DBA THESIS

Market Insights and their influence on Software product design. Application : Taguchi Methods

DBA Thesis

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Doctor of Business Administration

Whilst registered as a candidate for the above mentioned degree and a student of European International University, I have not been registered for any other research degree. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.



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Abstract

The Paper reports the findings of Applied research of Taguchi methods in Product engineering. It is specifically examined the relationship between Market Insights and Product feature capabilities of Software products performance when measuring the different components of product design and winning the market sales. Taguchi method is applied for the loss function mapping in software design process with an objective to improve product feature capabilities in the early stages of design. The study also proved that there was a significant relationship between Product feature capabilities and the Go-to-Market strategy. This paper also provides recommendations to the software companies and for further research.

Information technology and Software product development companies use traditional reliability engineering methods to calibrate the objective functions of their new software products to meet various market demands and customer requirements. These methods are marginally effective in reducing failure rates of their Software products with the competitive alternates. To fundamentally improve the Product quality, the engineers need to focus on improving the robustness of the basic functions and features of their new products or process technologies and apply parameter based design methods to make the basic functions and features approach the ideal requirements under real market demand conditions and overcome competition. These robust design activities should be conducted by research and development departments or rely on the Market Insights from research analysts who has done this Research in the product engineering before actual products are released with a Go-to-Market strategy. The objective is to improve the downstream reproducibility of new technologies. The technical development of an Software product is used to explain this proposition. An organization is at the point of taking up a new project with an objective of improving the software product quality by feature enrichments, Taguchi method is applied for the software design process with an objective that more than one new feature is found per competing alternate software product in the Market. The strategy in robust design and continuous innovation / improvements by absorbing the Market Insights and comparison of competing software product in the market to optimize the software product design by maximizing product feature capability measures with respect to design parameters. Towards this a cause and effect diagrams for design features was drawn. Subsequently a design strategy focusing on the Software Product Engineering approach is defined with the opinions from customers, product owners and delivery personnel

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2 List of Abbreviations

DBA – Doctor of Business Administration
SAP – Systems Applications and Products
CMI – Customer, Competitive and Market Insights
IoT – Internet of Things
LE-ACE – Land Early, Adopt to Consume and Expand
PFC – Product Feature Capabilities
OKR – Objective Key Results
PhD – Doctor of Philosophy
SME – Small and Medium sized Enterprises
GTM – Go to Market
SRS – Simple random sampling
NAS – Network Attached storage
MQ – Magic Quadrant
AML – Anti-Money Laundering
KYC – Know your customer
CMU – Consolidated Market Units
PE – Product Engineering
CPP – Cloud platform products
LOB – Line of Business
LTO – Long term Orientation
IDC – International Data Corporation
FSI – Financial Service Industry
CeFPro – Center for Financial Professionals
IT – Information Technology
PS – Professional services also called Consulting
BS – Business Software
CC – Cloud Computing
TCO – Total cost to Ownership / Total cost to Operations
TCI – Total cost to Implementation

