21%), Infor (7%) in terms of revenue (AMR Research, 2013). From 2009-2011, the leading software vendors for enterprise resource planning applications are Microsoft, IBM, Oracle and SAP with SAP recording the highest growth percentage of 16.2% from the previous years (AMR Research, 2013). In 2012, Microsoft has a market share of 5%. Oracle has 13% while SAP has held the highest market share of 25% (AMR Research, 2013). The market is occupied by the same software vendors for nearly five years but there is an increasing number of new vendors entering the market. Hence, the market is still attractive and competition between the leading firms remains high since they need to sustain their market share from new entries and still try to achieve the market leader position. This shows that software vendors need to adopt new strategic approach to developing enterprise applications that will act as a differentiator from other competitor's products.



ERP Market Share in 2006 in terms of Revenue (\$) Total=\$ 25,499 million

Figure 2.4: ERP application market share in 2006 and 2012 (AMR Research, 2013)

2.4.2. CRM

Going back to 2006, the CRM software vendor industry was led by SAP (26%), followed by Oracle (15%), Salesforce (7%) (Gartner, 2013). The total revenue in 2006 was \$6,573 million. In 2012, the CRM software vendor industry was led by Salesforce with 14% of the market share in terms of revenue after it overtook SAP which had 12.9% of the market (Gartner, 2013). SAP is followed by Oracle (10.9%), Microsoft (6.3%) and IBM (3.6%) (Figure 2.5). In total, CRM software vendor revenue was 18 billion in 2012 which is 12.5% higher than 2011. There is a fierce competition between the leaders in the CRM industry as there was an increase in the CRM adoption among the midsize and large enterprises. Therefore, there is a lot of potential in the market. The vendors saw a strong demand for Software as a Service deployment which took upto 40% of the total CRM revenue (Gartner, 2010). In 2012, nearly 50% of the total revenue belonged to the top 5 CRM vendors as mentioned above with Salesforce alone generating 2.5 billion (Gartner, 2013). Also, it should be noted that the number of other small software vendors

is increasing (in 2006, it is 44% while in 2012, it is 52%) (Gartner, 2013) which means new players are entering the market or that the older players are catching up to the leaders both of which means the leaders have to be competitive to stay ahead of the market. Best example is how Amdocs, which was one of the leaders, had to give way to IBM in 2012.



CRM Market Share in 2006 in terms of Revenue (\$) Total=\$ 6,573 million

Figure 2.5: CRM application market share in 2006 and 2012 (Gartner, 2013)

In order to understand the real competition between the software vendors, it is necessary to look at some non-financial measure. According to the research conducted by Forrester Research (Forrester Research, 2012) shown in Figure 2.6, which analyzed the current product offerings of the software vendors versus their business strategy, the 5 top market leaders in terms of revenue are also leading in terms of their current product offering and their product strategy with Oracle leading the market in current product offering followed by SAP while Salesforce is slightly lagging behind (Forrester Research, 2012). All the leaders are almost equal in terms of their business strategy. The following are clear from this - financial performance alone cannot provide the complete picture in the CRM software vendor industry and even the top CRM vendors can improve more on the product offerings.



Figure 2.6: Current Product Offering versus Product Strategy, CRM software vendors (Forrester Research, 2012)

Although there is a high level of adoption rates when it comes to CRM, organizations struggle to catch up with the fast changing and learning customers which makes it difficult for them to define CRM strategies, change customer facing business processes, implement a suitable technology to make sure the processes work correctly and lastly make organizational transition to new forms of learning about customers. This is an observed trend in CRM adopters. Other important trends are:

- Adopters have to adapt to the changing customer demand, which means that they have to move away from independent silos and learn to pay more attention to the customer's experience through the whole journey of the shopping experience (Gartner, 2013).
- Adopters have recognized the importance of cross channel customer interactions (Oracle, 2012). Software vendors from different solution categories such as ERP, CRM, content management applications are improving their capabilities to develop new applications that support cross channel communication and include all the customer touch applications under a single application.
- Adopters are giving more importance to customer management that they are treating it as a separate management module (Gartner, 2010). Customer management has moved away from aspirations to real and tangible strategies with a pre-defined customer experience they want to create, freedom to the employees to make appropriate decisions and give more priority to projects related to customer experiences.
- Adopters are increasingly adopting/will be adopting CRM technology (Figure 2.7) which means most firms will have a CRM technology soon (Forrester Research, 2012). Hence,

the strategic advantage for the adopters will disappear quickly. This shows the importance of developing a unique and strong customer experience strategy.





Figure 2. 7: Percentage of software adopters using CRM at different stages of implementation (Forrester Research, 2012)

From this discussion, we see that adopters slowly understand that customer experience is an important strategic advantage that they still have to improve and invest on. They view it as an opportunity to attract more customers and eventually achieve a competitive advantage. Recognizing the importance alone is not sufficient; adopters are still struggling to implement a sustainable customer experience strategy. Hence, integrating the CRM application with the multichannel commerce application will offer an opportunity for adopters to develop better customer strategy.

2.4.3. Multi-channel commerce

In a research conducted by Sparkred (Sparkred, 2014), which is an IT analysis company, the number of multi-channel commerce platforms that are used by companies are increasing with the market led by IBM WebSphere (Figure 2.8) followed by Hybris. But the larger number of companies develop their own websites which might be explained by the fact that previously, online shopping may not have been popular among customers hence adopters did not see the need to outsource website development due to higher costs. But with growing importance to online and mobile shopping to customers, software vendors can see this as a potential market to tap into by stressing on the value of having a streamlined website which can communicate effectively with other channels as well, to the adopters.

According to Forrester Research, ecommerce software application suites and the vendors, IBM, Oracle and SAP-Hybris are the leaders of the B2C e-commerce applications industry (Forrester Research, 2013). The latest acquisition of Hybris by SAP puts the big three firms (SAP, Oracle and IBM) as the leaders of this industry (Figure 2.9). What makes these firms to be and remain leaders is the level of depth they bring to their software packages. Each of the software packages developed by them consists of diverse capabilities, from Web Content management to Product



Information Management and Order management which is attractive to customers who want a single application to support all their relevant business processes (Sherlock & Fletcher, 2009)







2.4.4. Sub-conclusion

From subchapter 2.4., we derive the conclusion that software vendors in all the three enterprise applications industry face stiff challenges from competitors and also from new entries in the market. The top leading software vendors in CRM and multi-channel commerce industries have strong product strategies to sell their products but, can improve their product offerings. Hence,



software vendors need to come up with innovative products to be able to differentiate themselves from the competitors and achieve a higher market share.

2.5. Conclusion

This chapter answers the first sub-question:

Who are the stakeholders in the FMCG industry and what are their interests towards enterprise application integration?

Initially, this chapter offered the practical nature of enterprise applications and the level of complexity within each of the software applications and trends in the enterprise application market based on which we developed five specifications. Section 2.1 provided with an in depth picture of all the modules in ERP, CRM and multi-channel commerce applications in general, which will act as a basis from which we will develop business processes that will be used in this thesis in the next chapter. Section 2.2 introduced the stakeholders in the enterprise application market from which we concluded that the added values and information capabilities that will be analyzed in this research are for the adopters from the perspective of four stakeholders: vendors, adopters, consultants and academic professionals. In section 2.3, the need to integrate enterprise applications for both the vendors and adopters was discussed using various market analysis reports. For the vendors, developing integrated solutions will help them achieve substantial amount of product differentiation to allow them to achieve more market share or maintain the existing leader position. Integrated solutions can also open a new market which has never been addressed before. Adopters with more focus on FMCG industry find it hard to keep track of their customers and to address their dynamic demands, with the growth of digital channels. Hence, integrated solutions offer them an opportunity to streamline their business processes across various departments to improve their services to the end customers. Hence from this chapter, we have arrived at the following conclusions which answer the first sub-question:

- 1. Software vendor market is highly competitive and there is still scope for improving the software applications developed by them so vendors have to develop new product offerings to achieve market leader position in terms of revenue.
- 2. FMCG industry adopters are increasingly seeing a new trend of their customers using digital channels to buy and browse products. This trend has made companies in the retail industry to give more importance to improving their digital touch points through which they can reach out and learn more about their customers.
- 3. External Consultants play a vital role in the integration process since they need to understand the requirements of the adopters. The requirements vary for different adopters hence redesigning the business processes based on the different applications are vital. Also, the help the software vendors by providing them with customer insights and changes in the industry so that the vendors can make better product offerings.

Both of the above conclusions explain the interest for software vendors and software adopters to integrate enterprise applications namely ERP, CRM and multi-channel commerce.

We have stated five specifications (Table 3.2) that will be tested in the online survey to further explore the answers to the first sub-question.

The next chapter (Chapter 3) will operationalize Enterprise Application Integration for this research using three business processes and also, includes a brief technical approach to the integration process. The three business processes described in depth are widely adopted by retail companies and involves specific business transactions using the modules in each of the application described in this chapter. The business processes are the foundation to further develop the added value framework that identifies added values. Information technology capabilities are discussed in Chapter 4.

Table 2.2: Specifications

Specification Number	Specifications for FMCG Market
S ₁	Integrated enterprise applications help vendors to differentiate their products from competitors' products.
S ₂	External consultants play an important role in implementing integrated enterprise applications.
S ₃	Integrated enterprise applications offer additional value to adopters.
S 4	Popularity of digital channels among end customers will influence business process redesigns for adopters in FMCG Industry.
S ₅	Enterprise Application Integration can be implemented in FMCG industry.

CHAPTER

ENTERPRISE APPLICATION INTEGRATION

n this chapter, we operationalize the term Enterprise Application Integration for this research. First, in Section 3.1., we describe briefly the technical approach to the integration. Although it is not directly related to the research, it is useful in order to understand the fundamental techniques that are available to integrate the three applications. Then, we introduce the concept of business process approach to Enterprise Application Integration suggested by Linthicum (Linthicum, 2000). Second, in Section 3.2., the operationalization approach for Enterprise Application Integration for this research is described by defining three general business processes that widely exist among retail companies to deliver services/products to the end customers. The first business process is called Customer_Order_Online which describes a sequence of activities that takes place within the retail company, supported by ERP, CRM and multi-channel commerce applications, when a customer orders for a product online that is to be delivered to their home. The second business process is called *Customer_Complaint_Call_Center* which describes a sequence of activities that takes place within the retail company, supported by ERP, CRM and multi-channel commerce applications, when a customer registers a complaint about a product that was not delivered as expected. The third business process is called Marketing_Campaign_Management in which also describes a set of activities that describes the back end activities that takes place when a customer visits a company's website to purchase or browse for products. The research sub-question that will be answered in this chapter are:

Research Sub Question 2: How to operationalize Enterprise Application Integration?

The central issue that is going to be dealt with in this thesis is "Application Integration". From the 1990s, enterprises have adopted several software applications that were used to solve business and information related problems within each department of the enterprise. These applications evolved from the problems posed by previous mainframe applications. Although enterprise applications were a suitable solution to the existing problem, there is an inherent disadvantage to



their large scale implementation. They become 'storepipe or silo applications' (Batra & Mukharjee, 2011). The different units in an enterprise started to purchase packaged applications from the software vendors to solve the problems that existing applications posed to only their department. They did not view the firm itself as the beneficiary of the packaged applications. Packaged applications refer to applications that are purchased rather than developed within the firm that wants to use the applications for its business purpose. This exposed the reality that the applications were built and adopted without the idea of *information sharing*. Hence, there were no open applications or standards which allowed for these stovepipes to communicate with each other.

3.1. Technical Approach to Enterprise Application Integration

The concept of Enterprise Application Integration (EAI) was the solution to the problem described above. Although there are various definitions of EAI in literature, the general notion that each of them describe revolves around is integration of data. Green defines EAI as the integration of dissimilar application applications to share information via a common in user interface (Green, 2000) while Linthicum defines EAI as the unrestricted sharing of information and business process among all connected information applications in the enterprise. Taylor (Erasala, Yen, & Rajkumar, 2003) define EAI as moving information applications toward a platform for supporting electronic commerce. We follow the definition of Linthicum in this thesis as; EAI is the unlimited sharing and coordination of data and business process between any connected application and data source in an enterprise (Linthicum, 2000). EAI became a true demand once firms began to use numerous silos and they demanded a way to share the information between these silos without having to make any major changes to their existing applications. That is the technical advantage of using EAI. From a business perspective, implementing EAI meant enterprise can develop a central vision to the firm that cuts across different departments within the firm (Lam, 2005). Implementing EAI does not mean an end to the current applications or the legacy application; in fact the true advantage of using EAI is that the enterprises can connect all the applications without making any sweeping changes. The central principle of EAI is sharing of essential information but the ways to do it are different based on cost, risk and need of an adopter. This variety in the approach towards EAI makes it all the more complex. In order to implement EAI, it is critical to understand the business process and the data that needs to be shared between the applications. First, a technical approach to EAI is discussed. There are four dimensions under which EAI can be achieved: Data level, Application level, Method level, User interface level, each of which will be explained briefly below.

3.1.1. Data level EAI

In data level EAI, integration of applications take place via the data stores. A data store is defined as *a repository for permanently storing digital data and kept in an electronic form.* There are different types of data stores such as databases, file applications, texts, and images. Data is taken from one database and is updated in the other database to allow for future use or modifications. In an enterprise, data level EAI could mean transferring data from a huge amount of databases. The common method to do data level EAI is ETL (Extract, Transform, Load) which are tools that extract data from a data store and insert it into another data stores which can be used for other specific business needs (Figure 3.1). The two major advantages of using data level EAI are that it does not require any major modifications to be made to the existing applications hence there is



no need to test and develop new applications and the other advantage is the cost of implementing it is low because the its approach is based on database oriented middleware such as ODBC and JDBC.



Figure 3.1. Data level EAI

3.1.2. User Interface level EAI

User interface level EAI is the most basic form of integration. It consists of replacing already existing text-based user interfaces of existing applications with a standard browser enabled interface. It is commonly known as *re-facing or screen scraping*. Using these standard interfaces, applications can share data. In short, integration at this level takes place when two applications share the information which is present at the user interface. The process of retrieving information in the user interface involves defining the right screen to get the data from, locating the right data you want to extract, reading that data and then processing/storing that data in another user interface. In order to implement user interface level EAI, it is necessary to understand the applications that will be integrated and their data schema along with their business logic. Since the data represented in the user interface will not be the exact match to what is stored in the database because the application logic may change the data, it is critical to understand the business logic as well. The main aim to implement user interface level EAI is to be able to track the data right from the user interface back to the database through the application logic.

3.1.3. Method level EAI

Method level EAI refers to sharing methods between the different applications by placing these methods (otherwise called processes) in a common server and providing the infrastructure to the applications to access this common server. It is similar to application level EAI but at a lower level of granularity. The methods that are shared by the applications are the methods that compose the business logic that is shared between the applications in the application level EAI. This type of integration can be done using different technologies such as Java, RMI, CORBA, DCOM but the most recent approach that is followed by software vendors is Web services. The disadvantage of method level EAI is that is more invasive than the other types of integration since its needs changes to be made to the existing applications. In order to understand more about method level EAI, we need to define the term method (or process). A method or a process is *any business rule or a piece of logic that exists within an enterprise that has an effect on how information is processed*.



3.1.4. Application level EAI

Application level EAI involves making use of the interfaces provided by packages applications to access their business process and information. An Application Programming Interface (API) is defined as mechanisms which give access to services provided by any application. There are different types of services offered by an application namely business process, data and object services. A business process service gives access to the business logic of the application. For example, if a user wants to update the customer's purchase history from a different application then it can use that application's API to update this information. Data service refers to a process of only accessing the physical or the logical database and other data stores, meaning data services are used only for extracting any data but deleting/modifying them, that has to done through the business services. Object level service refers to the combination of business and data services encapsulated together as an object. This is the most typical type of integration that is followed by software vendors for making enterprise applications. Software vendors develop packaged applications developed by software vendors are business critical. The applications are built as a set of modules such as accounting, inventory, human resources, manufacturing and other functionalities. In order to successfully develop each of the functionalities, software vendors view each functionality as a single architecture. There are three main types of architectures namely centralized architecture, two-tier architecture and three tier architecture which are briefly explained below.

Centralized architecture stores both the data application logic and the user interfaces in the same application which can be accessed by a terminal. Centralized architecture is the classical type and simple to develop and software vendors have stopped from using this architecture long ago. SAP R/2 was using centralized architecture. Two-tier architecture follows a client/server model with three different pieces or layers: the user interface layer, the business logic layer and the data layer. Even though there are three layers, they are differentiated as client and server connected via a network. The client is the user interface layer while the server consists of the data layer and the business logic layer (sometimes the business logic layer is kept at the client side). The three tier layer introduces the application server which acts like an interface between the user interface layer and the data layer. The application layer takes care of all the application logic-processing services. The user interface layer and the data layer can communicate only with the application server but not themselves. This is the most popular architecture for the enterprise applications. It provides a clear separation between each layer, thereby increasing scalability. The scalability is increased because the application server can multiplex the number of connections between the user interface layer and the data layer. This process is called data funneling. The type of architecture is important when it comes to understanding how the application interfaces interact with other enterprise applications. Depending on whether an interface allows access to only the first tier or the second tier, the functionality of the interface will vary. Figure 3.2 describes the three types of application integration to integrate ERP, CRM and multi-channel commerce systems.

3.1.5. Integration through Application Server

Application servers are middleware components that help two or more heterogeneous applications to communicate with each other. By heterogeneous, we mean applications that are do not share the same programming structures or databases or data models. As an example, SAP ECC and SAP CRM are developed using the ABAP programming language which is specific to



SAP applications, while Hybris which is a multi-channel commerce application is developed using Java. Hence if these three applications are to be integrated, then the communication between them will be heterogeneous since they use different programming languages and their data structures will be different. Application servers are one approach to integrating at the three tier Application level EAI. Application servers act as message brokers wherein, they receive information from one application and convert that information into a message that can be read by other applications (Figure 3.3). By this approach, integrating the three applications is possible.



Three-Tier Architecutre

Figure 3.2. Architectures in Application Level EAI



Figure 3.3. Technical Approach to Integrate ERP, CRM and Multi-Channel Commerce Applications

3.2. Business Process Approach to Enterprise Application Integration

The previous sub-chapter provided an overview of enterprise application integration from a technical perspective. It described the various types of approaches that can be followed to implement enterprise application integration. This subchapter will introduce the concept of business process approach to EAI which deals with understanding the business processes changes involved during the integration process. Further, it defines three business processes which are used for operationalizing enterprise application integration. Although there are different ways to approach the concept of EAI, a general methodology to implementing EAI has been proposed by Linthicum (Linthicum, 2000). The goal of the methodology is to provide a workable list of checklists of the issues that needs consideration to make EAI possible in a firm. The most critical aspect of this methodology is to make sense of the business processes that must be supported by the applications that are to be integrated. A business process can be defined as a collection of activities or steps that are designed which begins with an event or a trigger/event (input) and ends with a product or service (output) that is desired by the end-customer (Georgakopoulos, Hornick, & Sheth, 1995). It puts emphasis on how the work is done within an organization to serve the end-customer, rather than what the products of the companies does. Thus, a business process is a pre-defined and specific ordering of activities within a company that takes place across time and space (Van Der Aalst, Weske, & Grünbauer, 2005), with a beginning, an end, an input and an output. A business process has a goal and makes use of resources and information from other parts of the company to achieve the goal (Wastell, White, & Kawalek, 1994). Figure 3.4 shows a diagrammatic representation of a business process.



Figure 3.4: Business Process and its attributes

Business processes are critical to understand enterprise application integration (Van Der Aalst, Weske, & Grünbauer, 2005). Hence, in order to really understand the value that can be gained by integrating the applications, we must first develop possible business processes that rely on these applications to function smoothly. We use this approach to operationalize Enterprise Application Integration. In this chapter, we develop three general business processes that are widely followed by retailers in their organization. Table 3.1., describes the attributes of the three business processes that will be used in this thesis.

Name of	Event/Trigger	Product/Service	Goal	Resources	Information
Business	(Input)	(Output)			
Customer_ Order_ Online	Customer purchases product through the website, wants it delivered to their home.	Product for delivery, information about delivery sent to the customer	Deliver the product to the customer on- time, at the right delivery method chosen by the customer	ERP, CRM, ecommerce applications, warehouse.	Customer data, product data, accounts data
Customer_ Complaint to_ Call Center	Customer calls the call center to register a complaint about a product not being delivered at their convenient	Deliver product to the customer through their convenient channel	Solve the customer's complaint	ERP, CRM, ecommerce applications, warehouse. Call center	Customer data, product data, accounts data, complaints data
	channel.				uata
Marketing_ Campaign_ Management	Customer visits the retailer's website to	Customer data analysis, loyalty rules for customers,	To gain insight into customer behavior	ERP, CRM, ecommerce applications,	Customer data, product data, Sales
	browse through products.	Planning	activities	warenouse	uata

Table 3.1. Description of the attributes of the three business processes used to operationalize Enterprise Application Integration

3.2.1. Business Process 1- Customer Orders Online

The first business process considers the process when a customer orders for a retail product online through a website and wants the product to be delivered at their home. The event or the trigger for the business process begins the moment the customer confirms the order in the website. From that point, the series of steps that are taken at each of the enterprise applications is explained below. Figure 3.5 shows a pictorial description. Each box inside the enterprise applications represents a particular module in that application. For example, Order Management module belongs to the multi-channel commerce application while the Sales module belongs to the ERP application. Each module has a specific function to perform; the output of that function can be used by other modules in the other enterprise applications. Complete process flow can be seen in Figure 3.6.

1. Order Management-> In-store Merchandise and Inventory Management

When a customer orders products online, the orders are recorded by the ecommerce application using the order management module. The order management module updates the order of the customers, records their delivery method. Then the availability and the price of the products must be determined to confirm the order and for billing which is done by the Sales module in the ERP application.



2. <u>In-store Merchandise and Inventory Management-> Order Management</u>

In the next module, when the order management module of the ecommerce application records all the products ordered, it starts a trigger at the ERP application's In-store Merchandise and Inventory Management (IMIM) module which checks the product availability and price and updates the ecommerce application's Order module. Once the confirmation is received from the IMIM module, the Order Management module confirms the order with the customer and sends it for billing to the Sales module in ERP.

3. Order Management->Sales

Once the order details are received by the Sales module in ERP from the Order Management module in ecommerce application, the module prepares the billing document and invoice. The module sends the invoice back to the Order management Module which asks the customer to pay for the products ordered. The customer pays for the products. Once the payment is confirmed, the confirmation is sent to the Sales module in ERP for accounts. In the meanwhile, the Sales module updates the accounting document which consists of the overall details of all the purchase transactions that are taking place.



Figure 3.5: Business Process 1 – Customer_Order_Online

4. <u>Sales->Warehouse Management</u>

The bill invoice and the confirmation that the payment is made is sent from the Sales module to the Warehouse Management module in ERP and the Warehouse management module receives the order details from the Order Management module. The Warehouse Management module takes care of packing and shipping the products safely by performing operations such as identifying the location of the product based on their rack, generating a packing document which consists of names and ids of all the products that are packed in case of any future references. Then, the products are shipped along with the invoice and billing document to the customer. Once the shipping is done, the Warehouse Management application triggers the Order Management module at the ecommerce application to alert the customer that the product has been shipped and the approximate time of delivery is also provided. The notification to the customer is done through their corresponding mobile phone.