Additionally there are NO typographic conventions

3 Structure of Study

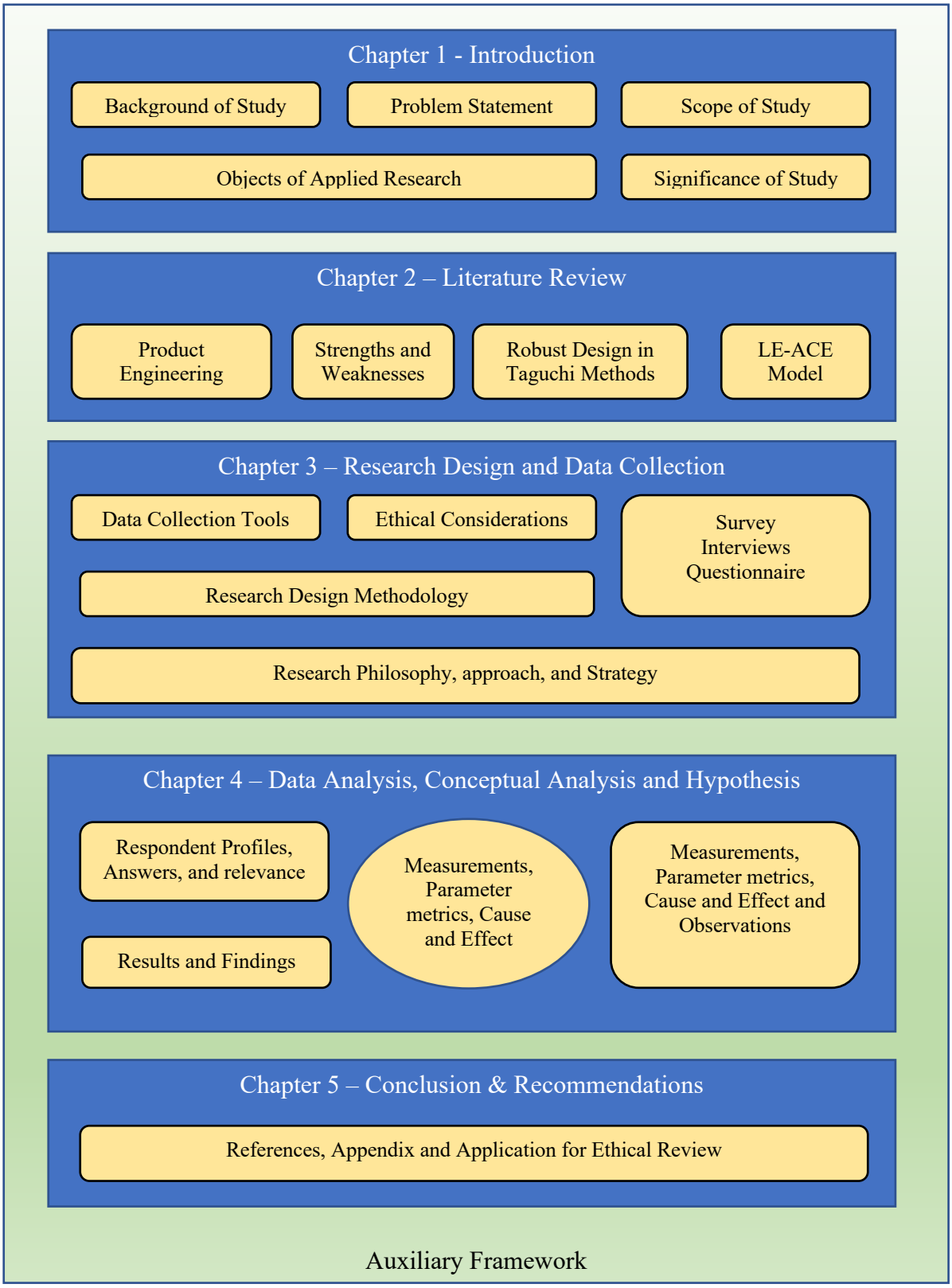


Figure 1.1: Thesis structure

The study starts with a critical examination of the body of literature. In a first step, the terms services, respectively Robust design of Products and the theory of Market Insights correlating to Product Engineering are reviewed. Having defined the two major fields of this study both fields will be connected and working hypothesis for possible links are developed in the last section of that part. The literature review chapter is followed by the development of the research model in Chapter III. In this section the investigated dimensions of product design are defined and the research model for the study is built. The section ends with the development of research hypotheses how the Market insights influencing the rage of continuous improvements in the product design by applying taguchi methodologies.

- Robust Design of Products
  - Dependent variables : Product Feature Capabilities

- Market Insights
  - Dependent variables : Gartner's Magic Quadrant
  - Dependent variables : IDC Market Segmentation

- Independent Variables
  - Go-to-Market Strategy
  - Customer Wins against the competitors

4 Chapter Synopsis

Chapter I : List of Abbreviations
Chapter I : Structure of the Study
Chapter I : Introduction

Chapter II : Literature Review

Chapter III : Continuous Innovation and Design with Applied Research by Taguchi Methods
Chapter III : Conceptual Framework and Development of Hypothesis
Chapter III : Methodology

Chapter IV : Findings
Chapter IV : Discussion

Chapter V : Conclusion

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5 Introduction

5.1 Background of Study

Feature capabilities of a Software Product plays an important role in every successful sales deal as any ineffective features will result in loss of customers and sale deals against the competitive alternates. An effective and robust features is able to generate more software sales for the company which directly affects the performance of the company. Therefore it requires a systematic approach based on Market insights which is managed by a group of employees who are experts in this area (e.g., department of CMI). Most studies in the Information Technology industry concentrates on the Customer Demand and Go to Market Strategy as the target end result is about "Winning the customer". Therefore this research attempts to widen the lengths and breadths of the Feature scope by examining a sales cycle in the Information Technology Industry based on product capabilities comparing against competing alternates.