5. <u>Warehouse Management->Analytics</u>

Once the steps in the process that are customer such as order confirmation, product availability check is completed, the Warehouse Management sends all the order information and the customer information to the Analytics module in the CRM application.

6. <u>Sales->Analytics</u>

The Sales module sends the billing details corresponding to the customer and the order to the Analytics module. The analytics module uses the data received from the Sales module and the Warehouse Management module to perform customer analysis, market analysis, product analysis and also on how well the customer has been taken care of based on the time it has taken to deliver the product or on customer satisfaction. The results of this research are useful for marketing, loyalty and campaign management programs.

3.2.2. Business Process 2 – Customer Complaint to Call Center

The second business process considers the process when a customer contacts the company through a call center to register a complaint that the product ordered earlier which he/she wished to be picked up at the in-store kiosk in one of the physical stores of the company has not been delivered to the store. The event or the trigger for the business process begins the moment the customer contacts the call center. The goal of this business process is to solve the customer's complaint while the output is to deliver the product through the customer's preferred channel, which in this case is the in-store kiosk. From that point, the series of steps that are taken at each of the enterprise applications is explained below. Figure 3.7 shows a pictorial description. Each box inside the enterprise applications represents a particular module in that application. For example, Customer Service module belongs to the multi-channel commerce application while the Sales module belongs to the ERP application. Each module has a specific function to perform; the output of that function can be used by other modules in the other enterprise applications. Complete process flow can be seen in Figure 3.8.

1. <u>Customer Service-> Complaint Processing</u>

When a customer registers a complaint through at the call center, the complaint is registered at the customer service module in the ecommerce application. The process of registering the complaint at this module begins with creating the complaint and checking if the complaint has been already registered by the same customer. If it has been registered already, then the new complaint is linked with the existing complaint. If the complaint is new, then the module assigns an unique identification or serial number to the complaint. Then the module categorizes the complaint based on priority or some other categories. Then the Customer Service module triggers the Customer Processing module to deal with the complaint.





Figure 3.6: Detailed Business Process Flow for Customer_Order_Online



2. <u>Complaint Processing-> Complaint Analysis</u>

When the Complaint analysis module receives the trigger from the Complaint Processing module that a complaint has been registered by a customer, it begins to analyze the complaint by checking the warranty the services rendered to the complainant's product. If the warranty exists, then the module waits for a manual approval from an employee to solve the complaint which in this example is a product that is not delivered. Hence, the employee checks if the product has not been released from the warehouse by creating a delivery request. Delivery requests are usually created in the CRM application to notify the ERP application that a new delivery has arrived with regards to a customer complaint. If the delivery request comes back negative, it shows that the delivery has been already done in which case the complaint processing module updates complaint service module in the ecommerce application that the product is already sent and is on its way to be delivered. If the delivery request is positive, it implies that the product is still not released for delivery. The complaint processing module updates the ERP application for further inventory processes to be carried out. Then, the Complaint Processing module saves, updates the complaint analysis module and releases the complaint.

3. <u>Complaint Processing->Sales</u>

The processes at the Sales module in ERP are similar to the first business process. Once the complaint details are received by the Sales module in ERP from the Complaint processing module in the CRM application, the module prepares the billing document and invoice. Once the payment is confirmed, the confirmation is sent to the Sales module in ERP for accounts. In the meanwhile, the Sales module updates the accounting document which consists of the overall details of all the purchase transactions that are taking place. After the billing and the invoice is done, the Sales module informs Warehouse management module about the new complaint and order.

4. <u>Sales ->Warehouse Management</u>

The bill invoice and the confirmation that the payment is made is sent from the Sales module to the Warehouse Management module in ERP. The Warehouse Management module takes care of packing and shipping the products safely by performing operations such as identifying the location of the product based on their rack, generating a packing document which consists of names and ids of all the products that are packed in case of any future references. Then, the products are shipped along with the invoice and billing document to the customer.

5. <u>In-store Merchandise and Inventory Management-> Customer Service</u>

Once the shipping is done, the Warehouse Management application triggers the Complaint Service module at the ecommerce application to alert the customer who registered the complaint that the product has been shipped and the approximate time of delivery at the in-store kiosk is also provided. The notification to the customer is done through their corresponding mobile phone (SMS).





Figure 3.7: Business Process 2 – Customer_Complaint_Call_Center

3.2.3. Business Process 3 – Marketing Campaign Management

The third business process starts with a customer visiting the company's website and how data is collected from this activity and is used in marketing, campaigning and generating loyalty programs for the customers. The event or the trigger for the business process begins when the customer searches for a product to buy or when a new customer registers with the website. The goal of this business process is to gain information about the customer which will help their marketing and campaigning. The series of steps from the starting that are taken at each of the enterprise applications is explained below. Figure 3.9 shows a pictorial description. Each box inside the enterprise applications represents a particular module in that application. For example, Web Channel Management module belongs to the multi-channel commerce application while the Sales Planning module belongs to the CRM application. Each module has a specific function to perform; the output of that function can be used by other modules in the other enterprise applications. Complete process flow can be seen in Figure 3.10.

1. <u>Web Channel Management-> Sales</u>

When the customer visits the company's website, the Web Channel Management module records their activities such as their search terms, products viewed, items purchased, ads clicked. This information is stored in the Web Channel Management module in the ecommerce application.

2. <u>Sales -> Loyalty Management</u>

From the information recorded by the ecommerce application's Web Channel Management module, the Sales Planning module in CRM application can develop forecasts and targets for sales, production and supply chain operations which can be useful for developing loyalty programs.



Figure 3.8: Detailed Business Process Flow for Customer_Complaint_Call_Center





Figure 3.9: Business Process 3 – Marketing_Campaign_Management

3. <u>Sales -> Profitability Analysis</u>

The Sales module in the ERP is the module where the actual sales of the products happen as a result of the marketing campaigns. It records the direct results of the campaigns by recording the data about the customers who have bought the products that are marketed, their market segment, channel of purchase etc. The data is used in analyzing the performance of the campaigns.

4. Loyalty Management -> Campaign Planning

The Campaign Planning module is responsible for the developing appropriate steps to campaign in terms of which products to market, which customers to target, what kind of campaigns to run. This information is later provided to the Campaign analysis module in order to analyze the results of the campaigns and its performance.

5. <u>Campaign Planning-> Campaign Analysis</u>

The campaign analysis module collects the information from the campaign planning team and the actual sales that happened during the campaign period to analyze the results of the campaign. The results are determined to be positive or negative based on previous set targets.

6. <u>Profitability Analysis -> Campaign Analysis</u>

Profitability analysis allows the companies to analyze market segments to categorize them based on products purchased, customers, orders or a combination of these to provide sales, marketing, product management and corporate planning departments with information to support internal accounting and decision-making with respect to analyze the results of the marketing and campaigns. This is an extremely valuable process for organizations as they can play a crucial role





Figure 3.10: Detailed Business Process Flow for Marketing_Campaign_Management

3.3. Conclusion

This chapter explained the approach taken to operationalize the integration of ERP, CRM and Multi-Channel Commerce applications for this research and answered the Sub-Questions 2.

Sub Question 2: How to operationalize Enterprise Application Integration?

Section 3.1 introduced Enterprise Application Integration from a technical perspective to provide insight into how the integration between the applications can take place through an application server, which is the most widely adopted form of integration in current enterprise applications. The three applications communicate using an application server which has the ability to interact with heterogeneous applications. Section 3.2 described the core operationalization of the term *"Enterprise Application Integration"* for this research. We have operationalized it by developing three business processes that commonly occur in any retail company and is used by retailers in their organization. The business processes were chosen such that it involved sufficient communication between the three applications. The first business process *(Customer_Order_Online)* begins with a customer's order online and follows various steps through each of the applications have a role to play to deliver a product to the end-customer. The second business process *(Customer_Complaint to_Call Center)* begins with a customer registering a



complaint at the call centre of a retail company that a product that was ordered has not been delivered at the expected nearest physical store to the customer. The third business process *(Marketing_Campaign_ Management)* involves marketing and campaign management which begins when a customer visits a retailer's website to shop for products and how the three applications develop marketing, sales and loyalty program strategies based on the information they get about the customers. The three business processes will act as the basis for developing the Added Value Framework in Chapter 4 using the Enterprise Application Benefit Framework and E-Business Value Creation Model.

The three business models are also part of the online survey that was used to collect data for this research. At the beginning of the survey, a brief description of the three business process was provided and the respondents were asked to consider the intensity and importance of the added values for these three business processes. The added values that will be explained in Chapter 4 are also derived from these business processes. Hence, the above business processes form the core of the research design. The reasons for following a business process approach as a research design is because they represent the processes that take place in FMCG industry from an industrial and practical perspective. Therefore the values identified and subsequently the added value framework that is developed can be put to use in practise and will be significantly useful. A technical approach to operationalize integration would have shifted the focus away from the post-integration developments which is essentially the focus of this research. Any other method to operationalize integration would not have been more suitable because in practise, values are identified based how integration business on the supports the process.

CHAPTER

ADDED VALUE FRAMEWORK

sing the business processes developed in Chapter 3, this chapter will utilize two frameworks namely, Enterprise Application Value Framework and E-Business Value Creation Model to construct the Added Value Framework that will be used as the conceptual model of this research. Added value is measured through two constructs - intensity of added value and importance of added value. Intensity refers to the degree of value added while importance refers to how crucial the value is for the adopter. In Section 4.1., we discuss briefly about the Enterprise Application Benefit Framework developed by Shang and Seddon which categories the values of using the enterprise applications are Managerial, Strategic, Organizational, IT and Operational. This model is used for measuring the intensity of the added value. In Section **4.2.**, we outline the Value Creation Model of Amit and Zott which described the values of using E-business technology from the perspectives of all stakeholders including the adopters, the providers and end customers. This model is used for measuring the importance of the added value. The reason for using two frameworks to ground this research is because the values created from the ERP, CRM and multi-channel commerce applications can be viewed from different perspectives and the framework described by Shang and Seddon does not include e-business applications while the Amit and Zott framework is exclusively for e-business applications. Hence, the theoretical foundation to identify values is similar to the integration approach itself which is integrating the ERP and CRM application with the multi-channel commerce applications. Section 4.3, we discuss the Information Technology capabilities literature in general and concentrate on the capabilities that are appropriate for implementing enterprise applications and its integration. Finally, we will present the added value framework of this research.

The research sub-questions that will be answered in this Chapter are:

Sub Question 3: What are the relevant theories and different perspectives to analyze enterprise application values?



Sub Question 4: What are the relevant theories and different perspectives to analyze a firm's Information Technology capabilities?

Chapter 3 operationalized enterprise application integration using a business process approach. We described three business processes and their corresponding process workflows. The business processes described how the three different applications communicate with each other across different channels and departments. The beginning of this chapter will further operationalize the added values that can be obtained from the three business processes.

4.1. Enterprise Application Value Framework

The Enterprise Application Benefit Framework (Figure 4.1) developed by Shang and Seddon (Shang & Seddon, 2002) addresses the different perspectives through which firms that adopt enterprise applications gain benefits from it. They claim that benefits can be categorized broadly into five perspectives namely Operational, Strategic, Managerial, IT, Organizational. The motivation behind the five perspectives is from the work of Anthony (Anthony, 1965) who describes that planning and control applications will deliver results in terms of the three perspectives of Operational, Strategic and Managerial. Several researches has already been conducted to exploit the three perspectives. (Weill, 1990) investigated the benefits of IT investments from the strategic perspective and found positive relationship between both. (Gorry & Scott Morton, 1971) (Ginzberg & Reitman , 1992) (Demmel & Askin, 1992) have found significant benefits from IT investments for managers to make decisions. (Mirani & Lederer, 1998) used the modified the Anthony's framework to prove that IT investments also lead to organizational benefits. The other two perspectives namely IT and Organizational were included after researching previous studies and noticing that they have been mentioned in large numbers.

Strategic activities include long term planning such as competition, capital sourcing, market penetration, new product development and other higher level decisions. The goal of investing in IT from the strategic perspective is to make sure IT contributes to innovative strategic activities rather than the most often followed, "should be the first to invest in IT". Investing in IT should be the starting point for further strategic innovations rather than being the end goal of a strategic step. Operational activities refer to the day-to-day activities that include acquiring and using the resources, in this case the enterprise applications. These activities take place regularly and multiple number of times and are repetitive. Managerial activities include allocating and controlling the IT resources, looking after the processes that use the IT resources and also supporting the long term strategic activities. IT activities refer to infrastructural usage of IT resources; infrastructure here refers to the computer networks, mainframe computers. Organization activities refer to the knowledge that the firm gains by using these applications and how that knowledge helps the firm to develop a common vision and share the information to instill inter-employee communication growth. According to (Shang & Seddon, 2002) all of the above activities will gain more benefits from implementing enterprise applications. The five perspectives are different from each other but it is considered from the point of view of the adopters.

The benefit framework was developed with the business managers in mind, leaving out the toplevel chief executive officers and the lower level operational managers. Chief Executive Officers tend to concentrate on the financial performances of the investments and there is a difficulty in



measuring the causal relationship between the investments in IT and the output of the company in terms of sales, market share and profits (Tallon, Kraemer, & Gurbaxani, 2000). Hence, the views of the top level strategic planners are too broad. At the other extreme, operational managers' perceptions tend to concentrate on their needs and interests to evaluate the success of IT applications, leaving out the more important attributes such as cost saving, productivity and improved service (Mckenney, 1995). Hence, the perceptions of the operational managers at the lower level are too narrow. Middle level business managers are most appropriate to evaluate the IT investments since they will have a comprehensive understanding of both the operational and strategic in terms of the capabilities of the enterprise applications and the business plans for using these applications. By concentrating on the middle-level managers, the framework developed by Shang and Seddon offers a suitable theoretical ground to conduct more literature on the existing values of enterprise application since the values from both strategic level and operational level can be analyzed. But this research will investigate the added values from three levels namely strategic, managerial and operational to gain a broader perspective.



Figure 4.1. Enterprise Application Benefit Framework (Shang & Seddon, 2002)

In this section, we have discussed the Enterprise Benefit Framework to explore five different perspectives through which benefits from enterprise applications can be analyzed. The five perspectives are *Strategic, Managerial and Operational, IT, Organizational.* A summary is provided in Figure 4.2. Following sections will describe the three levels that are included in the research.

4.1.1. Strategic Level

Strategic values refer to values that can be achieved which helps in developing new innovative business strategies or successfully implementing new business strategies. Several researches has been conducted to explain how implementing enterprise applications have led to strategic values. Porter and Miller (Porter & Miller, 1985) explain that there are three dimensions through which value can be gained by using enterprise applications namely, cost leadership, product differentiation and focus. Product differentiation could be a business strategy for a firm which is competing in the retail industry, hence integrating the enterprise applications could also be off strategic value. Thus, values gained by application integration that helps the upper level management to make decisions that have a *long term and strong effect* and will affect the company significantly are defined as strategic values.



4.1.2. Managerial Level

Managerial values refer to business decision making and resource allocation that has to be done by *middle level managers*. When enterprise applications are combined, they can perform more data analysis which will provide the managers with extensive data to make sound and concrete decisions which normally could be taken on instinctive bases (Brynjolfsson & Hitt, 1993). Information applications play a crucial role as a support for decision making processes since they can store huge amount of data and can perform different types of analysis. Thus, values gained by application integration that helps middle level managers make quick decisions that have an short term effect with comparatively less significant changes to the organization are defined as managerial values.

4.1.3. **Operational Level**

Operational values that can be achieved from using enterprise applications depend on the day-today activities that take place within the organization. Previous research has evidence that investing in information applications has lead to streamlined business processes and automating business transactions which provides benefits. Enterprise applications also help in speeding up processes, substituting labor and increasing operation manufacturing volumes (Weill, 1990) (Smith, 1991). As enterprise applications automate business processes and enable process changes, they would be expected to offer additional values when different applications are integrated. It will lead to a while scale process integration. Thus, values gained by application integration that helps lower level employees make day-to-day activities that have an immediate effect with lesser significance to the organization are defined as operational values.



4.2. Value Creation Model for E-Business

Value Creation Model (Figure 4.3) was developed from observations that new value can be created by the way in which transactions through the Internet takes place (Amit & Zott, 2001). The transactions included both B2B and B2C transactions which is why it is denoted as an E-business model and not specifically for E-commerce. The model is grounded from several entrepreneurial or strategic management theories such as resource based view, value chain analysis, virtual markets, and transactions economics theory. According to this model, new values can be created from e-business through four dimensions namely, efficiency, novelty, complementarities and lock in. In this model, value represents the total value that is generated by all the stakeholders such as the customer, enterprise application adopter, software vendor involved in the value chain. Each of the dimensions are explained below.

4.2.1. Efficiency

In e-business, efficiency refers to reduction in transaction costs. Efficient transactions lead to lower costs which are more valuable for firms (Williamson, 1975). One of the ways through which efficiency can be achieved when integrating information applications is reducing information asymmetry which means that when the applications are integrated then the data that one application generates or accumulates is visible and usable to the other applications which leads to lesser transactions for the applications to accumulate the same data (Amit & Zott, 2001). Also efficiency can be improved by up-to-date information on the Internet.

4.2.2. Lock-in

Lock-in refers to the ability of a firm to engage customers in repeated purchases. From an integration perspective, lock-in is created when two applications become dependent on each other to carry out their functionalities. Although, Amit and Zott explain lock-in from the perspective of the customers, additionally, we view lock-in as a general concept which makes two applications to be dependent on each other to function effectively. Hence in this research, lock-in is defined as the ability of a firm to make customers engage more with them and the ability of the enterprise applications to function more effectively when they are integrated.

4.2.3. Complementarities

The third source for value from e-business is complementarities which proposed that value can created when bundle of goods are provided together, they provide more value than when they are used separately. Integrating enterprise application is one way of complementing their capabilities. We conceptualize complementarities between the three enterprise applications as the approach through which information used in one application can be itself act as a potential resource for another application to perform its task better. Using these complementarities as a source of value, enterprise application adopters can combine their offline and the online businesses (physical stores and websites) which will be useful in increasing sales for the firm and offer a better experience for the customers.

4.2.4. Novelty

The fourth and final dimension is novelty. E-businesses also help to innovate in the way they do business by determining how they form the transactions. eBay as an example, that introduced



customer-to-customer auctions on a big scale, and other firms that have created value by connecting previously unconnected parties, adopted innovative transaction methods and created entirely new markets. When it comes to enterprise application integration, novelty results from the way new production or inventory management techniques are developed, new ways by which costs can be reduced. Eliminating inefficiency by integrating different business process which were not possible before.



Figure 4.3. Value Creation Model for E-Business (Amit & Zott, 2001)

We have introduced two frameworks to analyze the added values of integrating ERP, CRM and multichannel commerce. One of the framework stems from the ERP and CRM research while the other is derived from E-business research. Hence, in this thesis, we combine the two frameworks to identify the added values. Values will be introduced and grounded from theory which can be categorized on any of the above discussed criteria.



Figure 4.4: Measuring Added Value through two constructs

The two models that were developed will be used to measure the added values through two constructs – intensity of added values and the importance of the added value (Figure 4.4). Intensity of added values is defined as the degree of the value added while importance refers to how crucial the value is to the adopter. The intensity is measured with respect to the organizational level of the adopter's firm; therefore it is based on the Enterprise System Framework. The importance of the values is conceptualized using the E-Business Value creation Model.

4.2.5. Identifying Values (conceptualizing the importance)

This section identifies the added values based on the business processes discussed in Section 3.1 of Chapter 3. The added values will be categorized into the value dimensions discussed in Section 4.1 and Section 4.2. Based on each added value, specifications are developed which will be tested in the online survey (Chapter 5). The specifications are tested to get the importance of the added value; hence there are no independent and dependent variables. The results will indicate how *important each value to the value dimensions is*.

Improved Business Planning

Companies can plan their long term strategies and operational decision making better with an integrated application (Sambamurthy, Bharadwaj, & Grover, 2003). In the case of Customer_Complaint_Call_Center business process, when the multi-Channel Commerce application registers the complaint from the customer, the decisions to be made are straightforward since there is well established communication between the applications, the call center employees can immediately see the history of orders and purchases by the customer, billing details etc. In the long term business strategy, combining the three applications will help firms have a broader view of the firm with more information which will help them make decisions faster and better (Reich & Benbasat, 2000). Keeping in mind the long term value of integrating the applications, we categorize the value of improved business planning as a strategic value. But it also reduces the operational transactions every day. Employees can make better decisions themselves instead of relying on others to provide the data to make decisions; hence improved business planning is also a source of efficiency value creation through multi-channel commerce. Based on this, we propose the following specification:

 S_6 – If business planning is improved, then it will be valuable to the efficiency of the adopter.

Increased IT alignment with business

Implementing a single application which will be used in all the departments will increase the importance of IT in the company. Employees will have to learn new capabilities in order to work efficiently (Reich & Benbasat, 2000). IT will play a crucial role in the top management decision making about long term strategies (Tallon, Kraemer, & Gurbaxani, 2000). Hence there will be an increased alignment between IT and business. Such an alignment can provide strategic value as it helps in decision making and the information that is generated through the integration can be used strategically (Chenhall, 2005). The alignment can also acts as a complement between IT and business as they work together. Based on this, we propose the following specification:



 S_7 – If alignment between IT and business is increased, then it will provide complementary value to the adopter.

Better Customer Experience

Customer experience refers to the feeling that customers get when they visit a website or an instore kiosk or any touch points in order to purchase a product or a service of the retailer (Bose, 2002). Integrating ecommerce with the CRM application will help companies develop more knowledge on the customer which will help them connect to the customers more (Torkzadeh & Dhillon, Measuring factors that influence the success of Internet commerce, 2002). With increasing number of customers coming forward actively shopping through mobile phones and other devices, retailers can increase their shopping experience by providing the right information to them. Better customer experience is a strategic value for retailers as it can help them become market leaders in their industry by differentiating their products for each customer segment (De Brentani, 2001) (Liu, Liu, & Xu, 2013). Better customer experience is also a source of Lock-in Value Creation as they make sure customers will keep visiting their websites or stores more often. This will also improve customer retention, thereby the customer strategy. Based on this, we propose the following specification:

 \mathbf{S}_8 – If better customer experience is provided, then it will be valuable to the customer strategy of the adopter.

Increased Company Common Vision

Implementing a single integrated application inside a company will allow the employees to communicate effectively and also develop a common vision of serving the customers best (Scheel, 2005). It allows the employees to follow the company's vision to connect to the firm's products; by logic sales must be higher (Dermody, Ragsdale, & Aragon, 2012). But managing multiple channels at the front end along with the inventory, logistics and supply chain at the back end requires a tight integration among the ERP and ecommerce modules. Such integration will allow retailers to increase their sales which are of operational value to them as it could lead to increase in revenue. Increasing sales is by integrating the application is also a source of value through efficiency as the business processes that are used utilized for selling a product function together across department thereby reducing costs. Based on this, we propose the following specification:

 $\mathbf{S}_{\mathbf{9}}$ – If employees follow the vision of the company, then it will be valuable to the efficiency of the adopter.