5.2 Problem Statement

There are two problems that underlie this research. The first one arose when the stakeholders raised the issue of inefficiency in the company's performance with target revenues affecting directly the number of sales deals

The second problem is based on the software readiness, which shows that company X not having a quick turnaround getting into the market with a clear GTM strategy and winning the customers against the competitive alternatives with their Software Products aligning to the Product design within their respective Engineering departments in the Company.

5.3 Objectives of Applied Research

The general objective of this research is to examine the software product development problems with its capabilities and seek the best recommendation to be practiced by company X to improve their Go to market strategy by winning the customers with the product capabilities management by testing the beta releases with Continuous Innovation based on the information available at hand from the Market Insight studies. Thus, this study specifically attempted to address the following objectives:

First Objective: To explore the people skillset and their capabilities in information technology at company X, Y.

Second Objective: To identify the adaptability of the equivalent features available in the competitive alternates used by company X, Y in managing their current or upcoming software product(s)

Third Objective: To examine the relationship between feature capabilities and cost difference between two equivalent and different software products from company X and company Y.

Fourth Objective: To propose recommendations to the company X in order to improve their product capabilities with a quick adoption and go-to-market strategy from the results of objective one, two and three.

5.4 Scope of the Study

The scope was focused on the Product Engineering and management problems, systems used in relationship between Feature capabilities and performance of company X, Y and Company Z in multiple different geographical locations.

5.5 Significance of the Study

Recent literature on quality control in manufacturing has recognized the method of quality-based design as a more efficient alternative to the traditional approach of acceptance sampling. In particular, interest has been growing in the use of the concepts of robust design, which are attributed to the Japanese quality engineer, G.Taguchi. Even though Taguchi's methods of data analysis have been under the scrutiny of statisticians, they are being applied with a fair degree of success in many areas esp. in the Manufacturing industrial experimentations. Robust design addresses two major concerns faced by all product/process designers: how to economically reduce the variation of a product's/process' function in the user's environment, and how to ensure that decisions found to be optimal during laboratory experimentation will prove to be so in the manufacturing and the customer environments. The strategy in robust design is to conduct off-line experiments using orthogonal arrays, and to optimize the design by maximizing performance measures, the most commonly termed example is signal-to-noise ratios, with respect to the design parameters. In this paper, we attempt to show the applicability and relevance of Taguchi methods to ensure quality and performance into new software products and software development process. While applying these methods some characteristics of the software development process and its similarities and differences with the traditional manufacturing scenario are to be noted. Firstly, like in manufacturing software is a product; but unlike in manufacturing it involves development and not production. We do not reproduce the same object, but each product and each of its versions are different from the previous versions, Models for statistical quality control are considerably different and there is lack of useful models that allow us to reason about the software process, the software product and the relationship between them. In this preliminary paper, we demonstrate the application of Taguchi methods, to optimize the software architecture design parameters in the software development process especially in the design phase of its life cycle. If the software user is experiencing an unacceptable number of faults, the common solution would be to improve the underlying software development process. But if the project manager wants to incur this extra expense, he might have to justify it quantitatively. Problems of this nature constantly arise in software industry. Before such large investments are made, one ought to see if the errors can be reduced through better design decisions. Software system developers are skilful in approximately setting of software design parameter values. Considerable additional experimentation is necessary, to obtain the information needed to do a design optimization. Classical statistical experiments, called full factorial designs require trials under all combinations of factors. Taguchi has shown that if one runs many orthogonally designed experiments instead, product and process designs can be optimized economically and effectively

6 Literature Review

The purpose of this research is to study the best method of developing a quick adoption model of software product features which directly proportionate to its capabilities and positions the Product itself as Market Leader in order to recommend this to company X, where they can practice this to have a better Compete Zone and control their strategy on winning the customers which then leads to company's P&L balance sheet. In order to make the research more structured, the researchers reviewed four types of literature reviews.

A. Product Engineering
B. Relationship between Strengths and Weakness of each equivalent Competing software
C. Applying Robust design in Taguchi Methods
D. Winning the customers

6.1 Product Engineering

Integrating the "Process Engineering" into Product Engineering, within Process Engineering (= Manufacturing Engineering) customers want to address the focus in designing, planning and simulating the manufacturing process directly connected with Product Engineering. In the Software Engineering area, the two metrics that come into play with regards to Product Engineering are Product Structure Management and Product Engineering and Operations. Every company has its own Product Structures, since this research is about the Robust design, we primarily focus on Product Engineering and Operations where Research & Design of a product play a major role.