Increased Data Quality

When all the processes within the company has been simplified and easier to follow, employees can concentrate on spending time being to know their customers more, knowing the firm more (Park & Ram, 2004). Employees can also spend time to learn interpersonal skills which will help their professional growth. In this regard, integrating the application is of value to the managers since they can help their sub-ordinates to work together better which increases bonding and helping them to bring the best out of their employees (Park & Ram, 2004). This is also a source



of value in efficiency since when the employees know that they work they need to do is simpler, more efficient, then they devote more time in keeping up with the vision of the company (Aguilar-Savén, 2004). Based on this, we propose the following specification:

 S_{10} – If data quality is increased, then it will provide novel value to the adopter.

Accurate Sales Forecasting

Sales Forecasting refers to using past figure to predict short term and long term performance of a firm in terms of sales (Ahearne, Hughes, & Schillewaertb, 2007). There are many factors that can affect sales forecasting such as economic downturns, employee turnover, changing trends and fashions, increased competition, manufacturer recalls and other factors (Ching-Chin, Ao Leong, Ling-Ling, & Ling-Chieh, 2010). Hence integrating CRM analysis module with the multi-channel commerce modules will help in gathering more relevant data which can be used for making more accurate predictions. The accurate predictions can be a source of value through novelty since new ways of sales patterns are determine and new sales strategies can be developed. Also, predicting sales accurately will help managers plan their sales operations efficiently. Hence it is also accurate prediction is valuable to managers. Based on this, we propose the following specification:

 \mathbf{S}_{11} – If sales forecasting is more accurate, then it will provide novel value to the adopter.

Integrated Business Process

Business processes will be more streamline in the sense that there will be lesser number of steps taken to go from the input to the output with use of lesser resources (Delgado, Weber, & Ruiz, 2014). Certain activities in a business processes can be shared by other business processes. This increase efficiency as it decreases transaction costs if costs is measured as the time or resource spend in getting an activity done (Alotaibi & Fei, 2014). In this sense, streamlined business processes act as complementarities since they work together with business processes from the other integrated applications to achieve more value (Grover & Teng, 1993). Also, streamlining business processes is a value for operations that takes place on a daily basis. Based on this, we propose the following specification:

 $\mathbf{S_{12}}$ – If business processes are integrated, then it will provide complementary value to the adopter.

Increase in Sales

Sales represent the amount of products that are sold. Since the customer has multiple channels, the integration will improve the quality of the data that is generated by each of the application since they complement each other. For example, the campaign analysis module in CRM will give the performance results of the marketing campaigns that were conducted. But the marketing campaigns were conducted using the data from the ecommerce application which collected information from the behavior of the customers. Increased quality of data is a source of efficiency as it allows the retailers to gain new information about the end customers which may not have been possible before. Increased quality of data is also a value for the managers as they



learn more about their customers, thus helps them in making sales and marketing decisions. Based on this, we propose the following specification:

 \mathbf{S}_{13} – If sales increase, then it will be valuable to the efficiency of the adopter.

Improved On time delivery

On-time delivery is one of the performance measurement units in supply chains and logistics. It is better than other performance measurement units such as shipped on-time or one-time performance since it looks at the delivery from the customer's point of view. It measures performance based on whether the customer got what they wanted at a time and place they wanted. Increasing use of digital channels mean that firms have to measure on-time delivery across different channels. Integrating ERP and Multi-Channel Commerce application in this case would help firms keep track of all the ordered and products purchased on different channels at the back end. For example, in Customer_Order_Online business process, when a customer orders for an electronic item to be delivered to their home, it involves two channels namely, Internet and Home Delivery. Hence having a front end channel application will help firms have a complete view of sales. Increasing on-time delivery is an operational value to the firm as orders placed and shipping the products to the respective customers is a day-to-day activity. According to Value Creation Model for E-business, increasing on-time delivery is also as source of efficiency since it reduces the number of transactions that could have happened if the applications are not integrated. For example, if a firm does not have a multi-channel commerce application, then orders placed online has to be sent as a copy to home delivery, logistics information has to be sent separately to the inventory module. If integrated, the multi-channel commerce application will take care of all the orders while the ERP application is responsible for the back end functions. CRM integration is also useful here as they can analyze the performance of the products in terms of sales across all channels. Hence, integrating the three enterprise applications will lead to an increase in operational value and can be a source of efficiency. Based on this, we propose the following specification:

 S_{14} – If on-time delivery is improved, then it will be valuable to the efficiency of the adopter.

4.2.6. Sub Conclusion

Section 4.2., provided the theoretical background for determining the added values of integrating ERP, CRM and Multi-channel Commerce applications with the three business process discussed in the previous as the measurement of the integration. Table 4.1., provides a summary of the intensity and the importance of the added values using the two models. Figure 4.5, shows the added value framework with the corresponding added values.

Added Values	Description - what is the value with respect to integration?			
Improved Business Planning (corresponding specification S ₆)	 Strategic Value as it helps top management also to make long term decisions effectively. Source of Efficiency as it helps employees make decisions quicker and independently with more informed data. 			
More IT Alignment with business (corresponding specification S_7)	 Strategic Value as the integration of the applications will increase the alignment between IT and business which leads to a more important role for IT in the firm. Source of Complementarities as both business processes and IT complement each other with respect to their functionalities. 			
Better Customer Experience (corresponding specification S_8)	 Strategic Value as it helps firms achieve market leadership position by knowing more about their customers. Source of Lock-In when customers come back to their products because of better experience with the channel. 			
Increase in Company Common Vision (corresponding specification S ₉)	 Managerial Value as it helps employees instil the values and visions of the company more on their work which is useful for the managers Source of Efficiency as employees will work more productively. 			
Increased Data Quality (corresponding specification S ₁₀)	 Managerial Value as integration helps managers have more quality data to make decisions Source of Novelty as new insights about customers are identified. 			
Accurate Sales Forecasting (corresponding specification S ₁₁)	 Managerial Value as managers can make informed sales decisions well in advance using the sales forecasting reports that are generated when the applications are integrated. Source of Novelty as better forecasting will lead to learning about new patterns in new sales channels. Retailers learn new trends in the customer's behaviour which can be used for marketing later. 			
Integrated business process (corresponding specification S_{12})	 Operational Value as it decreases using common activities in different business processes repeatedly. Source of Complementarities as it allows business processes with common activities to reuse them, making their combination to add more value. 			
Increase in Sales (corresponding specification S_{13})	 Operational Value as it helps retailers to sell more products Source of Efficiency since it leads to economy of scale. 			
Improved on-time delivery (corresponding specification S_{14})	 Operational value as it helps improve the day-to-day activities by providing a single view of all order purchases and delivery status. Source of Efficiency as it reduces the number of transactions across different channels and departments 			

Table 4.1. Categorizing Added Values based on the two frameworks

4.3. Conceptualizing Information Technology Capabilities

In order to adopt enterprise applications, firms have to develop Information Technology capabilities. IT capabilities are defined as "*the abilities of a firm to mobilize and deploy IT resources with other resources in order to create some value*" (Bharadwaj, 2000, p.171). IT resources include the tangible physical infrastructure, human resources while intangible resources include knowledge assets, customer orientation and synergy (Grant, 1991). There are several studies which link IT



capabilities to firm performance positively hence there is a well-known and accepted relationship between business strategies of firms, their business processes and the importance of investing in IT Results have shown that IT investments have been both a boon (Coulson-Thomas, 1994) (Bashein, Markus, & Riley, 1994) and a bane (Benjamin, 1993) (Broadbent & Weill, Management by Maxim: How business and IT managers can create I.T. Infrastructures, 1997) (Davenport, 2000) for firms particularly when the IT capabilities developed by the firms are inappropriate (Brancheau, Janz, & J.C., 1996) (Wastell, White, & Kawalek, 1994). The physical capabilities of a firm are its hardware infrastructure such as the computers, network technologies, the software platforms and databases. The hardware infrastructure itself can be a source of competitive advantage for firms (Keen, 1991) (Mckenney, 1995) although some disagree (Carr, 2003). The infrastructure helps Firms gain competitive advantage by improving cycle time, business processes and cross-selling opportunities (Keen, 1991). Although individual components in infrastructure is like a commodity but the interaction between the different commodities create information that is tailor made for an organization is which complex and is not understood very well. (Broadbent & Weill, Management by Maxim: How business and IT managers can create I.T. Infrastructures, 1997) (Bharadwaj, 2000).

The physical infrastructure is the choices made about the applications, data, and technology configurations while the human capabilities are the choices about the knowledge needed to skillfully manage the resources within the organization, hence the human capabilities include experience, competencies, values, commitments and norms of personnel delivering the products and services (Henderson & Venkatraman, 1994).

Business value from IT investments is a widely debated topic with research to show that investing in IT has led to positive influences on business performance or no significant changes, sometimes even negative influences have been reported. But firms have begun to understand that IT investments are not a strategy anymore and that they have become a necessity to stay in the competition. Hence, the importance of IT in businesses, especially in retail industry is important and is acknowledged.

The necessity to invest in IT goes beyond any mere implementation. The real strategic value from implementing IT depends on how much importance does a firm give to IT and recognizes its role in shaping its business, in short, firms have to tap into the various capabilities offered by IT investments rather than a mere namesake implementation. Anandhi S. Bharadwaj has researched on the capabilities that are offered by investing in IT and has categorized them as IT Human capabilities and IT Infrastructure capabilities. These capabilities have to be an ongoing process post implementation of any information applications.

When enterprise applications are integrated, they require new capabilities from employees and also from the adopters themselves. Integrating enterprise application will result in a change in the business process flow, reporting procedures, the data that is expected to be filled in and used to conduct business. Hence, employees may have to change the way they used the enterprise applications before implementing them.


Figure 4.5. Added Value Framework with the added values

This research will operationalize information technology capabilities by adopting the model proposed the Anandhi. S. Bharadwaj (Bharadwaj, 2000). According to this model, information technology capabilities are measured using two dimensions namely, Human capability and Hardware Capability which are explained below:

4.3.1. Human Capabilities

Human capability refers to the training, relationships and insights of employees with respect to using the enterprise applications. The two dimensions that are vital for measuring human capability are technical skills and managerial skills. Technical skills include knowledge on programming, application analysis and design and the ability to develop competencies in new technologies quickly. Managerial skills include the abilities to manage information application functionalities, coordination between the business employees and the IT employees and effective project management skills. Companies which have a strong human capability will be able to integrate the applications and business planning processes effectively. Hence, in terms of integrating ERP, CRM and multi-channel commerce applications, it is essential that firms have employees who have the capability to understand both the systems that support the process and core functionality of the process to make sure they works properly and can be corrected quickly if there is a problem (Luftman, Lewis, & Oldach, 1993). Having a human capability also means firms can anticipate future needs well in advance. For example, based on the market analysis, employees with an extensive knowledge on the business side will understand that it may take time for certain business processes and will be able to make the best of any situation by having knowledge from all sides (Keen, 1991). The developed of both technical and managerial IT skills evolve over time along with the IT itself. Hence, becoming an expert is dependent on the adaptability to changes, it can be called as the organizational readiness which refers to the ability to dynamically change the way employees work depending upon changes on the information applications used in an organization (Bharadwaj, 2000). From the above discussion, we conceptualize human capabilities as:

- *Technical skills:* Refers to knowledge of programming languages, application design and technical functionalities.
- *Managerial skills:* Refers to the ability to understand both the business and IT side of business processes to make better decisions.

Based on the above explanation, we propose the following propositions:

 S_{15} – If the adopter has to accommodate integrated applications, then the non-technical employees have to increase their IT technical knowledge.

 S_{16} - If the adopter has to accommodate integrated applications, then the business oriented managers have to increase their IT technical knowledge.

 S_{17} - If the adopter has to accommodate integrated applications, then the IT oriented managers have to increase their knowledge of the firm's business processes.



 $\mathbf{S_{18}}$ - If the adopter has to accommodate integrated applications, then there should be increased cross department interaction between employees.

4.3.2. Hardware Capabilities

Hardware capability refers to the physical assets that form the core of a company's information technology infrastructure which comprises of computer and communication technologies, communication platforms and databases (Ross et al, 1996) (Weill et al 1996). The infrastructure used in a firm can be measured in term of reach and range. Reach refers to the locations to which a computer can have access while range refers to how much access it can have. For example, the ERP application may not be able to communicate with certain modules in CRM in which case the infrastructure is not so strong but the decision to keep it that way is dependent on the company's strategy. While using ERP, CRM or Multi-Channel Commerce applications separately, the disparate hardware would be followed while when they are integrated, the companies have to shift to an integrated hardware which is costly and time consuming. The infrastructure itself is indeed bought like a commodity but the way the infrastructures are integrated will act as a potential n source for value creation. This research will conceptualize Hardware Capability as follows:

- *Hardware Storage:* In order to effectively integrate the application to the expectations of the software adopter, more storage may be needed to make full use of the integration
- *Hardware Speed:* Since three applications have to communicate with each other, there could be an necessity to increase the bandwidth at which they communicate.

S₁₉- If the adopter has to accommodate integrated applications, then investments for purchasing more hardware are needed.

S₂₀ - If the adopter has to accommodate integrated applications, then enterprise applications need faster communication technologies between them.

4.4. Conclusion

This chapter describes the operationalization process for added values and information technology capabilities.

Section 4.1., and Section 4.2., answered Sub-Question 3:

Sub-Question 3: What are the relevant theories and different perspectives to analyze enterprise application values?

We explored the literature for different perspectives to analyze enterprise application values. We have developed two constructs for added values namely, intensity of the value added and importance of value added. This research uses the Enterprise Application Value Framework for measuring *intensity of added value* and Value Creation Framework for E-Business to measure the *importance of added value*. From both these models, we developed the Added Value Framework with



the intensity dimensions as *Strategic, Managerial and Operational* on one perspective while *Novelty, Complementarities, Efficiency and Lock-in* as importance dimensions in the other perspective. We have operationalized the dimensions by determining 9 values namely *Improved Business Planning, Increased IT alignment with business, Better Customer Experience Increased Company Common Vision, Improved on time Delivery, Accurate Sales Forecasting, Streamlined business processes, Increased Data Quality, Increase in Sales.*

Section 4.3., answered Sub-Question 4

Sub Question 4: What are the relevant theories and different perspectives to analyze a firm's IT capabilities?

We have analysed Information Technology Capabilities by conceptualizing it into Human Capabilities and Infrastructure Capabilities and operationalized them as *managerial skills and technical skills* for human capabilities while infrastructure capabilities is operationalized as *hardware storage and hardware speed*. Table 4.2., and Table 4.3., summarises the specifications develop in this chapter which will be explored further through the survey.

Specification Number	Importance of added values
S ₆	If business planning is improved, then it will be valuable to the efficiency of the adopter.
S ₇	If alignment between IT and business is increased, then it will be provide complementary value to the adopter.
S 8	If better customer experience is provided, then it will be valuable to the customer strategy of the adopter.
S 9	If employees follow the vision of the company, then it will be valuable to the efficiency of the adopter.
S 10	If data quality is increased, then it will provide novel value to the adopter.
S 11	If sales forecasting is more accurate, then it will provide novel value to the adopter.
S ₁₂	If business processes are integrated, then it will provide complementary value to the adopter.
S 13	If sales increase, then it will be valuable to the efficiency of the adopter.
S ₁₄	If on-time delivery is improved, then it will be valuable to the efficiency of the adopter.

Table 4.2. Specifications for importance of the added values

Table 4.3. Specifications for importance of Information Technology Capabilities

Specification Number	Information Technology Capabilities
S ₁₅	If the adopter has to accommodate integrated applications, then the non-technical employees have to increase their IT technical knowledge.
S 16	If the adopter has to accommodate integrated applications, then business oriented managers have to increase their IT technical knowledge.
S ₁₇	If the adopter has to accommodate integrated applications, then IT oriented managers have to increase their knowledge of the firm's business processes.
S 18	If the adopter has to accommodate integrated applications, then there should be increased cross department interaction between employees.
S 19	If the adopter has to accommodate integrated applications, then investments for purchasing more hardware are needed.
S 20	If the adopter has to accommodate integrated applications, then enterprise applications need faster communication technologies between them.

CHAPTER

RESEARCH METHODOLOGY

The added value framework that will was developed for this research was discussed in Chapter 4. This chapter will explain the research methodology that was followed for data collection and analysis. We begin by discussing the sampling process in Section 5.1. Then in Section 5.2., survey design is explained. Section 5.3., describes the measurement for each of the four variables namely interest of stakeholders, importance of added values and intensity of added values and information technology capabilities. Section 5.4., introduces Analytic Hierarchy Process technique and provides a measurement scale for the three business processes and the intensity of added values. Each of the questions corresponds to the specifications described in the previous chapters. Section 5.5., explains Likert Items followed by Section 5.6., which briefly describes the factor analysis. Appendix A contains the questionnaire protocol. Appendix B consists of AHP calculation snapshots. Appendix F contains an example of Analytical Hierarch Process calculation for a single response.

5.1. Sampling Process

The sampling process involves the following steps:

- 1. Defining the population
- 2. Defining the sample frame
- 3. Determine the sampling design
- 4. Determining the sample size
- 5. Execute the sampling process

Each of these points will be discussed briefly below.

5.1.1. Defining the population

The population of a survey refers to the complete group of people who are to be investigated by the researcher. For this research, there are four populations that were looked into:

1. Experts in using enterprise applications (ERP, CRM, Multi-Channel Commerce) as standalone applications **(Software Adopters).**

- **2.** Experts who develop enterprise applications (ERP, CRM, Multi-Channel Commerce) as standalone applications **(Software Vendors).**
- 3. Experts who help adopters to implement enterprise applications and integration in their organization (External Consultants).
- 4. Experts in the academic field of Enterprise/Information systems and enterprise application integration (Academic Professionals).

5.1.2. Defining the sample frame

From the population, we selected the sample based on the type of enterprise application used and location. The subjects in the sample are familiar with two groups of enterprise applications namely *SAP ECC, SAP CRM and SAP-Hybris.* SAP is one of the software vendors whose ERP and CRM software products are most widely used. SAP-Hybris is the leading vendor for multichannel commerce systems. The reason for choosing these two vendors is because they are the widely used applications; hence it is possible to generalize the findings. With respect to location, the sample consists of experts who are located within *European countries*.

5.1.3. Determine the sampling design

Sampling design refers to the method of choosing the sample from the population. There are two types of sampling design, namely probability sampling and non-probability sampling. Nonprobability sampling is when the sampling is done based on s known chance of being chosen as a part of the sample. Nonprobability sampling is the opposite when the elements in the population have no probability given to them of being a part of the sample. This research follows the widely used nonprobability sampling since we do not have a sampling frame. Under nonprobability sampling, there are different sampling methods such as convenience sampling, purposive sampling etc. But the one method that fit this research is the *quota sampling* which assigns a fixed quota to different groups in the population. The four groups in this research are the four experts (population) explained previously. Quota sampling is similar to the stratified random sampling but it is less generalizable.

5.1.4. Determining the sample size

We follow the research of (Roscoe, 1975) who developed rules of thumbs to determine the sample size. According to this rules of thumbs, the sample size should be within the range of 30-500. Thus, the research follows this rule of thumb.

5.1.5. Execute the sampling process

The sampling was done by sending the survey to the subjects through LinkedIn and electronic mail and in person. The sample was obtained by searching in LinkedIn extensively using the connections of the support company Capgemini. LinkedIn proved to be an useful tool since it was possible to choose the right respondent by knowing their profile beforehand. So it was possible to send the survey to different stakeholders with different levels of experience. The keywords used for searching were Information systems, SAP ERP, SAP CRM, ecommerce/multichannel commerce, application integration, enterprise application integration, SOA, Hybris, omnichannel, FMC industry, CPG industry. All the respondents were within Netherlands.



5.2. Survey Design

Questionnaire was used as the survey tool. The questionnaire was developed online using the tool SurveyGizmo (www.surveygizmo.com). The reason for choosing SurveyGizmo was because it was cheaper, user friendly and quick to implement. The questionnaire was sent to the sample selected through e-mail and LinkedIn, some were collected in person. The reason for choosing questionnaire is because added values identified earlier can be tested with a larger sample which consists of different experts such as software adopters, software vendors, consultants and academic professionals. In this way, the results gathered were from more variety of population to gain different perspectives. The survey explained each of the business processes shortly that were used to operationalize enterprise application integration and ask the opinion from the experts about the added values that can be achieved from each of the business processes. *The specifications mentioned in the previous chapters are converted into corresponding questions, hence they are a part of the questionnaire*. There are on specific dependent or independent variable as a part of the conceptual framework. The responses are collected based on those questions to analyze the specifications. The survey contained five sections:

Section 1: *Importance of stakeholders.* There are a total of 5 questions which helped to substantiate the choice of industry and the usefulness of the enterprise application integration process to the stakeholders involved. It is based on the specifications stated in Chapter 2.

Section 2: *Intensity of added values.* It contains <u>5</u> questions in total. It is based on added value framework in Chapter 4 and the business processes proposed in Chapter 3.

Section 3: *Importance of added values.* There are <u>9</u> questions in total. It is based on the specifications in Section 4.2.

Section 4: Information Technology Capabilities. There are <u>6</u> questions in total. It is based on the specifications in Section 4.3.

Section 5: General questions such as area of expertise, level of expertise and stakeholder which are <u>7</u> in total to generate respondent profiles. The complete survey is provided in Appendix A. Appendix E explains the steps that were taken to create the survey and pre data analysis stage.

5.2.1. Respondents Profile

The number of people to whom the survey was sent to was 236 and the number of respondents was 49 in total, of which 13 were discarded because of incomplete answers and high inconsistencies for Analytic Hierarchy Process. The effective response rate is 20,7%. 36 complete responses with acceptable consistencies were included. In this, software vendors and adopters correspond to 17 (8 and 9 respectively) respondents while external consultants were 11 and academic professionals were 8 respondents to a total of 36 (Table 5.1.). With respect to the experience levels of the respondents, the least experienced was 4 years while the most experienced was 21 years (Table 5.2.). The average experience level is 11 years, which means that the respondents are knowledgeable about the enterprise applications. Hence, we have a complete set of respondents with different levels of experience which is useful since the added values correspond to different levels of the organizational structure. The survey was sent to experts in all



the three enterprise applications and information systems in general and the distribution of the experts to each application is listed in Table 5.3.

Stakeholder Type	Frequency	Percent	Valid Percent	Cumulative Percent
Software Vendor	8	22,22%	22,22%	22,22%
Software Adpoter	9	25,00%	25,00%	47,22%
External Consultant	11	30,56%	30,56%	77,78%
Academic Professional	8	22,22%	22,22%	100%
Total	36	100%	100%	

Table 5.1. Number of respondents to the survey

Table 5.2.	Level of	experi	ience o	f respond	lents to	the	survey	
							~	

Experience Level	Frequency	Percent	Valid Percent	Cumulative Percent
4-9 years (Operational)	12	33,33%	33,33%	33,33%
10 – 15 years (Managerial)	13	36,11%	36,11%	69,44%
16-21 years (Strategic)	11	30,56%	30,56%	100,00%
Total	36	100%	100%	

 Table 5.3. Area of expertise of respondents to the survey

Ares of Expertise	Frequency	Percent	Valid Percent	Cumulative Percent
Enterprise Resource Planning	7	19,44%	19,44%	19,44%
Customer Relationship Management	12	33,33%	33,33%	52,78%
E-Commerce	5	13,89%	13,89%	66,67%
Information systems	12	33,33%	33,33%	100,00%
Total	36	100%	100%	

Software Vendor

The number of software vendors in the respondents is 8. Of the 8 respondents, 2 were experts in ERP, 3 in CRM, 2 in e-commerce and 1 in information systems. The average experience level was 9,1, with the highest experience of 18 years and lowest of 4 years. The distribution among the three experience levels was almost equal with 3 respondents in strategic and managerial and 2 in operational level. The respondents belonged to SAP and SAP-Hybris companies from European countries.

Software Adopter

The number of software adopters in the respondents is 9. Of the 9 respondents, 3 was expert in ERP, 3 in CRM, 3 in e-commerce and 0 in information systems. The average experience level was 10,3 with the highest experience of 18 years and lowest of 5 years. The distribution among the three experience levels was unequal with 1 respondent in the 10-15 years level while with 5 respondents in 4-9 years level and 3 in 16-21 years level. The respondents belonged to employees of FMCG companies who use SAP ECC, SAP CRM and SAP-Hybris applications from European countries.



External Consultant

The number of consultants in the respondents is 11. Of the 10 respondents, 2 was expert in ERP, 5 in CRM and 4 in information systems. The average experience level was 12,9, with the highest experience of 21 years and lowest of 8 years. The distribution among the three experience levels was unequal with 5 respondents in the 10-15 years level while with 2 respondents in 4-9 years level and 4 in 16-21 years level. The consultants were experts in the three applications and also in enterprise application integration.

Academic Professional

The number of academic professionals in the respondents is 8. Of the 10 respondents, 1 was expert in CRM and 7 in information systems. The average experience level was 10,7 with the highest experience of 17 years and lowest of 5 years. The distribution among the three experience levels was unequal with 4 respondents in the 10-15 years level while with 3 respondents in 4-9 years level and 1 in 16-21 years level.

5.3. Measurement Scales

There are two scales used to measure the variables in this research, namely *Likert Items and a preference scale* for Analytic Hierarchy Process (Section 5.4). Likert item is one type of ordinal scales which measure the responses of the survey depending on their level of attitude towards a certain issue. Likert items are similar to a likert scale, except it does not satisfy one formal requirement of a likert scale. The requirement is that likert scales have more than one item while likert type consists of only one item. The attitude that is measured could be related to agreements, frequencies, importance or quality. Depending on the variable and the question that is to be researched, the attitude that needs to be measured will be different. In our research, we have used Likert type to measure three variables shown in Table 5.4.

Table 5.4: Mea	surement Scales	
T 4	0 1	
Level	Scale	

Variable	Level	Scale
Interest of Stakeholders	Ordinal	1 - Strongly Disagree to 7 – Strongly Disagree
Intensity of Added Value	Ratio	1 – Equal added value to 9 – Extremely added value
Importance of Added Value	Ordinal	1 – Not valuable to 5 – Extremely Valuable
Information Technology Capabilities	Ordinal	1 - Strongly Disagree to 7 – Strongly Disagree

Three of the variables, namely interest of stakeholders, importance of added values and information technology capabilities are analyzed <u>only based on descriptive statistics</u>, which means they were not measured independently. For example, in specification S₁₁, the accurate sales forecast and novelty are not measured independently. Instead, <u>the specification was posed as a question to determine the degree of importance of accurate sales forecasting to a firm's novelty</u>. Since these variables are measured in ordinal scales, the statistics used for analyzing the data are median and range and also skewness. There is no specific independent and dependent variables to determine relationships. Results of the descriptive statistics can be seen in Chapter 6.

5.4. Analytic Hierarchy Process

Based on the theoretical models explained in the previous chapters, it is apparent that the research objective aims to understand added values from a multi criteria perspective. The criteria that will be used are based on the E-Business Value Creation Model and correspond to the



organizational levels of the adopters. Hence there are three criteria (Strategic, Managerial and Operational). Hence, the most suitable technique for validating the added value framework is through a multi-criteria analysis.

Multi-criteria decision making methodology (MCDM) is a widely used research method for carrying out analysis with different criteria. Multi-criteria decision making is a discipline in operations research which deals structuring and solving problems in decision making in multi-criteria environments. The criteria must be independent of each other and are often contrasting. There are many approaches to conducting a multi-criteria analysis such as Aggregated Indices Randomization Method (AIRM), Analytic Network Process (ANP), Analytic Hierarchy Process (AHP), Superiority and Inferiority Ranking Method (SIR) etc.

Analytic Hierarchy Process (AHP) is a multi-criteria decision making (MCDM) procedure which helps decision makers facing a complex problem with multiple criteria and alternatives to make effective decisions. Analytic Hierarchy Process is one of the widely used MCDM procedures with many advantages. First, AHP offers a mathematical approach to decisions which involve subjective opinions and personal preferences of individuals or a group during a decision making process. Therefore, the data obtained through AHP is highly preferable. Second of AHP's strengths is the possibility to evaluate quantitative as well as qualitative criteria and alternatives on the same preference scale (Ishizaka & Labib, 2009). Third, the preference scale is a ratio scale hence there is no necessity to have a unit to make comparisons. Fourth, AHP uses hierarchies to define criteria and sub criteria which make it easier to understand the problem, both for the researcher and for the respondents. By this way, the respondents can make better judgments since they can separate each level of the analysis clearly (Saaty T., How to make a decision: The Analytic Hierarchy Process, 1990). Fifth, the process of data analysis is comparatively rapid and cost effective. Finally, the most important advantage of AHP is that there are no pre-conditions to the number of responses that are required to get reliable results. AHP does have some drawbacks such as lack of a procedure to select the sample for the stakeholders, developing the questionnaire will be time consuming and it increases the stress level of respondents too leading to a lower response rate and inconsistent results have to be discarded. Even with such drawbacks, several researches such as (Kangas J., 1994) (Kangas & Kuusipalo, 1993) (Reynolds & Holsten, 1994) (Attaran & Gokhan Celik, 2012) have used AHP as a research method.

In general, AHP and other MCDM tools follow four steps to solve the problem: problem modeling, weights valuation, weights aggregation and sensitivity analysis each of which is briefly explained below.

5.4.1. Problem Modeling

Analytic Hierarch Process was first proposed by Saaty in 1977 (Saaty T. , 1977). AHP works by assigning priorities for *alternatives, criteria and sub-criteria* for judging those alternatives. As the first step in AHP, a hierarchy has to be constructed. The hierarchy is developed for a particular goal. Thus a goal is defined i.e., what is the ultimate decision that is to be made? In our research, the ultimate decision is to determine the added values of enterprise application integration. Nine added values have been identified in the previous chapter, thus, the goal of AHP here is to determine how the different stakeholders prioritize (based how much value does it add) these



nine values. The criteria we have to analyze the added values are strategic, managerial and operational which refer to the organizational level of the adopters. The hierarchy developed is an incomplete hierarchy since it has no alternatives. Such type of hierarchies have been used in previous researches (Golam & Akhtar Hasin, 2011) (Jie, Shahrokh, & Bouwman, 2013). This is the end of the first phase for AHP. This first step is extremely vital as different hierarchy will lead to different results. Once this is done, the researcher will have the AHP hierarchy as shown in Figure 5.1. Several authors (Pöyhönen, Hamalainen, & Salo, 1997)(Weber, Eisenführ, & von Winterfeldt, 1988) have noticed that criteria with more sub-criteria leads to getting more weightage than when they are less detailed. Increasing the number of elements in the hierarchy will only increase the number of choices that the decision makers have to make when comparing each element; hence the researcher has to make sure that similar elements are grouped into clusters to reduce the number of comparisons for the decision maker. (Ishizaka A., 2004) (Saaty T., Decision Making for Leaders; The Analytical Hierarchy Process for Decisions in a Complex World, 1982). We have minimized the sub-criteria to 9. These are the 9 added values that were identified in Chapter 4. This step will validate the intensity of the added value. Table 5.5., provides a summary.

Criteria	Sub criteria
Strategic	Improved Business Planning
(Organizational Level involving long term decisions with	Increased IT alignment with business
high impact)	Better Customer Experience
Managerial	Increased Company Common Vision
(Organizational Level involving midterm decisions with	Improved on time Delivery
medium impact)	Accurate Sales Forecasting
Operational	Streamlined business processes,
(Organizational Level involving day to day term	Increased Data Quality
decisions with low impact)	Increase in Sales

Table 5.5. Summary of Criteria and Sub criteria	Table 5.5.	. Summary	of Criteria	and Sub	criteria
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In addition to the hierarchy, the research will also aim to understand the preferences of the stakeholders towards the three business processes defined in Chapter 3. Hence they will be added to the web survey. In a complete AHP hierarchy, the business processes' preferences must be derived for each of the sub-criteria but due to time constraints and the drawback of AHP (number of pair-wise comparisons increase with each element in the hierarchy), we will adopt an incomplete hierarchy by obtaining the preferences for the alternatives independently.

5.4.2. Pair wise Comparison

Once the AHP hierarchy is developed, the priorities have to be made for each element (Criteria and sub-criteria) in the hierarchy. The priorities will be made by the respondents of the online survey by using pair-wise comparison which is based on the psychological factor that it is easier and accurate to compare two elements than all the elements at the same time (Saaty T., 1977).



The priorities for each pair-wise comparison are done by using ratio scales which means there is no need of any units for comparison. The judgment of the decision maker is of the form a/b of the two elements and it has to be noted that the judgment is only qualitative and has no numerical value attached to it apart from the scale value. Each pair-wise comparison leads to a reciprocal matrix (as shown in Figure 5.1.). The term reciprocal matrix is because when two alternatives A and B are compared and the priorities are a and b (i.e., a/b) respectively then the comparison between B and A is just the reciprocal of a/b (i.e., b/a). It is vital to keep in mind that the pair-wise comparison must be done to each pair of elements in the criteria and sub criteria. For example, strategic and managerial criteria must be compared, then strategic and operational and finally managerial is compared with operational based on the preference scale. From this, we can understand that adding one more element to the criteria will increase the number of comparisons by two (based on the formula $n^*(n-1)/2$). Hence, it is important that the number of elements in the overall hierarch is kept to the minimum and repetitions or dependencies are avoided.

5.4.3. Judgment Scale

The ratio scale that is used in AHP is intuitively attractive, user-friendly and is very much aligned with everyday decision making that people take in their lives. To determine the priorities, the verbal choices made the decision makers have to be converted to a numerical term.

$$\mathbf{A} = \begin{bmatrix} 1 & a_{12} & a_{1n} \\ a_{21} & \dots & a_{ij} & \dots \\ \dots & a_{ji} = 1/a_{ij} & \dots & \dots \\ a_{n1} & \dots & \dots & 1 \end{bmatrix}$$

Figure 5.1. Reciprocal Matrix General Form (Saaty T. , 1977)

There are several verbal to numerical conversions that exists. For example, (Harker & Vargas, 1987) have calculated a quadratic and a root square scale, (Lootsma, 1993) developed a geometric scale. Also, (Salo & Hamalainen, 1997) proposed a balanced scale where the variables are distributed between 0.1 and 0.9.

In this thesis, we adopt the traditional and more widely used scale of Saaty (Saaty T., Decision Making for Leaders; The Analytical Hierarchy Process for Decisions in a Complex World, 1982) which is shown in Table 5.6. The choice for using the Saaty's scale is because it is already widely used hence it is a proven ratio scale which will add some reliability to our results. But also, it is easier for the decision makers to understand the scale compared to geometric and balanced scorecard scales.

Intensity of added value	Definition
1	Equally added value
2	Weak Added Value
3	Moderate Added Value
4	Moderate plus
5	Strong Added Value
6	Strong plus
7	Very strong added value
8	Very Very Strong
9	Extremely Added Value

Table 5.6. AHP Judgment Scale

5.4.4. **Priorities Derivation**

As the next step, the priorities have to be derived for each of the alternatives. The priorities must be as consistent as possible. The priorities are derived as follows:

- 1. Sum the elements of each column
- 2. Divide each value by its column sum:

$$a_{ij}' = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \quad \forall i, j$$

$$j: \sum_{i=1}^{n} a_{ij} \quad \forall i, j$$

$$\sum_{i=1}^{n} a_{ij} \quad \forall i, j$$

a

 $p_i = \frac{j=1}{n}$

3. Mean of row:

5.4.5. Consistency

The reciprocal matrix that was obtained in the steps above must be consistent. The consistency is tested by checking for the transitivity rule. According to the transitivity rule, if the two alternatives A and B have a pair-wise comparison of 1/3 and two alternatives B and C have a pair-wise comparison of 1/2 then the pair-wise comparison between A and C must be 1/6 (1/3*1/2). This is not always the case since human choices are not perfectly consistent. But in order for the reciprocal matrix to be significant, an acceptable level of consistency must be achieved. (Saaty, 1971) proposed a method to check the consistency using an index called the consistency index (CI)

$$CI = (\lambda_{max} - n)/(n - 1)$$

Where

n= dimension of the matrix

 λ_{max} = maximum eigen value of the matrix

The consistency ratio is defined as the ratio of CI and RI:

$$CR = CI/RI$$

where RI is the random index defined by Saarty (1971) shown in Figure 5.2.

n	3	4	5	6	7	8	9	10
RI	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49
Figure 5.2. RI values (Saaty T. , 1977)								

If CR is less than 10% then we can assume that the reciprocal matrix is consistent. But up to 20% is acceptable (Kim & Han, 2009).

5.4.6. Aggregation

This subsection explains how group decision making can be derived from individual choices for each respondent. There are two ways of aggregating group choices, one is through consensus vote where the group agrees on each of the entries in the reciprocal matrix before the values are



entered (Table 5.7.). This is a cumbersome process since there will a several hours of discussion and need all the respondents to be at the same place. Alternatively, the consensus vote can be taken after the values have been entered in which case the discussions will be limited only to the disagreements between the extreme priorities. This method of filling the pair wise comparisons is called as aggregation of individual judgments (AIJ) (Saaty T., Decision Making for Leaders; The Analytical Hierarchy Process for Decisions in a Complex World, 1982). The other method to aggregate the individual choices is through mathematical aggregation. This method is referred when the group which made the initial choices cannot meet to discuss for the consensus vote and the respondents are asked to fill the pair-wise comparisons individually and then the data is aggregated. Filling up the pair-wise comparison individually is called as Aggregated Individual Priority (AIP) (Saaty T., Decision Making for Leaders; The Analytical Hierarchy Process for Decisions in a Complex World, 1982). There are two ways of doing mathematical aggregation, the first is through geographical mean and the second is through weighted arithmetic mean. The choice between the two options is dependent on whether AIJ or AIP is used. If AIJ is used, then geometric mean must be used. While when AIP is used, both the means are possible to use but geometric mean is found to be more consistent (Escobar, Aguar, & Moreno-Jimenez, 2004). Since the AHP hierarchy in this research is incomplete, the geometric mean obtained previously has to be normalized. To get a better understanding of AHP, the data analysis procedure for one respondent is provided in Appendix B and the aggregation is also explained in Appendix B.

	Table 5.7. Aggregation Techniques in A	AHP
	Mathematical	Aggregation:
Aggregation on:	Yes	No
Judgments	Geometric Mean on Judgments	Consensus vote on Judgments
Priorities	Arithmetic mean or geometric mean on	Consensus vote on priorities
	priorities	

Table 5.7. Aggregation	Techniques	in AHP
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Likert Type Items 5.5.

Likert Type items are used to test the specifications in the FMCG market, importance of the added value and the information technology capabilities. Two sets of likert type items were used for measuring the specifications. First, a 7 point scale for level of agreement was used for measuring the FMCG market specifications and the information technology capabilities. Then a 5 point degree of importance of added value scale was used for measuring the specifications in the added value from the value creation for E-business framework. The explanation for each point in the two scales is explained in Table 5.8 and Table 5.9. Both the scales are ordinal since it is not clear what the exact differences between two points are.

Table 5.8. 7 point scale for level of
agreement scale

Point	Definition
1	Strongly Disagree
2	Disagree
3	Somewhat Disagree
4	Neither Disagree nor Agree
5	Somewhat Agree
6	Agree
7	Strongly Agree

Table 5.9	. 5 point scale for	importance
	of added	value

Point	Definition
1	Not Valuable
2	Slightly valuable
3	Moderately Valuable
4	Very Valuable
5	Extremely Valuable.



5.6. Factor Analysis

Factor analysis has as its key objective reducing a larger set of variables to a smaller set of factors, fewer in number than the original variable set, but capable of accounting for a large portion of the total variability in the items. The identity of each factor is determined after a review of which items correlate the highest with that factor. Items that correlate the highest with a factor define the meaning of the factor as judged by what conceptually ties the items together. A successful result is one in which a few factors can explain a large portion of the total variability and those factors can be given a meaningful name using the assortment of items that correlate the highest with it. With the factor analysis results, it is possible to determine the correlations between the variables using regression or one way ANOVA. Results of these tests are discussed in the next chapter and statistical output is available in Appendix C.

5.7. Conclusion

This chapter answers the sub-question:

Sub Question 5: How to measure added values?

Chapter 4 described the theoretical model to measure added values based on two constructs namely intensity and importance of added value. This chapter explained the research methodologies and statistical techniques that were used to measure these two constructs. First, Analytic Hierarchy Process was used to measure the intensity of added value. Second, Likert Items was used to measure the importance of added values. Third, factor analysis and regression was used to measure the relationship between the added values and other variables. An online survey was developed using the tool SurveyGizmo to collect data. Section 5.1., discussed the sampling process for data collection. The data was collected from four stakeholders namely the software vendors, software adopters, consultants and academic professionals. Section 5.2., explained the survey design and the respondents' profile. The survey consisted of five sections, each section corresponding to one variable and a final general questions section. The survey protocol is in Appendix A. The measurement scales for each of the variables was discussed. The number of respondents was 49 out of the 236 to whom the survey was sent. Out of the 49, 36 were complete responses that satisfied the consistency requirement of AHP. Section 5.3., explained the measurement scales used for the variables. Based on Chapter 4, analytic hierarchy process was used to measure the intensity of the added values. The criteria used in AHP are based on the Enterprise Application Benefit Framework. Likert items were used for measuring the importance of added values (1 - not valuable to 5 – extremely valuable). The importance of added value is measured using the E-Business Value Creation Model dimensions. The other two variables namely, interests of stakeholders and information technology capabilities are also measured using likert item (1-strongly disagree to 7 – strongly agree). Section 5.4., gave a brief background on AHP and explained the methodology and steps to be taken in data analysis. Section 5.5., provided a brief description of the Likert items used for measuring the other three variables. Section 5.6., described the factor analysis approach taken to determine the relationship between the variables.



CHAPTER

VALIDATED ADDED VALUE FRAMEWORK

Chapter 5 defined the research method that will be used to measure added values. The primary research method is Analytic Hierarchy Process which was also explained in the previous chapter. Data was collected using an online survey. This chapter will discuss the results of this online survey. **Section 6.1**., discusses the results obtained from analytic hierarchy process which will answer second part of the added values, which is the intensity of added values. Section 6.2., briefly provides the results of descriptive statistics. Appendix B explores the descriptive statistics of the online survey. It will help us to answer the 20 specifications that were introduced in the previous chapters. This section also contains the answers to the first part of determining the added values which is the importance of the added values. **Section 6.3.**, discusses the results obtained from AHP results with respect to intensity of the added values. The chapter concludes by providing answers to the sub-questions 5 and 6 using the specifications.

6.1. Intensity of Added Value

This subsection will explore the results of the Analytic Hierarchy Process results with 36 complete and consistent responses. The explanation is provided based on the three criteria discussed in Chapter 5 – Strategic, Managerial and Operational. The results will be discussed keeping in mind individual stakeholder perspective and overall perspective. Table 6.4., provides the ranks of each of the criteria with respect to all the stakeholders. The weights can be represented as percentages as well, they are used both interchanged and used when explaining the results.

6.1.1. Criteria/Organizational Level

Strategic refers to the organizational level which is responsible for long term decision making regarding customer strategy, acquisitions, planning product development. In the analysis, strategic has the lowest weight (0,312) compared to the other two levels – managerial and organizational (Table 6.1). The results indicate that respondents believe that integrating the enterprise applications will not prove valuable for long term decision making. While strategic has the least

preference, understandably operational level, which is responsible for the day-to-day activities of the businesses, has the highest weight (0,361) which shows that integration will continue to offer

the maximum added value to the operational level of the firm. These are not surprising a result since it's well known that IT place a supporting role primarily to the core business and they are used for improving the day-to-day efficiency of the adopters.

Looking deeper, analyzing the same criteria for different stakeholder types separately yields surprising results (Table 6.2 and Figure 6.1). Software vendors and external consultants gave the highest weight to operational level (44,79% and 38,89% respectively) meaning they believe the most added value goes to the operational level and the least goes to the strategic level for vendors (23,53%) and managerial for external consultants (22,99%). Software adopters gave managerial level the highest weight (44,93%). Academic professionals think the values contribute most to the strategic level (36,57%). From this, we can understand that there is a lack of consensus in the perspectives of the stakeholders with respect to which organizational level will the added values contribute to. The weights were given by the stakeholders for the same three business processes, hence there is a significant difference in how perceive value (and its implication to an organizational level) even when supporting the integration of same business processes.

able 6.1. Aggregated results	for criteria with respect	to all the stakeholders.
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Criteria	Weight	Percentage	Rank
Strategic	0,312	31,21%	3
Managerial	0,327	32,69%	2
Operational	0,361	36,10%	1

Table 6.2. Percentage of preference for organizational level/criteria for each stakeholder

Criteria	Software Vendor	Software Adopter	External Consultant	Academic Professional
Strategic	23,53%	22,33%	38,11%	36,57%
Managerial	34,68%	44,93%	22,99%	31,44%
Operational	41,79%	32,74%	38,89%	31,99%



Figure 6.1. Preference to the organizational level/criteria for each stakeholder

6.1.2. Sub Criteria/Added Value

This section will discuss the second level of the AHP hierarchy which is the sub criteria. They were totally 9 sub criteria which were the added values described in Chapter 4.

Table 6.3 shows the weights, percentages and rankings of the added values of all stakeholders. In the overall ranking of the added values, three added values account for 40% of the overall weights. They are *integrated business processes* (14,90%), *increased data quality* (14,43%) and *more IT alignment with business* (12,48%) (Figure 6.2). This indicates that the added values of the three business processes that the stakeholders prefer are much focused. Surprisingly, each of the three added values that account for 40% of the overall preference is from different criteria. Hence, even though the stakeholders had the opinion that the values will be added most to the operational level, when it comes to individual values, they have suggested that values also add to other organizational levels. When looking at the least weights for added values, *increased company common vision* (8,81%) and *accurate sales forecasting* (9,73%) stand out.

Results from AHP show that these two added values are among the highly ranked weights; hence for the three business processes that we have used for this thesis, these two components have the highest level of intensity.

Added Values	Weight	Percentage	Rank	Criteria/Organizational Level
Improved Business Planning	0,090	8,99%	8	Strategic
Better Customer Experience	0,088	8,84%	7	Strategic
More IT Alignment with business	0,125	12,48%	3	Strategic
Increased Company Common Vision	0,088	8,81%	9	Managerial
Accurate Sales Forecasting	0,098	9,75%	6	Managerial
Increased Data Quality	0,144	14,43%	2	Managerial
Improved on-time delivery	0,097	9,69%	5	Operational
Integrated business process	0,149	14,90%	1	Operational
Increase in Sales	0,121	12,12%	4	Operational

Table 6.3. Aggregated intensity of added value with respect to all the stakeholders

When comparing the added value weights of different stakeholders (Table 6.4), we see a different perspective. Software vendors have ranked increased company common vision with the most weights (19,37%) while improved business planning has the least weight (5,37%). Business and IT alignment is ranked very low for software vendors (5,73%). More IT business alignment has a vast contrasting opinion between software vendors and adopters who ranked it very low (8th and 6th) while consultants and academic professionals have ranked it very high (1st and 2nd). Contrastingly the opposite is true for increase company common vision. Adopters and vendors have ranked it high (3rd and 4th) while the other two stakeholders have ranked it low (9th and 7th).