The Design of a Product heavily depends on the business requirements, when a company X wants to automate its business processes with technology, the first that the company X has to do is to understand and map these business processes into business requirements. These requirements are then converted into a software features and capabilities. We are not going to cover the underlying code and methodology of these software features and capabilities as the research is neutral focusing all types of software products.

6.2 Strengths and Weakness

For determining the Strengths and Weaknesses of a Software, the researcher will gather the Market Insights as an evidence from the Publicly available publications from the Research Analysts like IDC, Gartner, Forrester and SAP (with license permissions and limited usage). The Market Insights shall be covering primarily the following aspects

a) Market Consolidation
   Market Consolidation shall categorize and show the key players (companies) that will buy the majority of the share in the market against competing softwares Wedel, M. and Kamakura, W.A. (2003) Market segmentation: Conceptual and methodological foundations. Boston, Mass: Kluwer Acad. Publ.
b) Core Strengths and Weaknesses
   The Software core strengths and weaknesses are its product features, business processes, capabilities and user experience

c) Magic Quadrant
Magic quadrant is a series of market research reports published by IT Research and consulting firms like IDC, McKinsey and Gartner that rely on proprietary qualitative data analysis methods to demonstrate market trends, such as direction, maturity and participants. Their analyses are conducted for several specific technology industries and are updated every 1–2 years: once an updated report has been published its predecessor is "retired". Hayward, S. and Jacobs, J. (2002) Magic quadrant: Team colloboration support. s.l.: Gartner Inc.

6.3 Robust Design

A robust parameter design, introduced by Genichi Taguchi, is an experimental design used to exploit the interaction between control and uncontrollable noise variables by robustification—finding the settings of the control factors that minimize response variation from uncontrollable factors. However in the study, the robustification by Taguchi applies to manufacturing process and the research below shall apply the parameters against the product features in a Software Product in Information Technology Fowlkes, W.Y. and Creveling, C.M. (2012) Engineering methods for Robust Product Design: Using taguchi methods in technology and product development. Reading, MA: Addison-Wesley. The Methods of determining the parameters are explained further below in the Research Methodology section and the approach in categorizing the different parameters within Robust Design. Ulrich, K.T. and Eppinger, S.D. (2016) Product design and development. New York, NY: McGraw-Hill Education.

6.4 Winning the Customers

Winning the Customers is directly proportionate to the company's performance and annual P&L statements Gildersleeve, R. (1999) Winning business: How to use financial analysis and benchmarks to outscore your competition. Houston, TX: Gulf Pub. Co. / Cashman Dudley. In order to win the customers, the customers shall buy the software from a specific IT company. However there are multiple softwares competing the same space and the customer shall decide on what factors are determined by the fit-gap of the product features to their specific business needs, pricing, quality and sustainability & support of the product. When all the factors come together the sale lifecycle of a particular software would land in Winning the customers. In the research we are focusing on the robust design of the product features, which is addressing only one of the metrics for winning the customer. It is feasible to study further the research on winning the customers.

7 Research Methodology

7.1 Introduction

The research philosophy embodies assumptions about the way the world is constructed from a researcher's perspective and underpins the research strategy and the chosen methods (P. Johnson & Clark, 2006). A research philosophy or paradigm derives from the researcher's view of the nature of reality and being (ontology), the researcher's view regarding what constitutes acceptable knowledge (epistemology) and the researcher's view of the role of values in research (axiology) (Saunders, Lewis, & Thornhill, 2009). The following Table 5.1 lists the four research philosophies that are discussed by Saunders, Lewis and Thornhill (2009) and explains their view of the world regarding ontology, epistemology and axiology.

	Positivism	Realism	Interpretivism	Pragmatism
Ontology	External, objective and independent of social actors	Objective, independent of social actors, interpreted via social conditioning	Socially constructed, subjective	External, view chosen to best answer the research questions
Epistemology	Only observable phenomena can provide credible data or facts	Observable phenomena provide credible data and facts, but must be interpreted within context	Focus upon details of the situation that create subjective meanings	Both subjective meanings and observable phenomena can provide acceptable knowledge
Axiology	Research is undertaken in a value-free way; the researcher is independent of the data and maintains an objective stance	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing	Research is value bound; the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results; the researcher adopting both objective and subjective points of view

As shown in the above table, positivism is based on the view that only factual knowledge gained through observation and measurement is trustworthy, the role of the researcher is limited to data collection and interpretation through objective approach and the research findings are usually quantifiable (Collins, 2010; Easterby-Smith, Thorpe, Jackson, & Lowe, 2008). Interpretivism on the other hand invites the researcher to interpret elements of the study with the background of their own experience and knowledge (Saunders et al., 2009). Accordingly, research that follows this philosophy

assumes that access to reality is only through social constructions such as language, consciousness, shared meanings and instruments (Myers, 2013). Positivism and interpretivism are two mutually exclusive paradigms about the nature and source of knowledge (Collins, 2010). Although many research efforts can directly be linked to one of these two main paradigms, there is an occasional need for researchers to modify their philosophical assumptions over time and move to a new position on the continuum (Collis & Hussey, 2014). Such researchers follow a pragmatic approach and usually happen to be very seasoned in their field of study (Myers, 2013). According to pragmatism, research questions are the most important determinant of the research philosophy (Collis & Hussey, 2014; Saunders et al., 2009). Pragmatics can combine both, positivist and interpretivism positions within the scope of a single research according to the nature of the research question (Myers, 2013; Saunders et al., 2009). While pragmatism can adopt positions of both, positivism and interpretivism, realism can be interpreted as a less absolute form of positivism. Realism shares the idea that reality is independent from the human mind, but as the researchers are human and have a unique set of experience that they rely on to interpret their surroundings, the researchers cannot be totally independent from their studies (Saunders et al., 2009). They need to pay attention to this fact and need make efforts to be as objective as possible (Collis & Hussey, 2014; Myers, 2013). The underlying research philosophy of this study is positivism. As described above, the core idea of positivism is that the social world exists externally and its properties should be measured through objective methods (Easterby-Smith et al., 2008). This is an objective understanding of the phenomenon, as the individual does not affect the situation when it is measured (Saunders et al., 2009). This is in contrast with the subjective understanding that people's experience, insights and interactions will interfere with the analysed situation (Remenyi, 1998). Understanding culture as a set of predetermined cultural values that can be measured and compared to each other, it is clear that observable phenomena will provide credible data and subjective meanings related to the situations of the observed population will not play a major role as the focus is not on social interaction. This results in an epistemology that is based on observable phenomena and not subjective meanings (EasterbySmith et al., 2008; Saunders et al., 2009). As this research focuses on observable phenomena and involves testing of hypothesis, this research will adopt a positivist stance. Hence, this research will produce generalizable results, similar to those produced by physical and natural scientists (Remenyi, 1998). In consequence the research approach and design will be based on a positivism paradigm. This decision is also supported by the fact that positivism aims to generate generalizable results (P. Johnson & Duberley, 2000) and hence allows the operationalisation of concepts in management, enabling information to be measured quantitatively (Easterby-Smith et al., 2008) what is in line with the aim of this study.

7.2 Approach

The underlying research philosophy of this study is, Both qualitative and quantitative were deployed to address the research objectives. The qualitative research was conducted to understand the problem in Winning the Customers by conducting a structured interview with Company X and Y. For the quantitative research design needed to quantify the data and researchers calculate the Feature capabilities which the information obtained from Market Insights.

There are mainly three reasons why it is important to make a deliberate choice of the research approach (Easterby-Smith et al., 2008). First, it enables the researcher to make a more informed decision about the later research design. Second, it helps to think about these esearch strategies and choices that are going to work for the researcher and which will not be appropriate. Finally, the knowledge of the different research approaches will enable the researcher to adapt their research design to cater for constraints if necessary.

Having described why the work will be based on a positivism paradigm, this chapter aims to explain the general research approach of the work, that may have a deductive or an inductive character. A deductive approach develops a theory and hypothesis and will test those in the actual data analysis what closely links it to scientific research (Saunders et al., 2009). It is the dominant research approach in natural sciences, where laws present the basis of explanation, allow the anticipation of phenomena, predict their occurrence and therefore permit them to be measured, explained and controlled (Collis & Hussey, 2014). Research based on a deductive approach will use a highly structured methodology to facilitate replication what is important to ensure reliability (Gill & Johnson, 2002). Inductive approaches on the other hand collect data and develop a theory based on the analysis of this data (Saunders et al., 2009). This approach is mainly promoted by social sciences, as these researchers argue that a cause-effect link between particular variables without an understanding of the way humans interpret their social world is very dangerous and may not produce rigorous and applicable theories as the level of simplification is too high. Table 5.2, which follows the illustration of Saunders et al. (2009), compares both approaches and highlights their main characteristics.