Figure 6.2. Aggregated intensity of added value with respect to all the stakeholders

Values	Software Vendor	Software Adopter	External Consultant	Academic Professional	Criteria/Organiation nal Level
Improved Business Planning	5,37% (9)	7,16% (8)	10,14% (6)	13,26% (4)	Strategic
Better Customer Experience	10,58% (4)	5,87% (9)	10,72% (5)	6,55% (9)	Strategic
More IT Alignment with business	5,73% (8)	9,31% (6)	20,17% (1)	14,52% (2)	Strategic
Increased Company Common Vision	17,60% (3)	12,03% (4)	3,01% (9)	7,45% (7)	Managerial
Accurate Sales Forecasting	6,63% (6)	12,80% (3)	5,25% (8)	14,56 (1)	Managerial
Increased Data Quality	10,08% (5)	20,23% (1)	12,42% (3)	10,64% (6)	Managerial
Improved on-time delivery	6,54% (7)	8,20% (7)	10,80% (4)	13,34% (3)	Operational
Integrated business process	19,37% (1)	11,32% (5)	17,84% (2)	11,96% (5)	Operational
Increase in Sales	18,11% (2)	13,08% (2)	9,64% (7)	7,72% (8)	Operational

Table 6.4. Intensity of added value with respect to individual stakeholders

Individual results for each stakeholder will be discussed below based on Table 6.4., and Figure 6.3.

Software Vendors:

Software Vendors believe that the highest intensity of added value is from *integrated business process* (19,37%). Integrated business process is an operational level value and software vendors also chose this to be the organizational level which has the most benefit from the integration. Although *increased company common vision* was the value with the least intensity among all, for software vendors, it is ranked third (17,60%). Surprisingly, among the values with least intensity is *more IT alignment with business* (5,73%) contrasting to the results from the aggregation and *improved business planning* (5,37%). Both of these values belong to the strategic organizational level whereas the two highest ranked added values belong to the operational level. Hence, it is clear that software vendors do not think that integration offers any added value to the strategic level.



Software Adopters:

Software adopters believed that the intensity of added value is most from *increased data quality* (20,23%), which is almost similar to the aggregated results where it is ranked second. Similar to the software vendors, *increase in sales* is also ranked second for the software adopters (13,08%) although with a lesser intensity (13,08% compared to 18,11%). Among the top three chosen values, two of them (*Accurate Sales Forecasting and Increase in Data Quality*) belong to the managerial level and account for 33% of the overall values. The least intensity of added values are *better customer experience* (5,87%) and *better business planning* (7,19%). These results correspond to the results from the criteria where software adopters preferred strategic level least.

External Consultants:

External consultants are the most important stakeholders in the integration process. Results from analyzing them shows that they rank *more IT alignment with business* (20,17%) which adds the highest intensity. This is followed by *integrated business process* (17,84%). These results substantiate the point that external consultants play a crucial role in making sure business and IT work together. Among the least preferred were *increased company common vision* (3,01%) and *accurate sales forecasting* (5,25%). The three highest values (*more IT alignment with business, integrated business process and increased data quality*) belong to different organizational levels. It indicates that external consultants do not believe that values from integration contribute only to a single organizational level but can affect all the levels. This is contrasting to the results from software vendors and software adopters who had focused on a single organizational level to which values are most useful.

Academic Professionals

Academic professionals were included into the research to get a broader idea on the topic and to determine the differences between academic and practical perspective since its an explorative research. According to this group of stakeholders, *accurate sales forecasting* (14,56%) will be the most intense value followed by *more IT alignment with business* (14,52%) and *improved on-time delivery* (13,34%). Of the top three values, similar to the external consultants, academic professionals also prefer one value from each organizational level. This could be because of lack of knowledge of the practical concepts behind FMCG industry or SAP applications. Among the least intense added values, *better customer experience (6,55%)* and *increase in sales (7,72%)*.

When looking at the similarity of ranking for the added values (Table 6.5), the most consensuses exists between the external consultants and the academic professionals. For example, apart from accurate sales forecasting and integrated business processes, they have very similar ranks. They both have shown the closest rankings for each added value of all the stakeholders. While the least similarity exists between software vendors and academic professionals, both have them displayed the farthest difference in rankings. They have the same ranking only for increased data quality. Software adopters and external consultants also exhibit a major difference in rankings while software vendors show a much lesser difference in opinion. For example, the only contrasting ranking between them is in better customer experience where the vendors have ranked them in the upper quite high but the adopters have ranked them the least. All the other added values are almost ranked with similar ranks.





Figure 6.3. Intensity of added values based on AHP preferences for sub criteria for each stakeholder

Among all the stakeholders, software vendors' ranks were closest to the aggregated ranks with 2 of their top 3 rankings belonging to the operational level. Academic professionals displayed least consensus with the aggregated ranks.

Priority rank for intensity of added value	Software Vendor	Software Adopter	External Cons ultant	Academic Professional
1	Increased Company Common Vision	Increased Data Quality	More IT Alignment with business	Accurate Sales Forecasting
2	Integrated business process	Increase in Sales	Integrated business process	More IT Alignment with business
3	Increase in Sales	Accurate Sales Forecasting	Increased Data Quality	Improved Business Planning
4	Better Customer Experience	Increased Company Common Vision	Improved on-time delivery	Improved on-time delivery
5	Increased Data Quality	Integrated business process	Better Customer Experience	Increased Data Quality
6	Accurate Sales Forecasting	More IT Alignment with business	Improved Business Planning	Better Customer Experience
7	More IT Alignment with business	Improved on-time delivery	Increase in Sales	Integrated business process
8	Improved on-time delivery	Improved Business Planning	Accurate Sales Forecasting	Increased Company Common Vision
9	Improved Business Planning	Better Customer Experience	Increased Company Common Vision	Increase in Sales

Table 6.5.	Intensity	of Added	Value Lis	t based of	n AHP	ranks for	r all stakeho	olders
	-							

6.1.3. Business Process Preferences

Table 6.6., shows the weights of business processes analyzed from the responses which were the second part of AHP. Considering the aggregated results for the business processes preferences, *Marketing_Campaign_Management* and *Customer_Order_Online* have almost equal weights (36,16%, and 34,17%), followed by *Customer_Complaint_Call_Center* (29,69%). There is no drastic difference in the rankings of the three business processes indicating that stakeholders have an equal preference to implement integration for any of these three business processes.

Added Value Rank- All Stakeholders	Business Processes	weight	Percentage
1	Customer_Orders_Online	0,342	34,17%
2	Customer_Complaint_Call_Center	0,297	29,69%
3	Marketing_Campaign_Management	0,362	36,16%

Table 6.7 and Figure 6.4., shows the perspectives of the different stakeholders. There is consensus on the weights. Two of the stakeholders *(Software Vendor and Academic Professionals)* have chosen *Customer_Order_Online* as the business process they would prefer to be integrated. This is understandable from the fact that two of the applications that are proposed for integration are



front end applications. The other two stakeholders (Software Adopters and External Consultants) chose Marketing_Campaign_Management process for integration. The results shows that the stakeholders prefer integrated to support the proactive elements when dealing with customers such as making sure there orders are processed appropriately and information from the collected rather customers is than а reactive business process such as Customer_Complaint_Call_Center. This could indicate that integration is viewed not just as a support role but increasingly becoming a strategic tool.

Table 6.7. Percentage of weights and ranks of business processes with respect to individual stakeholders

Business Processes/Preference	Software Vendor	Software Adopter	External Consultant	Academic Professional
Customer_Orders_Online	39,92% (1)	33,56% (3)	32,13% (2)	34,51% (1)
Customer_Complaint_Call_Center	25,41% (2)	26,68% (2)	27,04% (3)	33,66% (2)
Marketing_Campaign_Management	34,62% (3)	33,36% (1)	40,83% (1)	31,82% (3)



Figure 6.4: Business Processes preferences for different stakeholders

In order to determine if there is a significant correlation between the variables (in particular Table 6.4), initially Spearman Rank Order Correlation was used (Appendix C). Since it did not result in any significant correlations, factor analysis was done to convert the ordinal scales to interval scales and to also reduce the number of variables. Using the factor values, regression was done which also did not result in any direction of relationship (Appendix C). These tests reveal that there is a definite lack of consensus between the stakeholders and their perspectives on added values for integration. The lack of consensus could also be because of insufficient responses since 36 responses is on low marginal level for conducting factor and regression analysis. Also, since the business processes developed were not too specific, the approach to answering the pair-wise comparison questions by the respondents can be different.

6.2. Descriptive Statistics

Table 6.8., provides the descriptive statistics for the specifications introduced in the previous chapters. Explanations for the specifications are provided in Appendix B.

Specifications	Notation	Ν	Median	Skewness	Range
Integrated enterprise applications help vendors to differentiate their products from competitors' products.	S ₁	38	5	-0,425	6
External consultants play an important role in implementing integrated enterprise applications.	S ₂	38	6	-1,133	4
Integrated enterprise applications offer additional value to adopters.	S ₃	38	6	-0,573	3
Popularity of digital channels among end customers will influence business process redesigns for adopters in FMCG Industry.	S 4	38	5	-0,999	6
Enterprise Application Integration can be implemented in FMCG industry.	S ₅	38	6	-1,689	6
If business planning is improved, then it will be valuable to the efficiency of the adopter.	S ₆	38	4	-0,38	3
If alignment between IT and business is increased, then it will be provide complementary value to the adopter.	S ₇	38	5	-1,566	3
If better customer experience is provided, then it will be valuable to the customer strategy of the adopter.	S ₈	38	4	-0,923	3
If employees follow the vision of the company, then it will be valuable to the efficiency of the adopter.	S ₉	38	3	0,236	4
If data quality is increased, then it will provide novel value to the adopter.	S ₁₀	38	4	-0,159	3
If sales forecasting is more accurate, then it will provide novel value to the adopter	S 11	38	4	-0,853	4
If business processes are integrated, then it will provide	S 12	38	4	-1,4	3
If sales increase, then it will be valuable to the efficiency of the adopter	S ₁₃	38	4	-0,049	4
If on-time delivery is improved, then it will be valuable to the efficiency of the adopter.	S ₁₄	38	3	-0,595	4
If the adopter has to accommodate integrated applications, then the non-technical employees have to increase their IT technical knowledge.	S ₁₅	38	5	-0,793	4
If the adopter has to accommodate integrated applications, then business oriented managers have to increase their IT technical knowledge.	S 16	38	3	0,218	5
If the adopter has to accommodate integrated applications, then IT oriented managers have to increase their knowledge of the firm's business processes.	S ₁₇	38	6	-0,868	5
If the adopter has to accommodate integrated applications, then there should be increased cross department interaction between employees.	S ₁₈	38	6	-1,036	4
If the adopter has to accommodate integrated applications, then investments for purchasing more hardware are needed.	S ₁₉	38	3	0,165	5

Table 6.8: Specification 1 to Specification 20 – Descriptive Statistics



If the adopter has to accommodate integrated applications,					
then enterprise applications need faster communication	S 20	38	4	-0,083	6
technologies between them.	20				

6.3. Discussion

This sub section discusses the differences in the perspectives of the stakeholders towards the intensity of added values based on the criteria and sub criteria discussed in Section 6.1. Section 6.3.1., discuses the results obtained for the organizational levels and the added values for intensity of added values.

6.3.1. Intensity of Added Values

Chapter 4 discussed the operationalization of the intensity of added value variable using the Enterprise Application Benefit Framework. Three organizational levels were introduced namely strategic, managerial and operational. Based on the levels and E-Business value creation framework, 9 nine business models were identified. The organizational levels form the criteria in AHP while the added values form the sub criteria. Results from AHP corresponding to these are discussed below.

Strategic level and sub criteria:

Strategic level of the organizational refers to the top management which makes decisions regarding product development, customer strategies, acquisitions and financial investments. These decisions have a long term effect on the business process of the firm. In the previous chapter, it was clear that only academic professionals chose strategic level to be the one obtaining the most added values. In fact, it was ranked the least when the results were aggregated. The reason behind this could be because enterprise applications only play a supporting role (in FMCG industry) to the processes in the flow. But that is not the case with all the applications. Applications such as the business intelligence systems play a crucial role in building customer strategies and product development. Another reason for such a low intensity at the strategic level could be because adopters may not immediately realize the importance of integration to higher level decisions. The process through which the enterprise applications can have a strong impact on strategic decisions is based on time as well. As the integrated applications are used over a period of time, they can play an important role in long term decisions. Hence, it is important that consultants give a clear picture on the long term values that can be obtained from integration and also be specific on the duration when the values can be obtained. So values from integrating the three applications are only obtained over a period of time for the strategic level of the adopters. Further, the sub criteria under strategic level are discussed.

Better Business Planning:

This sub criterion can help adopters their business well in advance. By business, it means logistics, purchasing, storage and supply maintenance. None of the stakeholders implied that this value will offer much value to the adopter if integration is done. The highest rank it received was from academic professionals who ranked it third. Software adopter and software vendors ranked it among the bottom two. From a software vendor's perspective, business planning is a part of the 'business' side of the adopter and the enterprise applications may not play an important role

since they can be very flexible towards changing business plans. The low rank to this value implies that enterprise applications still do not play a significant role in making decisions. Another factor to consider is if they are not so vital to business planning then whether if the applications need integration at all. Hence, external consultants have to stress on the importance of IT in high level decisions irrespective of how important IT is to the adopters.

More IT alignment with Business

This was one of the important sub criterion and added value chosen by all the stakeholders. Software adopters and software vendors have ranked it in the middle while external consultants and academic professionals have ranked it high. This signifies that only external consultant have a clear view of the practical importance of the alignment. The low rank from the software adopters for this value could also offer some insights into why they ranked the previous value low. Based on the two results, one important conclusion is that IT plays only a supporting role in FMCG industry, both with respect to software vendors and adopters. Hence, both of them are unaware of the potential benefits from integration. External consultants have to make collaborative steps to bridge this gap since they believe that alignment is extremely important.

Better Customer Experience

As an adopter in the FMCG industry, it was expected that the adopters would consider this value to have a high intensity but the results proved surprising since they ranked it the last. This shows that adopters believe customer experience is beyond the enterprise applications. While this is true considering that customer experience is more of a strategy than an offering from IT applications but these applications play a vital role in making sure the experience is sustainable and automated. Also, it helps to gain critical information about customers that can be used in the future to improve customer experience. Considering these factors, adopters have to reconsider their view about enterprise applications and customer experience.

Based on the three sub criterion under the strategic criteria, it is very clear that that adopters view enterprise applications not from a strategic tool but only as a support tool. Software vendors and external consultants who also feel to an extent the same, but not as drastic as the adopters. This shows that integrated solutions are yet to break free from the concepts that IT is a support.

Managerial Criteria and sub criteria:

The managerial criteria refer to the organizational level where decisions regarding the allocation of resources, market strategy and analysis are made usually by the middle level managers. This level is second most preferred among all the stakeholders aggregated. Software adopters rank this level the highest which means they believe added values from integration is highest. The explanation could be that enterprise applications provide crucial information that is needed to make these decisions. Apart from that, enterprise applications will help also in converting strategic decisions into operational activities by providing a much needed 360 view of the company.

Increase in Company common vision

Increases company common vision is ranked higher between the adopters and vendors while the consultants and the academic professionals have ranked it very low. The reason could be that



vendors design the business processes based on industry best practices. The integration and the subsequent remodeling of the business processes will also be based on best practices that are suitable for the adopter. And the business processes will be standardized. The vendors offer such standardized solutions so that adopters can concentrate on other aspects of their business. Adopters could prefer increased company common vision because it allows the employees to be more productive with the standardized processes. This could help them to align their customer facing communication to be less about the work but more about serving the customers based on what the adopter's visions are. For consultants, common vision is not an important strategy since they do not take this into account when integrating the applications. This maybe because they are more involved in the business itself rather than how the employees feel about the adopters.

Accurate Sales Forecasting

Accurate sales forecasting refers to how important the enterprise applications are to make sales forecasts accurately. The applications help by gathering and analyzing customer information and providing important input for making market and product based decisions. Software adopters have rated this value high (3rd) in the rank list. This could be because they understand that the information provided by the application is crucial. It is interesting to see that all the three top added values ranks for adopters are related to data collection and sales. This shows how important this particular aspect of the business is to adopters. Academic professionals ranked accurate sales forecasting as the highest. Compared to these two stakeholders, software vendors and consultants ranked this sub criteria in the middle of the list. This implies that sales forecasting accuracy depends on other factors and not only the enterprise applications. These factors could be the need for sales forecasting, data quality, customer strategy and the products offered. If the products offered do not have any external dependency for sales or if the product is already entrenched in the market then forecasting is not needed to such an extent.

Increase in Data Quality

Increase in data quality refers to two aspects; one is the amount of data gather about the customers and the product and it also refers to the completeness of the data. Software adopters have ranked it the highest followed by external consultant who have ranked it a month top 3.

Operational Criteria and sub criteria:

The operational criteria refer to the organization level where day to day activities regarding sales, customer interaction are made usually by operational managers. This is the most preferred organizational level among all the stakeholders aggregated. Software vendors and external consultants rank this level the highest which means they believe added value from integration is the highest. The reason could be that IT is viewed to play a supporting role hence it should not a surprise that operational is chosen to be the highest level which gets value from integration. By comparing it to strategic level's values, it supports the earlier inference that enterprise applications are viewed only as supporting tools rather than strategic elements.

Improving on-time delivery

On time delivery refers to the time taken from a customer order to a delivery. This sub criterion is crucial for adopters since it can help them provide a better customer experience and thereby retain them. Also, it helps them to improve efficiency of the process flow by decreasing the on-



time delivery time. Software adopters and software vendors have ranked the sub criteria in the lower ranks in the list while external consultants and academic professionals have ranked in the mid range. The reasons for this sub criterion to not so effective for the operational level with respect to integration is because in the process flow, the relationship between the enterprise applications and the on-time deliver may not be high since there are other aspects which play a role such as supply chain, logistics, finance etc. Also, other factors also have more influence on improving customer experience. These include a more proactive approach by offering incentives or by making sure their complaints are addressed to, also providing customized products.

Integrated Business Process

Integrated business processes refer to the ability of different business processes which before the integration were independent but afterwards, they were integrated. Software Vendors and External consultants have ranked it among the top three preferences while adopters and external consultants have given mid range ranks to this sub-criterion.

Increase in Sales

Sales refer to selling products or services to the end customers. Software vendors and adopters provided this sub criterion with a rank in the top of the added values while external consultants and academic professionals have provided mid range values.

In general, the preferences to added values are very different for the stakeholders. Operational criteria were the most preferred criteria followed by managerial. While, integrated business processes, increase in alignment between IT and business and increase in data quality were the top three added values in term of intensity. Increased company common vision and better customer experience had the lowest rankings. There is a lack of consensus among stakeholders which can attribute to the individual strategies and experiences in integration. From the research perspective, the difference could be because the business processes were too general hence the added value preferences were too diverged. This also shows that when discussing integration, the stakeholders must get to the specific details of the business processes as much as possible to obtain the right perspective of the outcomes of the integration.

6.4. Conclusion

This chapter presented the results of the online survey. We conclude the chapter by presenting key findings with respect to each variable that was measured.

With respect to the interest of the stakeholders in the FMCG industry, responses indicate that software adopters are the most ones who will most benefit by this integration and it will result in value for them. External consultants also have a big role to play in the integration process. This is because in order for the integration to work properly, the software adopters have to seek the help of these external consultants. External consultants have the expertise in business process management and making sure that existing IT processes are not affected by the integration. This signifies their role more. The results show that FMCG industry is indeed a very suitable industry to implement the integration. FMCG industry is growing rapidly along with the changing shopping habits of its customers. Integrating the three applications will only reinforce this strategy.



With respect to the importance of the added values, three values stood out to be most important namely, increase in business and IT alignment, integrated business processes and better customer experience. While the least important values were increase in company common vision and increase in sales.

With respect to the intensity of the added values which were measured using AHP. The organizational level which had the highest weight was operational which shows that integration impacts the organizational level the most. Also, there was a significant amount of difference in opinion regarding the weights of the added values between the different stakeholders. The contrasting differences were between the academic professionals and the adopters while the most consensus opinion was among the consultants and the academic professionals. The results of the business process weights were more consistent with three of the stakeholders (except adopters) providing business process 1, **Customer_Order_Online** with the highest weights. The consensus among preferring the same business processes and the difference in preference of added values shows that the stakeholders perceive different values from integrating a single business processes.

Finally, factor analysis was done to two variables namely the importance of the added values and the information technology capabilities to determine relationships between the four variables. The results of the factor analysis led to reducing the importance of added values to 3 factors from 9, while the capabilities reduced to 2 factors from 6. But correlation results conclude that there are no significant correlations between any of the factors and the variables. Kruskal Wallis test was also done to explore if there is a statistical difference between the stakeholders on the variables but the results were insignificant.

CHAPTER

CONCLUSION AND RECOMMENDATION

In this chapter, we will conclude this study by presenting answers for each research questions. Subsequently we will discuss some reflection and the implications of the results to literature and practitioners. Finally, we will present the limitations of this study and our recommendations towards future studies.

7.1. Conclusion

This research had two objectives. First, to develop an added value framework for enterprise application integration and to identify the information technology capabilities needed to make the integration possible in the FMCG industry.

In order to address the first objective, enterprise application integration needs to be operationalized. This was done by a business process approach, rather than a technical approach. This was done because the focus of the research was on the developments or implications that take place once the integration is already completed. Following a technical approach to operationalize EAI would have resulted in focusing on possibilities and different methods for integration rather than the post integration phase. Three business processes were developed which were loosely based on SAP ECC, SAP CRM and SAP-Hybris applications. The business processes were developed after considerable study on the different activities that take place in FMCG industry and also making sure that all the three applications have an equal role to play in the integration. The first business process (Customer_Order_Online) deals with the process flow that takes place once a customer orders for products online and wants it to be delivered via a different channel. The steps in the process flow involved communications between 5 modules of the three applications. The second business process (Customer_Complaint_Call_Center) deals with the process flow that takes place when a customer calls that call center to register a complaint that a particular product has not been delivered at the expected time and channel. This process flow involves 6 modules in the three applications. Finally, the third business process (Marketing Campaign Management) deals with the process flow that occurs when a customer visits the adopters' website and further collects the data generated to develop marketing campaigns and profitability analysis. This process flow involved 7 modules between the three applications.



Further, a comprehensive framework was developed which will help stakeholders in the FMCG industry to identify and categorize added values based on their importance and their intensity. The stakeholders who are present in the enterprise applications market are software vendors, software adopters, and external consultants. Additionally, academic professionals were also included to get a theoretical perspective of the research. It was identified that software vendors can benefit from integrating the three applications because even the market leaders were experiencing stiff competition from other vendors and even new entrants. It was also identified that market leaders of all the three applications could increase their product offerings to stay competitive. Hence, integrated solutions can be a unique product offering. Software adopters also faced challenges that can be addressed by integration. The problems were from the customers who were becoming digital day by day. Thus, the adopters are forced to improve their process flow to improve their business globally and to satisfy their customer demands which are rapidly changing.