Deductive Approach	Inductive Approach
• Scientific principles • Moving from theory to data • The need to explain causal relationships between variables • The collection of quantitative data • The application of controls to ensure validity of data • The operationalisation of concepts to ensures clarity of definition • A highly structured approach • Researcher independence of what is being researched • The necessity to select samples of sufficient size in order to generalise conclusions	• Gaining an understanding of the meanings humans attach to events • A close understanding of the researcher context • The collection of qualitative data • A more flexible structure to permit changes of research emphasis as the research progress • A realisation that the researcher is part of the research process • Less concern with the need to generalise

There are mainly three reasons why it is important to make a deliberate choice of the research approach (Easterby-Smith et al., 2008). First, it enables the researcher to make a more informed decision about the later research design. Second, it helps to think about

these research strategies and choices that are going to work for the researcher and which will not be appropriate. Finally, the knowledge of the different research approaches will enable the researcher to adapt their research design to cater for constraints if necessary. A deductive approach in comparison to an inductive approach aims to develop a hypothesis based on an existing theory to design a research strategy to test the hypothesis (Wilson, 2010). In other words, deduction starts with an expected pattern, which is tested against observations. Contrary to this, an inductive approach starts with observations and theories will be formulated as a result of the interpretation of those observations (Goddard & Melville, 2004). The inductive approach essentially reverses the process found in deductive research (Crowther & Lancaster, 2008). Therefore it is often referred to as a bottom-up process to generate knowledge, in which the researcher uses observations to build an abstraction or to describe the phenomenon that is being studied (Lodico, Spaulding, & Voegtle, 2010). That means that in inductive studies no known theories or patterns need to be tested during the research process (Lodico et al., 2010).

Having in mind the raised research questions and hypothesis for this study, it is obvious that this study is concerned with stressing possible links between national culture and preferences for PAS, using existing theories from cross-cultural research, which closely links it to deductive working. This interpretation is supported by Beiske (2007), who states that a deductive research approach explores a known theory and verifies it in a given context. In this case well established cultural models will be tested for their validity in the context of Product Design. For this reason, the research methodology will follow a deductive approach.

7.3 Research Design

A constant debate between advocates of qualitative and quantitative methodologies has always been represented as an academic front for scholars to justify their way of conducting 62 research (Gelo, Braakman, & Benetka, 2008). The main difference of qualitative and quantitative research strategies are summarized in the following Table

	Quantitative research strategy	Qualitative research strategy
Type of data	numerically described phenomena	narrative description of phenomena
Analysis	descriptive / statistical	identification of major schemes
Scope of inquiry	specific hypothesis	broad, thematic concerns

While quantitative research relies on numerical described phenomena to statistically test specific hypothesis, qualitative approaches rely on narrative descriptions of phenomena to identify major schemes in a researched field (Dudovskiy, 2016).

As the goal of this study is to test to what extent the preferences for PFC differ across different national cultures focusing on a large and representative international sample, namely customers of Product Engineering division, this study will adopt a quantitative research strategy to test the research hypothesis and to answer the research questions.

The data for the study will be collected via a survey, as it is a suitable technique to gather data from a larger sample in an efficient manner. This decision is also supported by the fact that almost all quantitative cross-cultural studies use survey methods to investigate the influence of Market Insights. Surveys can further be divided in four broader groups. A researcher can choose between online surveys, mail surveys, telephone surveys and face-to-face interviews depending on the availability of the participating personnel and budget, the needed flexibility during the survey process and the possibility to collect additional information beyond the surveyed questionnaire. As the available budget is limited and the survey will be conducted in several countries and atleast couple of companies which has multinational presence with appropriate sample sizes in a short period of time, an online survey is the most appropriate method of surveying. However, if not properly addressed, online surveys may face certain weaknesses as well. A careful design and conduct is mandatory to achieve good and statistically valid results. Table 5.4 will show some potential weaknesses and how it is planned to overcome those in this study.