The added value framework developed consists of two dimensions derived from two existing models. The two dimensions represent two constructs of added values. The first dimension which represents the <u>importance of the added value</u> is categorized as *novelty, efficiency, lock-in and complementarities.* Novelty refers to the new information that can be gathered from integrating the applications, efficiency refers to decreasing the transaction costs (both financially and time), it also refers to reduced number of steps in the process flow. Lock-in consists of two aspects, one is the ability of the integrated solution to attract and retain customers but it also refers to how well the applications that are integrated are dependent on each other. Complementarities refer to the values gained from sharing common resources between the three applications. The second dimension represents <u>the intensity of the added values</u> and is categorized as *Strategic, Managerial and Operational.* The three denote different organizational levels in the adopters' firm with strategic being the top organizational level while operational refers to the low organizational level. Managerial refers to the mid organizational level.

Based on the framework and the business processes, nine added values were identified namely, Improved Business Planning, Increased IT alignment with business, Better Customer Experience Increased Company Common Vision, Improved on time Delivery, Accurate Sales Forecasting, Streamlined business processes, Increased Data Quality, Increase in Sales. The nine values were then fitted into the added value framework developed earlier. The final added value is shown in Figure 7.1. These nine values were tested for both their intensity and their importance using nine specifications and analytic hierarchy process preference scale.

The first conclusion from the results is that there is very little consensus between the four stakeholders when looking at the intensity of added value. Second, overall among all the stakeholders, the most preferred intensity of added value dimension was found to be to the operational organizational level. This indicates that the stakeholders believe integrating enterprise applications is most useful to the operational activities of the organizations. The least preferred intensity of added value was for strategic level of the organization. When comparing the results of different stakeholders separately, it was found that software vendors and external consultants believe that the added values will be most intense at the operational level. This could be explained by while the adopters believe it to be managerial level. Academic professionals chose strategic level.



Values	Efficiency	Novelty	Lock-in	Complementarities
Dimensions				
Strategic	Improved Business Planning		Better Customer Experience	Increased alignment between IT and business
Managerial	Increase in company common vision	Accurate Sales Forecasting Increased data quality		
Operational	Improved On-Time Delivery Increase in Sales			Integrated business processes

Figure 7.1. Added Value Framework developed.

When considering the intensity of added value, the perspectives of the stakeholders were different too. Software vendors found increase in company common vision to be the one which adds the most value. This is very contrasting to the overall results in which the increase in company common vision got the least rank. But similar to the aggregated results for the criteria, software vendors found integrated business processes and increase in sales to be the next intense added values. They preferred the improved business planning value the least.

Software adopters found increased data quality to be the highest added value followed by increase in sales and accurate sales forecasting. Both of these two results are similar to the aggregated results. The surprising outcome was that better customer experience was placed least intense value. This could be because this particular value was paired up with improved business planning and increase in business IT alignment under the strategic level. Since strategic level received the low score, better customer experience is ranked lower. Another aspect from this result is the lack of knowledge among the adopters about what values can be obtained to different organizational levels.

Another critical stakeholder which are the the external consultants' ranked more IT alignment with business as the highest value, followed by integrated business processes and increase in data quality. They preferred the increase in company common vision least.

The final stakeholder was the academic professionals who preferred accurate forecasting, followed by more IT alignment with business and improved business planning. They preferred increase in sale value least.

It is interesting to see that none of the stakeholders except the software adopters had a consensus with respect to the added value they most preferred (increase in data quality) and the organizational value they believed would gain most from the integration (managerial). This shows that either the stakeholders are not aware of implications of the added values on the different organizational levels or they believe that the added values cannot be limited to specific organizational levels. The following table summarizes the results for the intensity of added values variable.

Stakeholder	Most Intense Added Value	Inference	
Software	Increased Company Common Vision	Overall strategy of the adopter is considered to be	
Vendor	Integrated business process	important criteria when deciding product offerings.	
	Increase in Sales	Focus is first on the users of the applications and then on the processes involved.	
Software	Increased Data Quality	More importance is given to the data generated by the	
Adopter	Increase in Sales	integration. Could be attributed to the fact that	
Accurat	Accurate Sales Forecasting	information about customers is vital to build a brand name and decrease by increasing efficiency.	
External	More IT Alignment with business	Focus is completely on the interface between business	
Consultant	Integrated business process	and IT. Thus, perceives that integrating the three	
	Increased Data Quality	applications will greatly benefit this interface.	
Academic	Accurate Sales Forecasting	Focus was on the strategic level values	
Professional	More IT Alignment with business		
	Improved Business Planning		

Table 7.1. Stakeholder preferences for intensity of added value variable

There are definitely some differences about the perspectives of the stakeholders but there are certain similarities too. More IT alignment with business and integrated business processes has ranked among the highest intense added values from more than one stakeholder. Hence, it is safe to infer that the primary benefit from integrating these three applications comes from bridging the gap between IT and business for the software adopters. Secondary benefits include obtaining new information about customers and increasing sales.

The next conclusion is the business process preferences shown in Figure 7.2. The significant conclusion is that three of the stakeholders preferred the customer Orders Online business process to be suitable for integration. While there is consensus for this result, it is interesting to see that choosing similar business processes does not yield in consensus with respect to the intensity of added values. This could be because other factors can play a role in generating values such as the adopters' experience when dealing with change, their different business strategies, adoption time.

Table 7.2. Business process	preferences for all stakeholders
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Stakeholder	Business Process Preference	Inference
Software Vendor	Customer Orders Online	Most basic and frequent business process used FMCG industry hence most important
Software Adopter	Customer Orders Online	First customer touch point during sales hence it is an importance business process
External Consultant	Marketing and Campaign Management	Retaining customers is important.
Academic Professional	Customer Orders Online	Business process is most suited for integration.



The next conclusion is with respect to the importance of added value variable. The importance was operationalized using the E-business Value Creation Model and measured in 5 point Likert Scale (1 – Least Important to 5 – Most important). Table 7.3., shows the results of the ranking of importance added value and intensity of added value. The ranks are based on the medians. If two added values had the same median then the one with a higher negative skewness was ranked higher since it denotes more importance to the added value in terms of number of respondents.

Rank	Ranking for importance of added value	Ranking for intensity of added value
1	More IT alignment with business	Integrated business process
2	Integrated business Process	Increased Data Quality
3	Better Customer Experience	More IT Alignment with business
4	Accurate Sales Forecasting	Increase in Sales
5	Improved on-time delivery	Accurate Sales Forecasting
6	Improved Business Planning	Improved on-time delivery
7	Increased data quality	Improved Business Planning
8	Increase In Sales	Better Customer Experience
9	Increase in Company Common Vision	Increased Company Common Vision

Table 7.3. Importance of added values rank

The results offer some interesting insights. First, importance and intensity of values are not dependent on each other. It implies that a value that is considered to be important to an adopter does not guarantee that they will be able to achieve. Also, not all values that can be obtained from integration can be considered important. This specific inference supports the claim that both the software adopters and external consultant need to collaborate more to understand between what is offered by the consultants and to match it to what is required by the adopter. Second, not all the ranks are different. Added Values such as more IT alignment with business and integrated business processes are present in the top 3 ranks of both the dimensions. This could be because of how crucial these two values are to the adopters and also that software vendors and consultants are focusing on offering this value the most, which is a positive sign towards understanding each other. It is interesting to note that increase in company common vision ranks low in both the dimensions. This is very important for the software vendor since they believed that the integration will offer a high level of common vision. From this result, it is clear that all the stakeholders have not ranked that value very high in term of importance.

Finally, the second objective of identifying the information technology capabilities was based on two dimensions namely human capability and hardware capability. Human capabilities refer to the technical and the managerial skills to accommodate the integration while hardware capabilities refer to the speed and hardware storage required for integration. Based on these dimensions, five specifications were developed and tested. The results indicate that the highest capability needed is the cross departmental interaction between IT and business units. This capability is also related to the increase in business IT alignment added value. The need for IT technical employees to gain

managerial skills was also a much needed capability. The capabilities that were not required were business managers learning IT technical details and more hardware storage for integration.

7.2. Recommendations

Our study into the market analysis and recent trends on FMCG industry and enterprise applications market has revealed that software vendors have to improve their product offerings to remain competitive. The main challenge for the vendors will be the new and smaller vendors. This is because the market for applications to larger firms is almost saturated leaving the SMEs and the smaller companies. Software vendors have lesser product offerings for these types of firms since their main customer target was the bigger companies. Whereas smaller vendors have the capability to develop only less complex applications, which is more suitable for SMEs. Hence vendors have to develop their product offerings. Further, the new product offerings must be differentiated sufficiently so that competitors do not follow with their own similar product offerings. Another suggestion to maintain market share is to collaborate more with the software adopters directly rather than through the external consultants. This should be done prior to developing integrated solutions since the adopter's input can be vital to make the product offering unique. Also, for market leaders, another strategy to stay ahead in the market would be acquiring a new entrant who is perceived to be a threat. This strategy can work well if the new entrant has product offerings that are not offered by the buying vendor.

Software adopters have to develop their customer strategy to meet the changing demands of customers through different channels. And for this purpose, their integration approach should match with which values are important to them for achieving an appropriate customer strategy. This can be achieved using this model through the lock-in dimension as one of the dimensions of the importance of added value construct. Software adopters must also communication between business and IT units as that is most important IT capability identified in this research.

External Consultants have to use the framework sparingly during the initial integration projects. The robustness of the framework increases as more and more real practical are under taken, values are identified and categorized on the framework. Then, it can be used to determine values for future projects. This is because the framework is still only theoretically developed. It needs more generalization and testing before it can be used on a wide scale.

7.3. Reflection

This subsection will present the limitations of the research followed by a discussion on the generalization. Finally, it consists of the implications for theory.

7.3.1. Limitations of the research

There are limitations to the research, each of which is discussed below:

- 1. The business processes that were constructed used the modules which were from SAP applications. Although many applications show similar module structure, the processes of integrating them could be done differently. Hence the integrated business processes developed could be different for other applications
- 2. The list of added values from integration can be exhaustive and can only be identified as and when the integration is done. This research has concentrate only on nine such values and they


are not values that were directly reported after integration. These values were obtained after studying customer stories, research papers which concentrated on the values obtained from using the independent applications. Hence, the list of added values is limited and not derived directly from examples of previous integration approaches done.

- 3. The number of business processes was not exhaustive. It is hard to develop such a comprehensive framework in such a short span of time which covers more of the common business processes in the FMCG industry. Only three of those business processes were used for this research. But more research can be done to identify more values that contribute to other business processes. These can also be added to the framework.
- 4. Finally, due to the low number of responses, the relationships between the different variables and the possibility to explore the difference in opinions of the stakeholders could not be done.
- 5. The variable "Importance of added value" was measured and analyzed only using descriptive statistics. This is because there is no possibility to measure the Value Creation from E-business dimensions even before the integration is done. Instead, this model was used to determine the degree of importance of a value to a particular dimension.
- 6. Also, the survey responses were limited within the European countries.

7.3.2. Generalization

The framework was developed with the SAP applications in mind; hence the business processes were developed from these applications' modules. But using this framework for other business processes would not be a problem at all since the framework itself does not rely on the business processes. Only the added values are dependent on the business processes. And we can safely assume that most values that can be achieved through enterprise application integration can be fit into this framework since it covers a wide range of perspectives. The information capabilities identified are applicable to any type of company irrespective of whether they treat IT as a support or a strategic tool.

The framework can also be used to determine the added values of other industries based on the business processes. Company size maybe a factor for using the framework. Since it clearly distinguishes the organizational levels within a company, SMEs and other smaller companies may not be the most suitable firms to use these firms. It can also be argued that SMEs and smaller firms will rarely go integrating their systems therefore this framework will nevertheless not be useful for them.

7.3.3. Theory Contribution

This research adds several contributions to the theory. Firstly, the research contributes to the enterprise application integration literature. The research has highlighted a specific topic in enterprise application integration, which are the values obtained from it. The research also contributes to the field of added value determination, multi-channel commerce. This research has contributed to the work of Shang and Seddon, 2002) who developed the benefit framework solely for a single system. This research contributes to this work by adding two main aspects namely integration and importance of the values in the framework. Getting the opinions of the academic professionals is also adding a key stakeholder in contributing to this framework. This research confirms a part of their findings that strategic, managerial and operational levels in an



organization play a key role in determining the values of enterprise applications and that no two levels have the same effect from the values.

This study also contributes to the value creation model developed by Amit and Zott (Amit & Zott, 2001). Their work is groundbreaking in the sense that values that can be gained from using e-commerce were divided into clear structure which didn't exist earlier. Our research contributes minutely to this exhaustive literature by distributing the values to different organizational levels. For example, increase in data quality, according to the Value Creation Model would be a source of novelty but it fails to see to which organizational level does it act as a source of value. We have found that increase in data quality offers the most value to the managerial level of the organization.

To sum it up, this research has made some of the first attempts into constructing an Added Value Framework for enterprise application integration that explicitly takes into account the differences in perspectives of the stakeholders. The research contributes to the enterprise application integration and added value literature. Research on the combination of application integration and added value is still lacking.

7.3.4. Applicability in business

Since this thesis was undertaken at Capgemini, it will be useful to them to explain the applicability of this research to practical use. First, it gives them an understanding of the different perspectives of all the stakeholders. Some of the results are surprising such as the fact that many respondents failed to see a competitive advantage for the software vendors when they offer integrated solutions. Results relating to how there is a wide difference in opinion about the added values is also useful to them. They can utilize these results to improve their communication with the vendors and the adopters and to strive to make sure that they have a similar opinion regarding integration from the beginning when they tackle integration projects. Results relating to the importance of the added values probably don't offer any insights to the consultants since they understand that difference in importance can be attributed to the different business strategies that are followed by the adopters.

The framework itself is quite useful to them since they can categorize their integration projects based on this framework and as more projects are being undertaken, the framework will offer a clearer picture about which added values can be gained by integrating which types of business processes. Furthermore, the framework might very well be applied to different industries and therefore Capgemini also might use or implement the framework at different clients within different industries. The possible range of clients where the framework could potentially be applied is therefore quit large. Another advantage for Capgemini is that the list of added values that can be included in the framework is large. Hence, it is robust and non-exhaustive. As more values are included in the framework, the framework might need some restructuring by either broadening the perspectives or diving deeper to expand the framework more.

7.3.5. Research Methodology

The research method followed was a quantitative method known as Analytic Hierarchy Process. The research design followed is a simple combination of two models. But the aspects based on which the two models were unique was well grounded from theory. Reflecting on the models



used, E-Business Value Creation Models provides dimensions to measure value which are not so easy to map based on customer stories. Although the dimensions were unique, it lacked more depth in the sense that it viewed value only from the perspective of the customer. Using this model, even adopters can gain value internally. Contrastingly, Enterprise Application Benefit Framework was well suited for identifying values according to organizational levels but the disadvantage was that the levels had to be defined for the research explicitly since the framework has no strict rules to follow and the differences between the organizational levels were subjective.

Coming to the business process approach, it was a different approach than the traditional technical approach. Even if previous research has used business process approach, the business processes were developed only from an academic point of view. But this research has developed it from industry applications. This may affect the generalizability of the research but it makes the research more appropriate for practical purposes.

Determining added values from different dimensions is not new. Traditionally, added values relate to the degree of value added and the importance of the value. The same procedure was followed in this research. Both of these dimensions were measured independently. Reflecting on this, the research would have been more interesting if there was a possibility to determine the dependencies of these two dimensions.

7.4. Future Research

Based on the limitations described in the above section, it has become clear that there is still some room left for further research. First, the framework is only applied once in this research; more research to validate the framework and find more evidence would create a more solid basis for the validation of the framework and fill the empty slots for combinations of added values that are novel and operational.

Further, other factors affect the concept of capabilities apart from IT, which have an effect on the success of integration. These factors include organizational, financial and regulation. Organizational factors are important for international companies since there will be difference in the way employees from different countries adapt to IT, hence to bring about an organizational change after integration is hard, even if all the required IT capabilities are present. Another example is when a company acquires a new company, then it is difficult for the parent company to force changes to the sister company quickly since employees are not succinct to change. Financially, employees have to trained, maintenance has to be done and investments must be made to re-design the business processes. Hence, apart from IT capabilities, all these capabilities must also be analyzed and their effect on the added values must be known.

Future research must include another important stakeholder in the framework which is the end customers. Adopter's strategy is keenly based on the end customer behavior, hence added values that adopters will prefer from integration could be based on the opinions of customers and what they expect from the adopter firms. It is not possible to implement the framework as such with the end customers since its only created for the adopters. Hence, the framework has to be modified to make each dimension more suitable to the end customer.

And the framework must be tested in other industries and with other enterprise applications products apart from SAP to make the framework more robust.

More research for the validation of the framework and fill the empty slots for combinations of added values that are novel and operational. Other factors that affect the concept of capabilities apart from IT, such as organizational, financial and regulation have to be investigated. Future research must include another important stakeholder in the framework which is the end customers since they are important in the adopter's strategy. And the framework must be tested in other industries and with other enterprise applications products apart from SAP to make the framework more robust.

7.5. Research Process

In this research, besides the development of the framework, an explorative attempt has been made to understand the differences in the perspectives of four stakeholders who all have a role to play in enterprise application integration. Also effort has been put into analyzing different constructs of added values from different methodologies and models. This research is only the tip of the iceberg. More in depth research has to be carried out by interviewing the stakeholders, both from the technical perspective and the business process perspective of integration to identify more dormant factors that may hinder or help the identification of added values.

7.5.1. Finding Respondents

When the research was proposed initially, the duration of the research mainly depended on how quickly we get the responses for our survey. Although optimistic at the start of the research, the task was quite challenging given the fact that a wide variety of stakeholders were included in the research and we focused on only 3 kinds of enterprise applications in the market. Adding to this, the survey was quite long, hence we had a number of partial responses. We also had to check for the consistencies in order to satisfy the assumptions of AHP. Hence, even if we did arrive at a considerable number of responses, we still had to eliminate quite a few due to these factors. Apart from this, the survey was mainly sent through electronic email and LinkedIn; reminders had to be sent once at least to make sure the respondents fill the survey.

7.5.2. Planning

Overall the research planning seemed ok. Although at the start of the research, effort had to be put in to make sure we covered all the three enterprise applications completely in terms of understanding the business processes, reading the customer stories and defining the values. The period which slightly delayed the progress of the research was during survey design. Designing a survey is an art and several iterations had to be taken to make sure that the survey did not tire the respondents by having too long questions or too many questions.

7.5.3. Personal Experience

This research complements existing literature by presenting something new about the two models that are used and the specifications that were tested. This thesis has become quite theoretical and elaborate but I could have still explored the relationships between the concepts more in detail and validated those results with some interviews. Also due to time constraints this was not investigated very extensively and could be described in more detail.



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Appendix A - Questionnaire Protocol

Thank you for accepting the invitation to participate in this survey!

The goal of this survey is to understand the information technology capabilities and added value of integrating enterprise applications for firms in the Fast Moving Consumer Goods Industry.

In order to have a common ground of understanding, we define enterprise application integration as "the unlimited sharing of data and business process between any connected application and data source in an enterprise". The enterprise applications that are considered for integration are Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Multi-Channel Commerce Systems. For your convenience, in the rest of the survey, wherever we use <u>"integrated enterprise applications"</u>, we mean the integration of ERP, CRM and Multi-Channel Commerce systems.

There are four sections in the survey:

- 1. Enterprise applications market (5 questions).
- 2. Added value of Integration (14 Questions).
- 3. Technology Capabilities for successful integration (6 Questions).
- 4. General questions (7 questions).

Your answers will be completely anonymous and confidential. Data will be combined and analyzed as a whole. Any questions marked with an asterisk (*) require an answer in order to progress through the survey. Finally, we end the survey with a comment section for you to give your feedback.

Your participation in the study will be greatly appreciated. Thank you very much for your time and assistance. If you are interested to know the results of the survey, kindly leave your email id at the end of the survey.

Enterprise Applications Market

This section aims to determine the interest of four different stakeholders towards integrated enterprise applications.

The four stakeholders are:

- 1. <u>Adopters:</u> Firms in Fast Moving Consumer Goods Industry which use enterprise applications.
- 2. Vendors: Firms which develop enterprise applications.
- 3. External consultants: Firms which help adopters to implement enterprise applications.
- 4. End customers: Customers of adopters.

There are 5 statements below corresponding to the interest of these stakeholders. Please tell us your level of agreement to each of those statements.

1. Fast Moving Consumer Goods is a suitable industry to implement integrated enterprise applications.



- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- 2. The use of digital channels by end customers influences adopters to redesign their business processes.
- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- 3. Integrated enterprise applications offer additional value to adopters.
- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree

4. Integrated enterprise applications help vendors to differentiate their products from competitors' products

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree

5. External consultants play an important role in implementing integrated enterprise applications.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree

7.5.4. Added Value of Integration

We are trying to determine the added values of integrated enterprise applications that help the decision making at three organizational levels of <u>an adopter</u>. We classify the three levels as:

1. Strategic Level: Decisions taken by the <u>upper</u> level management of the adopter that has a long term and strong effect.

2. Managerial Level: Decisions taken by the <u>middle</u> level management of the adopter that has a short term and moderate effect

3. Operational Level: Decisions taken by the <u>lower</u> level employees of the adopter that has an immediate and least effect.

From question 6 to 9, please tell us your opinion on how much value integrated enterprise applications provide at each level of decision making.

6. For each pair of organizational levels below, please choose to which extent one level will offer more added value than the other level when implementing integrated enterprise applications.

	Extremely added value.	Very strong added value.	Strong added value.	Moderate added value.	Equal Added Value	Moderate added value	Strong added value	Very strong added value	Extremely added value	
Strategic	0	0	0	0	0	0	0	0	0	Managerial
Strategic	0	0	0	0	0	0	0	0	0	Operational
Managerial	0	0	0	0	0	0	0	0	0	Operational

7. For each pair of attributes below, at the <u>strategic</u> level, please choose to which extent one attribute will offer more added value than the other attribute when implementing integrated enterprise applications.



	Extremely added value.	Very strong added value.	Strong added value.	Moderate added value.	Equal Added Value	Moderate added value	Strong added value	Very strong added value	Extremely added value	
Improved Business Planning	0	0	0	0	0	0	0	0	0	Better Customer Experience
Improved Business Planning	0	0	0	0	0	0	0	0	0	More IT Alignment with business
Better Customer Experience	0	0	0	0	0	0	0	0	0	More IT Alignment with business *

8. For each pair of attributes below, at the <u>managerial</u> level, please choose to which extent one attribute will offer more added value than the other attribute when implementing integrated enterprise applications.

	Extremely added value.	Very strong added value.	Strong added value.	Moderate added value.	Equal Added Value	Moderate added value	Strong added value	Very strong added value	Extremely added value	
Increased Company Common Vision	0	0	0	0	0	0	0	0	0	Accurate Sales Forecasting
Increased Company Common Vision	0	0	0	0	0	0	0	0	0	Increased Data Quality
Accurate Sales Forecasting	0	0	0	0	0	0	0	0	0	Increased Data Quality

9. For each pair of attributes below, at the <u>operational</u> level, please choose to which extent one attribute will offer more added value than the other attribute when implementing integrated enterprise applications.