Weaknesses of online surveys and their handling in the study		
	Description	**Strategy in this study**
Perception as junk mail	Spam mails have become a big problem in the 2000s and the willingness to click on links in emails has been drastically reduced	This fact is valid and should not be underestimated. The only counter measure that is implemented in the study isthat the invitation email will be sent from my work email SAP, a trustworthy source. This is likely to positively influence the perception of the receiver of the email invitation

Sample selection	It is difficult to select an appropriate sample in the internet, as the respondent of an online administered questionnaire might not be the good representatives of the researched population. Heavily critiqued sample selection methods are blanket e-mailing and volunteer samples	This study will not address a randomly chosen internet population. All respondents are chosen from SRS sampling, however may or may not be actual SAP customers and can be competitors as well. They will therefore be representatives of the researched population.
Technological variations	How a survey is displayed, heavily depends on the web interface (browser, device) of the user (Blair et al., 2014). Questions and answers that seem neatly aligned on one device may be distorted and confusing on another	For administering the survey the provider surveygizmo.com was chosen to allow a good visualisation on all devices (desktop computers, tablets and smartphones) and all relevant browsers.
Unclear instructions	As online surveys are selfadministered, answer instructions must be clearly stated or some respondents will be frustrated and exit the survey if the system detects input errors	The survey contains only one question type. A clear and precise statement how the respondent should answer it is given at the first page of the survey.
Impersonal	Typically there is no human contact in online surveys and this can limit the ability to probe in-depth as an interviewer could do in a face to face or telephone interview	An online survey is per definition impersonal and this fact cannot be ignored. However, there is no possibility for a potential interviewer to bias the respondent on the other hand. In this study this is valued as an advantage from the researcher's perspective.
Low response rate	Some scholars state that online surveys have comparably low response rates	The response rate can be positively influenced by personalisation of the invitation email, a clear statement of the needed time for completion and a clear communication of the goal of the survey (Petrovcic et al., 2016). Further factors will be discussed in a later section in more detail.

Having explained the methodical groundwork of the study as wells as the applied research method, the next chapter will address the development of an appropriate scale to measure preferences for product features

7.3.1 Defining the Constructs

The critical first step of the scale development process is defining the constructs that are measured by it, to outline the specific domain the researcher is investigating. The goal of this step is to determine the purpose of the questionnaire. Researchers should have clearly defined ideas about what actually defines the constructs they are investigating before they proceed to the scale design

The following Table will sharpen the brief explanations that have outlined the constructs

Scope of the investigated constructs

Scope	Inclusion	Exclusion
Product Features	Features and Capabilities of a Product	Product line of business
Market Insights that influence the Product Design	Magic Quadrants and customer feedback with reasons explaining why would they have chosen a specific product for their use case	Conclusion of Market Insights and detailed Market segmentation per geographical region
Customer Feedback	Taken directly from the Product Owners / Managers / Delivery Personnel	No direct interaction with end-users

7.3.2 Generating sample items

Recommendations based on relevant literature for the development of question items can be summarised as follows :

- Use uncomplicated wording that is appropriate for respondent's educational level
- Use as few words as necessary
- Use complete sentences
- Avoid the use of multiple negatives in question design
- Avoid fashionable expressions that may be outdated in near future
- Avoid the use of ambiguous questions that combine several facets or constructs
- Avoid asking questions that cannot conceivably be answered in a reliable way
- Avoid asking questions that can be assumed not be answered truthfully by respondents

During the initial development phase, it is important to generate more questions items than the final scale will contain, since further psychometric analyses will identify items that fail to capture the essence of a construct. It is not predictable how many question items are necessary to form a valid scale, although it is rare that more than twenty items are necessary to form a valid scale. Unfortunately there are no universal guidelines to estimate the needed amount of items to effectively build a scale, but keeping the measure short is an effective way of minimizing response bias caused by fatigue or boredom. While some authors suggest that as little as three items may obtain adequate internal consistency of a construct, others suggest that at least four items per construct are needed to test the homogeneity of items within each construct. It is difficult to improve the internal consistency of five appropriate items by simply adding further items to a construct and adding items indefinitely makes progressively less impact on a construct's reliability. Statistical tests support this finding, as constructs with many items may have high internal consistency reliabilities, even if item inter-correlation is low. These findings suggest that a valid scale can be built with approximately three to five questions per construct.
To value each product features dimension equally, it is decided that the final scale should contain three items per product feature dimension. As explained earlier it is mandatory to develop more items in the beginning as some will fail to measure the targeted construct adequately. For this reason, atleast 1 item per construct have been developed in the initial generation phase, which can be found in Appendix of this work. As a result of verbally pretesting the questionnaire with some SAP Product Engineering teams, the initial number of items per construct had already been reduced for some constructs, before the pilot study tested the remaining questions.