	Extremely added value.	Very strong added value.	Strong added value.	Moderate added value.	Equal Added Value	Moderate added value	Strong added value	Very strong added value	Extremely added value	
Improved on- time delivery	0	0	0	0	0	0	0	0	0	Integrated business process
Improved on- time delivery	0	0	0	0	0	0	0	0	0	Increase in Sales
Integrated	0	0	0	0	0	0	0	0	0	Increase in



	Extremely added value.	Very strong added value.	Strong added value.	Moderate added value.	Equal Added Value	Moderate added value	Strong added value	Very strong added value	Extremely added value	
business process										Sales *

7.5.5. Added Value of Integration (contd.)

Assume that an enterprise system adopter in the Fast Moving Consumer Industry has to choose between three business processes (see below) for implementing integrated enterprise applications.

Business Process 1. <u>Customer Orders Online</u>: When a customer orders for a product through the firm's website and wants it to be home-delivered.

Business Process 2. <u>Customer Complaints at Call Centre</u>: When a customer registers a complaint at the call center regarding non-delivery of a product.

Business Process 3. <u>Marketing and Campaign Management</u>: When customers visit the firm's website and information collection from that is used for marketing and campaigns.

The following question is regarding the change in the above three business process scenarios while implementing integrated enterprise applications.

10. For each pair of business processes below, please choose to which extent, change in one business process will get more added value than change in the other business process, when implementing integrated enterprise applications.

	Extremely added value.	Very strong added value.	Strong added value.	Moderate added value.	Equal Added Value	Moderate added value	Strong added value	Very strong added value	Extremely added value	
Customer Orders Online	0	0	0	0	0	0	0	0	0	Customer Complaints at Call Centre
Customer Orders Online	0	0	0	0	0	0	0	0	0	Marketing and Campaign Management
Customer Complaints at Call Centre	0	0	0	0	0	0	0	0	0	Marketing and Campaign Management

7.5.6. Added Value of Integration (contd.)

From question 11 to 19, kindly tell us your opinion on how valuable certain attributes are to a firm.

- 11. How valuable is increasing on-time delivery to a firm's efficiency?
- Not valuable
- Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable
- 12. How valuable is making business planning better to a firm's efficiency?
- Not valuable
- Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable
 - 13. How valuable is increasing sales to a firm's efficiency?
- Not valuable
- Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable
 - 14. How valuable is it for a firm if its employees follow the firm's long term vision?
- Not valuable
- Slightly valuable
- Moderately Valuable
- Very Valuable
- Extremely Valuable
 - 15. How valuable is business process integration to a firm?
- Not valuable
- Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable
 - 16. How valuable is increasing alignment between business and IT to a firm?
- Not valuable



- Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable
 - 17. How valuable is increasing alignment between business and IT to a firm?
- Not valuable
- Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable
 - 18. How valuable is increasing data quality to a firm?
- Not valuable
- Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable
 - 19. How valuable is offering better customer experience to a firm's customer retention strategy?
- Not valuable
- C Slightly valuable
- Moderately Valuable
- Very Valuable
- C Extremely Valuable

7.5.7. Information Technology Capabilities

Information Technology Capability is defined as a firm's Information Technology resources. We propose that enterprise system adopters have to acquire new information technology capabilities to integrate their enterprise applications. The following statements address the capabilities needed by the adopters. Kindly tell us your level of agreement for each statement.

20. Non-managerial employees need to learn new technical skills to implement integrated enterprise applications.

- Strongly Disagree
- Disagree
- 0
- Somewhat Disagree

Neither Agree or Disagree



- Somewhat Agree
- Agree
- C Strongly Agree

21. Business managers need to learn new technical skills to implement integrated enterprise applications.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree

22. Information Technology managers need to learn new managerial skills to implement integrated enterprise applications.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree

23. Cross-department interaction between employees is necessary to understand the functionalities of integrated enterprise applications.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree

24. More hardware needs to be purchased to implement integrated enterprise applications.

- Strongly Disagree
- Disagree
- Somewhat Disagree



- Neither Agree or Disagree
- C Somewhat Agree
- Agree
- C Strongly Agree
 - 25. The speed of communication between the integrated enterprise applications should be increased.
- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree or Disagree
- Somewhat Agree
- Agree
- Strongly Agree

Appendix B - Analytic Hierarchy Example Solution

A detailed analysis of the calculation of Analytic Hierarchy Process (AHP) is provided in this appendix. AHP was used for analyzing the data collected from the survey. Figure B1 provides a sample calculation for a single respondent using AHP.

Value Criteria	Strategic	Managerial	Operational	Eigen Vector	Normalized Eigen Vector Cl	
Strategic	1	7	1	1,000	0,487	0,006
Managerial	1/7	1	1/5	0,160	0,078 CR	
Operational	1	5	1	0,894	0,435	0,011
Sum				2,054		
Strategic Sub criteria	Improved Business Planning	Better Customer Experience	More IT Alignment with business	Eigen Vector	Normalized Eigen Vector Cl	
Improved Business Planning	1	1/5	1	0,179	0,134	0,006
Better Customer Experience	5	1	7	1,000	0,747 CR	
More IT Alignment with business	1	1/7	1	0,160	0,119	0,011
Sum				1,339		
Managerial Sub criteria	Increased Company Common Vision	Accurate Sales Forecasting	Increased Data Quality	Eigen Vector	Normalized Eigen Vector Cl	
Increased Company Common Vision	1	5	3	1,000	0,637	0,019
Accurate Sales Forecasting	1/5	1	1/3	0,164	0,105 CR	
Increased Data Quality	1/3	3	1	0,405	0,258	0,033
Sum				1,570		
Operational Sub criteria	Improved on-time delivery	Integrated business process	Increase in Sales	Eigen Vector	Normalized Eigen Vector Cl	
Improved on-time delivery	1	1/5	1/5	0,139	0,086	0,068
Integrated business process	5	1	1/3	0,481	0,297 CR	
Increase in Sales	5	3	1	1,000	0,618	0,117
Sum				1,619		
Business Processes	Customer Orders Online	Customer Complaints at Call Centre	Marketing and Campaign Management	Eigen Vector	Normalized Eigen Vector Cl	
Customer Orders Online	1	7	1	1,000	0,557	0,068
Customer Complaints at Call Centre	1/7	1	1	0,273	0,152 CR	
Marketing and Campaign Management	1	1	1	0,523	0,291	0,117
Sum				1,796		
Final added value percentage & preferen	ce to business process					
Improved Business Planning	Better Customer Experience	More IT Alignment with business	Increased Company Common Vision		Average Consistency for this r	espondent
6,50%	36,38%	5,81%	4,96%	i		0,109
Accurate Sales Forecasting	Increased Data Quality	Improved on-time delivery	Integrated business process			
0,81%	2,01%	3,73%	12,92%	i		
Increase in Sales	Customer Orders Online	Customer Complaints at Call Centre	Marketing and Campaign Management	ĺ		
26,88%	55,68%	15,22%	29,11%			

Figure B2 shows the results of the aggregated weights of all the criteria, sub criteria and business processes done using AHP. The geometric mean is calculated for aggregation. The red column represents an inconsistent response.

Criteria	RI	R2	R3	R13	R14	R32	F I33	R34	R35	R38	Geometric Mean - All Stakeholders	Normailzed Geometric Mean - All Stakeholders	Added ¥alue Rank- All Stakeholders	criteria	weight	percentage
Strategic	0,487	0,202	0,731	0,333	0,200	0,602	0,637	0,114	0,333	0,481	0,242	0,312	1	Operational	0,381	38,10%
Managerial	0,078	0,701	0,081	0,333	0,600	0,075	0,258	0,481	0,333	0,114	0,253	0,327	2	Managerial	0,327	32,69%
Operational	0,435	0,097	0,188	0,333	0,200	0,324	0,105	0,405	0,333	0,405	0,280	0,361	3	Strategic	0,312	31,21%
CR	0,109	0,157	0,041	0,043	0,116	0,165	0,345	0,184	0,070	0,177	0,119	0,119				
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,775	1,000				
Subcriteria													Added ¥alue Rank- All Stakeholders	¥alues	weight	percentage
Improved Business Planning	0,065	0,021	0,283	0,111	0,091	0,192	0,048	0,025	0,074	0,050	0,057	0,090	1	Integrated business process	0,149	14,90%
Better Customer Experience	0,364	0,129	0,376	0,111	0,018	0,133	0,383	0,036	0,153	0,046	0,056	0,088	2	Increased Data Quality	0,144	14,43%
More IT Alignment with business	0,058	0,052	0,071	0,111	0,091	0,277	0,208	0,052	0,106	0,384	0,079	0,125	3	More IT Alignment with business	0,125	12,48%
Increased Company Common Vision	0,050	0,057	0,009	0,063	0,068	0,049	0,075	0,125	0,074	0,036	0,056	0,088	4	Increase in Sales	0,121	12,12%
Accurate Sales Forecasting	0,008	0,132	0,039	0,027	0,288	0,009	0,039	0,253	0,153	0,025	0,062	0,098	5	Accurate Sales Forecasting	0,098	9,75%
Increased Data Quality	0,020	0,512	0,033	0,244	0,243	0,017	0,144	0,103	0,106	0,052	0,092	0,144	6	Improved on-time delivery	0,097	9,69%
Improved on-time delivery	0,037	0,007	0,086	0,040	0,139	0,108	0,050	0,135	0,074	0,072	0,082	0,097	7	Improved Business Planning	0,090	8,99%
Integrated business process	0,129	0,058	0,086	0,249	0,026	0,108	0,012	0,135	0,153	0,210	0,095	0,149	8	Better Customer Experience	0,088	8,84%
Increase in Sales	0,269	0,031	0,017	0,045	0,035	0,108	0,042	0,135	0,106	0,123	0,077	0,121	9	Increased Company Common Vision	0,088	8,81%
sum Business Processes	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.635	1.000	Added ¥alue Rank- All Stakeholders	Business Processes	veight	percentage
Customer Orders Online	0,557	0,557	0,081	0,319	0,221	0,519	0,177	0,185	0,333	0,460	0,294	0,342	1	Marketing and Campaign Management	0,362	36,16%
Customer Complaints at Call Centre	0,152	0,152	0,188	0,221	0,319	0,177	0,304	0,659	0,333	0,221	0,258	0,297	2	Customer Orders Online	0,342	34,17%
Marketing and Campaign Management	0,291	0,291	0,731	0,460	0,460	0,304	0,519	0,158	0,333	0,319	0,311	0,362	3	Customer Complaints at Call Centre	0,297	29,67%
Sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,861	1,000				

Figure B2 – Aggregation of weights for all the responses from the survey

Criteria/Organizational Level	R1	R9	R10	R11	R12	R19	R20	R36	Geometric Mean	Normailzed Geometric Mean	Added Value Rank	Criteria/Organizational Level	Weight	Percentage
Strategic	0,487	0,092	0,097	0,081	0,279	0,405	0,405	0,075	0,182	0,235	1	Operational	0,4	41,79%
Managerial	0,078	0,170	0,515	0,731	0,072	0,481	0,481	0,324	0,268	0,347	1	2 Managerial	0,3	47 34,68%
Operational	0,435	0,738	0,388	0,188	0,649	0,114	0,114	0,602	0,323	0,418	1	3 Strategic	0,2	35 23,53%
CR	0,109	0,131	0,190	0,074	0,199	0,098	0,159	0,139	0,138	0,138				
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,773	1,000				
Subcriteria/Values											Added Value Rank	Sub Criteria/Values	Weight	Percentage
Improved Business Planning	0,065	0,042	0,018	0,007	0,190	0,046	0,046	0,025	0,037	0,054	1	Integrated business process	0,1	94 19,37%
Better Customer Experience	0,364	0,008	0,071	0,059	0,061	0,195	0,195	0,025	0,072	0,106	1	2 Increase in Sales	0,1	31 18,11%
More IT Alignment with business	0,058	0,042	0,008	0,015	0,028	0,164	0,164	0,025	0,039	0,057	1	3 Increased Company Common Vision	0,1	76 17,60%
Increased Company Common Vision	0,050	0,102	0,344	0,451	0,016	0,221	0,221	0,072	0,120	0,176	4	Better Customer Experience	0,1	06 10,58%
Accurate Sales Forecasting	0,008	0,013	0,045	0,063	0,051	0,106	0,106	0,103	0,045	0,066		5 Increased Data Quality	0,1	10,08%
Increased Data Quality	0,020	0,055	0,125	0,217	0,005	0,153	0,153	0,149	0,069	0,101	(Accurate Sales Forecasting	0,0	6,63%
Improved on-time delivery	0,037	0,316	0,038	0,021	0,047	0,020	0,020	0,086	0,045	0,065	1	Improved on-time delivery	0,0	6,54%
Integrated business process	0,129	0,105	0,200	0,091	0,421	0,059	0,059	0,258	0,132	0,194	8	3 More IT Alignment with business	0,0	57 5,73%
Increase in Sales	0,269	0,316	0,151	0,076	0,181	0,035	0,035	0,258	0,124	0,181	9	Improved Business Planning	0,0	54 5,37%
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,683	1,000				
Business Processes											Busines s Process Prefere	s Business Processes	Weight	Percentage
Customer Orders Online	0,557	0,519	0,214	0,221	0,281	0,515	0,691	0,134	0,341	0,399	1	Customer Orders Online	0,3	39,92%
Customer Complaints at Call Centre	0,152	0,304	0,260	0,319	0,584	0,097	0,189	0,119	0,217	0,254	1	2 Marketing and Campaign Management	0,3	47 34,67%
Marketing and Campaign Management	0,291	0,177	0,527	0,460	0,135	0,388	0,120	0,747	0,296	0,347	1	3 Customer Complaints at Call Centre	0,2	54 25,41%
Sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,854	1,000				

Figure B3 represents the aggregated weights for the Software Vendor Stakeholder.

Figure B3 - Aggregation of weights for all the software Vendor Respondents from the survey.

Figure B4 represents the aggregated weights for the Software Adopter Stakeholder.

Criteria/Organizational Level	R2	R5	R14	R16	R24	R25	R27	R28	R32	Geometric Mean	Normailzed Geometric Mean	Added Value Rank	Criteria/Organizational Level	Weight	Percentage
Strategic	0,202	0,333	0,200	0,156	0,200	0,092	0,114	0,114	0,602	0,189	0,223	1	Managerial	0,449	44,93%
Managerial	0,701	0,333	0,600	0,659	0,600	0,170	0,481	0,481	0,075	0,379	0,449	2	2 Operational	0,327	32,74%
Operational	0,097	0,333	0,200	0,185	0,200	0,738	0,405	0,405	0,324	0,276	0,327	3	3 Strategic	0,223	22,33%
CR	0,157	0,047	0,116	0,085	0,161	0,093	0,090	0,116	0,165	0,105	0,105				
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,844	1,000				
Subcriteria/Values												Added Value Rank	Sub Criteria/Values	Weight	Percentage
Improved Business Planning	0,021	0,111	0,091	0,047	0,044	0,008	0,081	0,032	0,192	0,049	0,072	1	Increased Data Quality	0,202	20,23%
Better Customer Experience	0,129	0,111	0,018	0,028	0,020	0,027	0,008	0,074	0,133	0,041	0,059	2	2 Increase in Sales	0,131	13,08%
More IT Alignment with business	0,052	0,111	0,091	0,081	0,136	0,057	0,025	0,008	0,277	0,064	0,093	3	Accurate Sales Forecasting	0,128	12,80%
Increased Company Common Vision	0,057	0,045	0,068	0,434	0,402	0,019	0,042	0,153	0,049	0,083	0,120	4	Increased Company Common Vision	0,120	12,03%
Accurate Sales Forecasting	0,132	0,094	0,288	0,103	0,053	0,069	0,117	0,221	0,009	0,088	0,128	5	5 Integrated business process	0,113	11,32%
Increased Data Quality	0,512	0,195	0,243	0,122	0,146	0,082	0,322	0,106	0,017	0,139	0,202	6	6 More IT Alignment with business	0,093	9,31%
Improved on-time delivery	0,007	0,111	0,139	0,124	0,019	0,065	0,098	0,032	0,108	0,057	0,082	7	7 Improved on-time delivery	0,082	8,20%
Integrated business process	0,058	0,111	0,026	0,016	0,103	0,494	0,036	0,197	0,108	0,078	0,113	8	3 Improved Business Planning	0,072	7,16%
Increase in Sales	0,031	0,111	0,035	0,045	0,078	0,179	0,271	0,176	0,108	0,090	0,131	9	Better Customer Experience	0,059	5,87%
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,689	1,000				
Business Processes												Business Process Preference Rank	Business Processes	Weight	Percentage
Customer Orders Online	0,557	0,460	0,221	0,460	0,135	0,319	0,304	0,669	0,519	0,366	0,403	1	Marketing and Campaign Management	0,335	33,46%
Customer Complaints at Call Centre	0,152	0,319	0,319	0,221	0,584	0,460	0,177	0,088	0,177	0,239	0,263	2	2 Customer Complaints at Call Centre	0,263	26,28%
Marketing and Campaign Management	0,291	0,221	0,460	0,319	0,281	0,221	0,519	0,243	0,304	0,304	0,335	3	3 Customer Orders Online	0,403	40,26%
Sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,910	1,000				

Figure B4 - Aggregation of weights for all the software adopter respondents from the survey.

Figure B5 represents the aggregated weights for the External Consultant Stakeholder.

Criteria/Organizational Level	R3	R6	R13	R15	R17	R23	R26	R29	R31	R35	R37	Geometric Mean	Normailzed Geometric Mean	Added Value Rank	Criteria/Organizational Level	Weight	Percentage
Strategic	0,731	0,637	0,333	0,174	0,324	0,135	0,143	0,487	0,753	0,333	0,097	0,303	0,381	1	Operational	0,389	38,89%
Managerial	0,081	0,105	0,333	0,132	0,075	0,584	0,143	0,078	0,184	0,333	0,701	0,183	0,230	2	Strategic	0,381	38,11%
Operational	0,188	0,258	0,333	0,694	0,602	0,281	0,714	0,435	0,063	0,333	0,202	0,310	0,389	3	Managerial	0,230	22,99%
CR	0,041	0,086	0,043	0,088	0,069	0,149	0,074	0,181	0,153	0,070	0,075	0,094	0,094				
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,796	1,000				
Subcriteria/Values														Added Value Rank	Sub Criteria/Values	Weight	Percentage
Improved Business Planning	0,283	0,178	0,111	0,030	0,139	0,010	0,016	0,089	0,167	0,074	0,039	0,072	0,101	1	More IT Alignment with business	0,202	20,17%
Better Customer Experience	0,376	0,046	0,111	0,016	0,046	0,038	0,016	0,219	0,240	0,153	0,011	0,076	0,107	2	Integrated business process	0,178	17,84%
More IT Alignment with business	0,071	0,413	0,111	0,129	0,139	0,088	0,111	0,180	0,346	0,106	0,047	0,144	0,202	3	Increased Data Quality	0,124	12,42%
Increased Company Common Vision	0,009	0,019	0,063	0,011	0,008	0,065	0,043	0,005	0,021	0,074	0,155	0,021	0,030	4	Improved on-time delivery	0,108	10,80%
Accurate Sales Forecasting	0,039	0,016	0,027	0,025	0,008	0,189	0,025	0,024	0,088	0,153	0,322	0,037	0,053	5	Better Customer Experience	0,107	10,72%
Increased Data Quality	0,033	0,069	0,244	0,096	0,058	0,331	0,074	0,049	0,075	0,106	0,223	0,088	0,124	6	Improved Business Planning	0,101	10,14%
Improved on-time delivery	0,086	0,052	0,040	0,056	0,122	0,169	0,238	0,145	0,014	0,074	0,018	0,077	0,108	7	Increase in Sales	0,096	9,64%
Integrated business process	0,086	0,181	0,249	0,507	0,058	0,091	0,238	0,145	0,020	0,153	0,092	0,127	0,178	8	Accurate Sales Forecasting	0,053	5,25%
Increase in Sales	0,017	0,025	0,045	0,131	0,422	0,021	0,238	0,145	0,029	0,106	0,092	0,069	0,096	9	Increased Company Common Vision	0,030	3,01%
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,713	1,000				
Business Processes														Business Process Preference Rank	Business Processes	Weight	Percentage
Customer Orders Online	0,081	0,602	0,319	0,072	0,481	0,135	0,460	0,405	0,519	0,333	0,086	0,273	0,321	1	Marketing and Campaign Management	0,408	40,83%
Customer Complaints at Call Centre	0,188	0,324	0,221	0,649	0,114	0,281	0,221	0,114	0,177	0,333	0,297	0,230	0,270	2	Customer Orders Online	0,321	32,13%
Marketing and Campaign Management	0,731	0,075	0,460	0,279	0,405	0,584	0,319	0,481	0,304	0,333	0,618	0,348	0,408	3	Customer Complaints at Call Centre	0,270	27,04%
Sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,851	1,000				

Figure B5 - Aggregation of weights for all the External Consultant Respondents from the survey.

Figure B6 represents the aggregated weights for the Academic Consultant Stakeholder.

Criteria/Organizational Level	R4	R7	R8	R21	R22	R30	R34	R38	Geometric Mean	Normailzed Geometric Mean	Added Value Rank	Criteria/Organizational Level	Weight	Percentage
Strategic	0,731	0,091	0,304	0,785	0,097	0,388	0,114	0,481	0,275	0,366		1 Strategic	0,366	36,57%
Managerial	0,188	0,455	0,633	0,066	0,515	0,097	0,481	0,114	0,237	0,314		2 Operational	0,320	31,99%
Operational	0,081	0,455	0,063	0,149	0,388	0,515	0,405	0,405	0,241	0,320		3 Managerial	0,314	31,44%
CR	0,085	0,116	0,000	0,042	0,162	0,145	0,184	0,177	0,114	0,114				
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,752	1,000				
Subcriteria/Values											Added Value Rank	Sub Criteria/Values	Weight	Percentage
Improved Business Planning	0,522	0,026	0,237	0,102	0,030	0,201	0,025	0,050	0,084	0,133		1 Accurate Sales Forecasting	0,146	14,56%
Better Customer Experience	0,049	0,053	0,034	0,049	0,017	0,069	0,036	0,046	0,041	0,065		2 More IT Alignment with business	0,145	14,52%
More IT Alignment with business	0,160	0,012	0,034	0,635	0,051	0,118	0,052	0,384	0,092	0,145		3 Improved Business Planning	0,133	13,26%
Increased Company Common Vision	0,015	0,037	0,308	0,022	0,156	0,009	0,125	0,036	0,047	0,075		4 Improved on-time delivery	0,133	13,34%
Accurate Sales Forecasting	0,082	0,332	0,276	0,022	0,091	0,054	0,253	0,025	0,092	0,146		5 Integrated business process	0,120	11,96%
Increased Data Quality	0,092	0,086	0,049	0,022	0,267	0,034	0,103	0,052	0,067	0,106		6 Increased Data Quality	0,106	10,64%
Improved on-time delivery	0,049	0,117	0,041	0,050	0,240	0,095	0,135	0,072	0,084	0,133		7 Increased Company Common Vision	0,075	7,45%
Integrated business process	0,016	0,290	0,017	0,050	0,115	0,080	0,135	0,210	0,076	0,120		8 Increase in Sales	0,077	7,72%
Increase in Sales	0,016	0,048	0,005	0,050	0,033	0,339	0,135	0,123	0,049	0,077		9 Better Customer Experience	0,065	6,55%
sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,632	1,000				
Business Processes											Business Process Preference Rank	Business Processes	Weight	Percentage
Customer Orders Online	0,092	0,352	0,221	0,405	0,460	0,455	0,185	0,460	0,291	0,345		1 Customer Orders Online	0,345	34,51%
Customer Complaints at Call Centre	0,170	0,552	0,319	0,481	0,221	0,091	0,659	0,221	0,284	0,337		2 Customer Complaints at Call Centre	0,337	33,66%
Marketing and Campaign Management	0,738	0,096	0,460	0,114	0,319	0,455	0,156	0,319	0,268	0,318		3 Marketing and Campaign Managemen	0,318	31,82%
Sum	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,843	1,000				

Figure B6 - Aggregation of weights for all the Academic Professional Respondents from the survey.

Appendix C - Factor Analysis Results

In order to find this, Spearman Rank Order Correlation was used since the data resulted in nonnormal distribution. For both the relationships, no correlations were found with p=0,05.

The Kruskal–Wallis one-way analysis of variance by ranks was performed (since the data resulted in non-normal distribution) to determine if there is a statistical differences between the stakeholders on the variables. The test revealed that there was no significant differences between any of the variables with p=0,05.

A Principal Axis Factor (PAF) with a Varimax (orthogonal) rotation for the Likert items was performed for two reasons. One, the effort to correlate the weights obtained from AHP with the ordinal scales failed, hence an appropriate technique to convert the ordinal to interval scales was needed. Factor analysis is used for this purpose. Second, once we obtain the interval values of the ordinal scales, it is possible to perform regression analysis. Hence, the importance of the added values and the information capabilities variables were used in the factor analysis. The results of the factor analysis were:

- 1. For information technology capabilities, the factor analysis resulted in Kaiser-Meyer Olkin measure of sampling adequacy of 0,561 which means that factor analysis can be done. Further, the analysis led to two factors with Eigen values of 2,169 and 1,575
- 2. For the importance of added value, the factor analysis resulted in Kaiser-Meyer Olkin measure of sampling adequacy of 0,590 which means that factor analysis can be done. Further, the analysis led to three factors with Eigen values of 3,443, 1,423 and 1,267

Once the factors were determine, the next step is to determine if there is a correlation between the factors identified along with the other variables. The aim of doing is that to:

- 1. Determine if there is a relationship between the choices of business processes with the intensity of added values.
- 2. Determine if there is a relationship between the intensity of the added values and the importance of the added values.

Factor Analysis for Information Technology Capabilities

Descriptive Statistics					
	Mean	Std. Deviation	Analysis N		
If the adopter has to accommodate integrated applications, then the non- technical employees have to increase their IT technical knowledge.	4,92	1,024	38		
If the adopter has to accommodate integrated applications, then business oriented managers have to	3,32	1,435	38		

increase their IT technical			
knowledge.			
If the adopter has to	5.42	1,266	38
accommodate integrated	,	,	
applications, then IT oriented			
managers have to increase their			
knowledge of the firm's			
business processes.			
If the adopter has to	6,05	1,089	38
accommodate integrated	,	,	
applications, then there should			
be increased cross department			
interaction between employees.			
If the adopter has to	3.66	1.494	38
accommodate integrated	-)	,	
applications, then investments			
for purchasing more hardware			
is needed.			
If the adopter has to	4 55	1 389	38
accommodate integrated	1,00	1,000	50
applications, then enterprise			
applications need faster			
communication technologies			
between them.			

KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy. ,561			
Bartlett's Test of Sphericity	46,227		
	Df	15	
	Sig.	,000	

Communalities				
	Initial	Extractio		
		n		
If the adopter has to	1,000	,630		
accommodate integrated				
technical employees have to				
increase their IT technical				
knowledge.				
If the adopter has to	1,000	,483		
accommodate integrated	-	-		
applications, then business				
increase their IT technical				
knowledge.				
If the adopter has to	1.000	.640		
accommodate integrated	-,000	,010		
applications, then IT oriented				
managers have to increase their				
knowledge of the firm's				
business processes.				

If the adopter has to	1.000	638
accommodate integrated	1,000	,000
applications, then there should		
be increased cross department		
interaction between employees.		
If the adopter has to	1.000	660
accommodate integrated	1,000	,000
applications, then investments		
for purchasing more hardware		
are needed.		
If the adopter has to	1.000	694
accommodate integrated	1,000	,051
applications, then enterprise		
applications need faster		
communication technologies		
between them.		
Extraction Method: Principal Co	mponent Ana	lysis
Extraction method. I micipal Co.	mponent ma	uy 515.

Total Variance Explained									
Compon		Initial Eige	envalues	Extraction Sums of Squared		Rotation Sums of Squared			
ent		-			Loadings			Loadings	
	Т	% of	Cumulative	Total	% of	Cumulati	Total	% of	Cumula
	ot	Varianc	%		Varianc	ve %		Varianc	tive %
	al	e			e			e	
1	2,	36,154	36,154	2,169	36,154	36,154	1,978	32,961	32,961
	16								
	9								
2	1,	26,256	62,410	1,575	26,256	62,4 10	1,767	29,449	62,410
	57								
	5								
3	,8	14,372	76,782						
	62								
4	,6	10,958	87,740						
	57								
5	,4	6,851	94,591						
	11								
6	,3	5,409	100,000						
	25								
Extraction I	Method	l: Principal (Component Ana	lysis.					

Component Matrix ^a			
	Comr	onent	
a. 2 components extracted.	Comp	Jonenie	
	1	2	
If the adopter has to		,701	
accommodate integrated			
applications, then the non-			
technical employees have to			
increase their IT technical			
knowledge.			
If the adopter has to	,633		
accommodate integrated			
applications, then business			
oriented managers have to			
increase their IT technical			
knowledge.			
If the adopter has to	,716		
accommodate integrated	,		
applications, then IT oriented			
managers have to increase			
their knowledge of the firm's			
business processes.			
If the adopter has to		,655	
accommodate integrated			
applications, then there			
should be increased cross			
department interaction			
between employees.			
If the adopter has to	,682		
accommodate integrated			
applications, then			
investments for purchasing			
more hardware is needed.			
If the adopter has to	,667		
accommodate integrated			
applications, then enterprise			
applications need faster			
communication technologies			
between them.			
Extraction Method: Principal O	Component A	nalysis.	

Rotated Component Matrix ^a				
	Component			
	1	2		
If the adopter has to accommodate integrated applications, then the non- technical employees have to increase their IT technical knowledge.		,788		
If the adopter has to accommodate integrated applications, then business oriented managers have to	,684			

increase their IT technical		
knowledge.		
If the adopter has to		701
accommodate integrated		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
applications, then IT oriented		
managers have to increase		
their knowledge of the firm's		
business processes.		
If the adopter has to		799
accommodate integrated		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
applications, then there		
should be increased cross		
department interaction		
between employees.		
If the adopter has to	812	
accommodate integrated	,012	
applications, then investments		
for purchasing more		
hardware is needed.		
If the adopter has to	832	
accommodate integrated	,032	
applications, then enterprise		
applications need faster		
communication technologies		
between them.		
Rotation converged in 3 iteratio	ns.	
2		
a.		

Component Transformation Matrix				
Component	1	2		
1	,823	,568		
2	-,568	,823		
Extraction Method: Principal				
Component Analysis.				

Rotation Method: Varimax with Kaiser

Normalization.

Factor Analysis for Importance of Added Value

Descriptive Statistics					
	Mean	Std. Deviation	Analysis N		
How valuable is increasing	3,61	,823	38		
on-time delivery to a firm's					
efficiency?					
How valuable is	3,66	,781	38		
making business planning					
better to a firm's efficiency?					
How valuable is increasing	3,24	1,173	38		

sales to a firm's efficiency?			
How valuable is it for a firm if its employees follow the firm's long term vision?	3,16	1,151	38
How valuable is business process integration to a firm?	4,13	,844	38
How valuable is increasing alignment between business and IT to a firm?	4,50	,726	38
How valuable is accurate sales forecast to a firm?	3,55	,950	38
How valuable is increasing data quality to a firm?	3,89	,863	38
How valuable is offering better customer experience to a firm's customer retention strategy?	4,16	,823	38

KMO and Bartlett's Test				
Kaiser-Meyer-Olkin Measure of Sampling Adequacy. ,590				
Bartlett's Test of Sphericity	st of Sphericity Approx. Chi-Square			
	df	36		
	Sig.	,000		

Communanties					
	Initial	Extraction			
How valuable is increasing on-					
time delivery to a firm's	1,000	,604			
efficiency?					
How valuable is					
making business planning	1,000	,512			
better to a firm's efficiency?					
How valuable is increasing sales	1.000	765			
to a firm's efficiency?		,705			
How valuable is it for a firm if					
its employees follow the firm's	1,000	,747			
long term vision?					
How valuable is business	1.000	,716			
process integration to a firm?	1,000				
How valuable is increasing					
alignment between business	1,000	,729			
and IT to a firm?					

Communalities

How valuable is accurate sales forecast to a firm?	1,000	,742
How valuable is increasing data quality to a firm?	1,000	,694
How valuable is offering better	1.000	623
customer retention strategy?	1,000	,023

Extraction Method: Principal Component Analysis.

Componen	Initial Eigenvalues		Extraction Sums of Squared		Rotation Sums of Squared				
t				Loadings		gs	Loadings		<u>Ş</u> S
	Total	% of	Cumulative	Total	% of	Cumulative	Total	% of	Cumulative
		Varianc	%		Varianc	%		Varianc	%
		e			e			e	
1	3,443	38,260	38,260	3,443	38,260	38,260	2,759	30,661	30,661
2	1,423	15,811	54,070	1,423	15,811	54,070	2,097	23,300	53,961
3	1,267	14,075	68,146	1,267	14,075	68,146	1,277	14,185	68,146
4	,985	10,949	79,094						
5	,675	7,500	86,595						
6	,484	5,377	91,971						
7	,361	4,009	95,980						
8	,201	2,235	98,215						
9	,161	1,785	100,000						

Total Variance Explained

Extraction Method: Principal Component Analysis.



TT 1 11 · · · ·			
How valuable is increasing on-			
time delivery to a firm's	,593		-,503
efficiency?			
How valuable is			
making business planning	,523		
better to a firm's efficiency?			
How valuable is increasing sales			0.01
to a firm's efficiency?			,621
How valuable is it for a firm if			
its employees follow the firm's	,845		
long term vision?			
How valuable is business	727		
process integration to a firm?	,/3/		
How valuable is increasing			
alignment between business		,541	
and IT to a firm?			
How valuable is accurate sales	714		
forecast to a firm?	,/14		
How valuable is increasing data	701		
quality to a firm?	,/81		
How valuable is offering better			
customer experience to a firm's		,640	
customer retention strategy?			

Extraction Method: Principal Component Analysis.

a. 3 components extracted.

Rotated Component Matrix ^a					
	Component				
	1	2	3		
How valuable is increasing	, 550				
on-time delivery to a firm's					
efficiency?					
How valuable is	,696				
making business planning					
better to a firm's efficiency?					
How valuable is increasing			,853		
sales to a firm's efficiency?					
How valuable is it for a firm if	,729				
its employees follow the					
firm's long term vision?					
How valuable is business		,766			
process integration to a firm?					

How valuable is increasing alignment between business and IT to a firm?		,794		
How valuable is accurate sales forecast to a firm?	,856			
How valuable is increasing data quality to a firm?	,740			
How valuable is offering better customer experience to a firm's customer retention strategy?		,728		
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 4 iterations.				

Component Transformation Matrix					
Component	1	2	3		
1	,814	,580	-,017		
2	-,567	,787	-,243		
3	-,128	,208	,970		

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Kruskal–Wallis one-way analysis of variance by ranks

Variables	Chi- Square	df	Asymp. Sig.
Factor_1 of Information Technology Capabilities	,707	3	,871
Factor_2 of Information Technology Capabilities	2,562	3	,464
Factor_1 of Importance of Added Value	2,438	3	,487
Factor_2 of Importance of Added Value	6,090	3	,107
Factor_3 of Importance of Added Value	7,464	3	,058
Improved_Business_Planning	2,370	3	,499
Better_Customer_Experience	1,191	3	,755
More_IT_Alignment_with_Business	4,628	3	,201
Increased_Company_Common_Vision	3,506	3	,320
Accurate_Sales_Forecasting	,899	3	,826
Increased_Data_Quality	2,844	3	,416
Improved_On_Time_Delivery	6,065	3	,108
Integrated_Business_Process	8,038	3	,055
Increased_in_Sales	5,203	3	,157
Customer_Orders_Online	3,446	3	,328
--	--------	---	------
Customer_Complaint_Call_Center	,820	3	,845
Marketing_Campaign_Management	2,677	3	,444
The speed of communication between the integrated enterprise applications should be increased.	2,015	3	,569
Fast Moving Consumer Goods is a suitable industry to implement integrated enterprise applications	,427	3	,935
The use of digital channels by end customers influences adopters to redesign their business processes	3,431	3	,330
Integrated enterprise applications offer additional value to adopters	7,488	3	,058
Integrated enterprise applications help vendors to differentiate their products from competitors' products	10,222	3	,047
External consultants play an important role in implementing integrated enterprise applications	4,287	3	,232



TUDelft













 \mathbf{S}_{15} – Frequency Distribution



Specification 1: The high range shows that there is a difference in the consensus of the respondents. The reason for such a wide difference could be because the respondents feel that competitive advantage gained out of developing enterprise applications may not be sufficient enough to differentiate vendor's products. Another reason could be that most vendor competitors could do also develop integrated applications to nullify the first mover advantage. The negative skewness and median (5) show that many of the respondents believe integrated applications offer some competitive advantage. The maximum numbers of respondents neither agree nor disagree to the specification. Clearly, there should be more research done specific to what role does integrated applications play in the business strategy of vendors and how it can alter the vendor market.

Specification 2: It shows a clear consensus about the role of external consultants in integration applications. The reason being that adopters will have to redesign their business processes more when integrating applications. Consultants' responsibility lies in making sure those implementing enterprise applications without causing major re-structuring of the adopter's business processes. Hence, their role is very important. Maximum number of respondents chose to agree with the specification.

Specification 3: The range is low while the maximum number of respondents chose to agree with the specification. The low range and negative skewness show the consensus among the respondents and its more on the higher agreement level. This is an interesting result keeping in mind that the goal of the thesis is to find added values for the adopters. The results support the motivation behind this thesis that finding added values for adopters when integrating applications is useful.

Specification 4: The high range is due two respondents choosing strongly disagree and disagree. But most of the respondents agree more to the specifications which is seen by the high negative skew. This result supports the fact that customers are becoming more digital during shopping hence firms have to adjust their business processes to keep up with their customers.

Specification 5: Again, the high range is due to one respondent disagreeing to the specification. The high negative skew means there is a high level of agreement for the specification. Most of the respondents chose to agree with the specification. This results support the motivation behind choosing FMCG industry for this research.

Specification 6: The responses show a high level of agreement to the specification with a range of 3. None of the responses has disagreed that business planning is very valuable to adopter's efficiency. There is a slight negative skew with the maximum number of responses (nearly 20) being that business planning is very valuable to efficiency.

Specification 7: The responses completely agree with the specification which is evident from a very high negative skewness (-1,566). Most of the responses think that business and IT alignment is extremely important to a firm.

Specification 8: Here as well, there is a high consensus about the specification. The maximum number of responses believed customer experience is very valuable to the firm which is evident from a high negative skew (-0,923).



Specification 9: There are fewer consensuses about the specification. Responses are more distributed compared to the previous specifications and most responses point out to the fact that having a common vision towards the company is only slightly valuable to the firm. The range of 5 shows the lack of consensus about the specification. This is the only specification which has a positive skew (0,236).

Specification 10: There was a high consensus to the specification with a negative skewness (-0,159) and most responses to the fact that increasing data quality is very valuable to the firm. **Specification 11:** There was a high consensus to the specification with a negative skewness. Most responses agreed that accurate sales forecast is very valuable to the firm.

Specification 12: The lower negative skewness shows that although most responses were to "very valuable". Some responses were also towards "moderately valuable". Hence, to an extent the specification can be assumed to hold good.

Specification 13: There was a convergence with this specification. Most responses believed that integrating the business process is very valuable to the firm. A very high negative skewness supports this fact.

Specification 14: Only for this specification, the number of responses recorded the highest response for "not valuable" but still there is a negative skewness to the results. The high range shows the lack of consensus between the respondents.

Specifications 15 to 18: They are conceptualized as the human capabilities required for integration. Specification 16, 17 and 18 have a negative skew which implies that responses agree to the specifications. Specification 18 has the highest skewness negative (-1,036), there is a stronger consensus for this specification, also shown by the low range (4). The only specification to show a positive skewness is 16, which also shows the highest range showing a lack of consensus. Respondents believe that there is no need for business managers to learn any technical knowledge about integration since the maximum number of respondents chose to disagree with the specification.

Specification 19: The positive skewness (0,165) indicates to the general disagreement to the specification. It can be explained because when enterprise applications are integrated, the hardware storage required will only decrease since most data is shared between the applications.

Specification 20: The maximum respondents neither disagreed nor agreed (19) with the specification.

Appendix E – Survey Design Steps

As mention in Chapter 5, in order to create the online survey, an online survey tool called SurveyGizmo was used. This appendix will explain the steps taken to create the survey.

- 1. The researcher had to register with the tool by monthly subscription and then an account should be created.
- 2. Then, a new survey was created.
- 3. The type of questions for the ordinal type questions was already existing with the tool (likert 5 or 7 point scale)
- 4. For the AHP type questions, the most appropriate question type was semantic differential.
- 5. Because, this made the pair-wise comparison possible.
- 6. The pair-wise comparison in semantic differential type questions is filled based on a single header and 2 columns (one on the left and one on the right). The headers were filled with the rating scale (1, 3, 5, 7, and 9) with one being equal added value and 9 being extreme added value. Both the columns were either filled with the criteria/organizational value or sub criteria/values or business processes. The elements were filled pair-wise. Hence, for a single question such as Better Customer Experience and Improved Business Planning, one will be on the left side of the header and another on the right side.
- 7. All questions were made compulsory except name of the respondent.

Steps taken after data collection and before analysis

Pre data analysis steps had to be taken to convert the survey responses to a suitable format that can be used for analyzing the data. The most suitable format is Excel files.

1. SurveyGizmo tool had the option to convert responses into pdf files. The data can be downloaded with the response ID as reference.

2. Then, from the pdf files, the Excel sheets were generated manually by making the necessary reciprocal matrices for AHP.

3. SPSS was used to analyze the data for the Likert Scale type questions.

Appendix F – Data Analysis (AHP)

This appendix will explain the data analysis carried out in Analytic Hierarch Process.

Data for analysis was obtained from the online survey. The data was pre processed by downloading the pdf documents from the survey tool and manually entering the responses into Excel sheet. Excel was used since its user friendly and it's simpler to perform data analysis using Excel.

The main steps in the analysis in AHP are to first determine the preferences (intensity of added value) for each respondent and then aggregate all the preferences to provide a consensus.

Individual Responses

As explained in Chapter 5, each pair-wise comparison leads to a single reciprocal matrix. The reciprocal matrix is a square matrix. Hence, if there are 3 criteria (as it is in our case), the reciprocal matrix is a 3x3 matrix.

The entries in the reciprocal matrix are filled based on the responses. The following rules apply when comparing two criteria, say a and b:

- 1. Reciprocal matrix entry: $i_{ab} > 1$ if criteria a is more preferred than criteria b.
- 2. Reciprocal matrix entry $i_{ab} < 1$ if criteria a is less preferred than criteria b.
- 3. Reciprocal matrix entry $i_{ab}=1$ if both the criteria are equally preferred.
- 4. $i_{ab}*i_{ba}=1$ (this condition must always be satisfied)
- 5. The leading diagonal should always be 1.

An example matrix is shown below

Value Criteria	Strategic	Managerial	Operational
Strategic	1	7	1
Managerial	1/7	1	1/5
Operational	1	5	1

This respondent strongly prefers the strategic level values than the managerial level values (7). He also prefers operational values more than the managerial values (5) although with lesser strength than how he preferred strategic over managerial. He prefers strategic and operational values equally.

The next step in the analysis is to determine the relative preference or weights of each element in the criteria. In order to this, Eigen vector method was used. Eigen vector method determines the Eigen vector for each row in the matrix based on geometric mean. Then the Eigen vectors are normalized from 0 to 1 (for the purpose of obtaining a percentage). For the previous example, the process continues in the figure shown below.

Value Criteria	Strategic	Managerial	Operational	
Strategic	1	7	1	
Managerial	1/7	1	1/5	
Operational	1	5	1	
Eigen Vector	1,000	0,160	0,894	Total: 2,054
Weight (Normalized Priority Vector)	0,487	0,078	0,435	
Rank	1	3	2	

From the above figure, it is clear that weight for strategic criteria is the highest (0,487), followed by operational (0,435) and finally managerial (0,078). This respondent clearly thinks added values add negligible value to the managerial level of the adopters firm.

Similar approach is carried for each criteria and sub-criteria.

The final step is to calculate the global weights for the sub-criteria. The weights obtained above are known as the local weights (or priorities). To reiterate, AHP follows a hierarchy approach, hence it is necessary to calculate a global weight as well for the sub-criteria. Global weights are weights given to the sub-criteria elements which make them comparable to all the other subcriteria in the hierarchy. The global criteria are calculated by multiplying the local weights of each sub criteria with the local weights of their corresponding criteria. Following is the same calculation as the figure above but for sub-criteria under the strategic criteria.

				1
	T	Detter	More IT	
0 , , , ,	Improved	Better	Alignment	
Strategic	Business	Customer	with	
Sub criteria	Planning	Experience	business	
Improved				
Business				
Planning	1	1/5	1	
Better				
Customer				
Experience	5	1	7	
More IT				
Alignment				
with				
business	1	1/7	1	
Eigen				
Vector	0,179	1,000	0,160	1,33
	í í	í í	More IT	
	Improved	Better	Alignment	
	Business	Customer	with	
	Planning	Experience	business	
Weight		I		
(Normalized				
Priority				
Vector)	0,134	0,747	0,119	
Rank	2	1	3	

Sub Criteria	Local Weights of Sub criteria	Weights of Strategic Criteria	Global weights of Sub criteria
Improved Business Planning	0,134	0,487	0,065
Better Customer Experience	0,747	0,487	0,364
More IT Alignment with business	0,119	0,487	0,058

Now the global weights are calculated by multiplying the weights of the criteria with the local weights of the sub criteria. The table below shows the procedure

Consistency

Consistency is an important part of AHP. A particular response is inconsistent if the following rule applies:

Suppose we have 3 criteria say A, B, C. A response is inconsistent if the respondent prefers criterion A over criterion B, then prefers criterion B over criterion C but then prefers criterion C over criterion A. This is inconsistent since it does not satisfy the transitivity property. The logical explanation would be that a criterion A is better than criterion B. But human beings are not always consistency 100%, hence a certain degree of inconsistency is acceptable. To calculate the acceptable inconsistency, we use the consistency index explained in Chapter 5. Based on these values, identified 6 inconsistent responses out of the 49 responses we received. 36 of the responses were consistent and 7 were partially completed.

Aggregating all the responses

Once the individual responses were analyzed, then the data has to be aggregated. The aggregation was done by combining all the responses and also based on the experts groups. Geometric mean was used since they also have ratio properties, compared to arithmetic mean.