7.4 Qualitative & Quantative Approach

The above mentioned approach aims to develop a hypothesis based on an existing theory to design a research strategy to test the hypothesis (Wilson, 2010). In other words, deduction starts with an expected pattern, which is tested against observations. Contrary to this, an inductive approach starts with observations and theories will be formulated as a result of the interpretation of those observations (Goddard & Melville, 2004). The inductive approach essentially reverses the process found in deductive research aligning to Qualitative and Quantitative (Crowther & Lancaster, 2008). Therefore it is often referred to as a bottom-up process to generate knowledge, in which the researcher uses observations to build an abstraction or to describe the phenomenon that is being studied (Lodico, Spaulding, & Voegtle, 2010). That means that in inductive studies no known theories or patterns need to be tested during the research process (Lodico et al., 2010). Having in mind the raised research questions and hypothesis for this study, it is obvious that this study is concerned with stressing possible links between Design Parameters and Market Insights and preferences for Robust Product Design, using existing theories from cross-cultural research, which closely links it to deductive working. This interpretation is supported by Beiske (2007), who states that a Qualitative and Quantitative research approach explores a known theory and verifies it in a given context in a deductive way. In this case well established research models will be tested for their validity in the context of Robust Product design from the Market insights. For this reason, the research methodology will follow a both Quantitative and Qualitative approach.

8 Robust Design in Taguchi Methods for Software Products

8.1 Introduction

It is very important that Product design and innovation plays key roles in software development. The conclusion is based on the following research which justifies the evidence of Product design and getting into the market quicker. The Research study talks about the product design rather than the evidence of the research which is already done by Market Research analysts like IDC, Gartner, Forrester etc.



Source: Product and Service Innovation Survey, IDC, May, 2021

Further to the above conclusion from IDC is attached in the APPENDIX

8.2 Design in Taguchi Methods

The main focus of Taguchi methods is in design that is robust with respect to internal and external disturbances. The disturbances to an information system include:
- Errors by customers who do not follow the instructions for using the software as intended
- Data errors entering into the system (Manual or Automatic by Integrated data flow)
- Errors from employees who do not follow the required procedures
- Failure of the Product feature capabilities aligning to Customer needs
- Failure of the network on which the information system operates

The decision to alter one component of the system, such as the manager of a node in a distributed database deciding to change its database software or add a data item to its database
- The data not being updated on time
- Hardware failure

According to the Taguchi methods, the design of the system should minimize or preferably eliminate the possibility of such disturbances. Taguchi suggests the measure of signal-to-noise ratio as a measure for guiding the design [Taguchi, 1990]. Signal is what the system is expected to produce, and noise is an undesirable output. A robust design attempts to maximize signal-to-noise ratio.

For example, the user interface could be designed such that it would not allow the customer to make a mistake—or, if he or she does make a mistake, corrective actions are immediately provided to the customer. Similarly, the intelligent data-entry interface stops the data-entry clerk from entering the wrong data. If the data is not updated on time, the system could send a warning signal to the system manager and in sensitive cases, could even shut down the system. In the case of network problems, such as a failure in a link, one can design alternative routes in case one link in the network shuts down. In the case of a hardware failure, such as a node or a server becoming unoperational, a back-up node or server may take over the function without interrupting the system's operation.

Information systems are among the best candidates for implementing Taguchi's 2823 robustness idea. A robust information-system design has an intelligent component for self-control and self-management. Although various fragments of self-management, such as intelligent user interface and intelligent database-entry systems are recognized as necessary modules of a system, there are no common and well-accepted design principles for a self-management unit as a major and necessary component of information systems [Bagchi, 1993].

The purpose of the self-management unit is to increase the system robustness with respect to environmental and external factors, and to self-evaluate the system performance and reliability well before the customers become dissatisfied with the system.

Measuring Signal-to-Noise Ratio of Design Factors. The signal-to-noise ratio is a powerful metric for designing various components of the system. If we could identify the value of this metric for each system module, the design decisions would become straightforward and simple. The field of information systems has not begun to address the measurement issues related to quality metrics. Therefore, for the time being we need to use the signal-to-noise ratio as a metaphor to compare various design options. Although we cannot measure the signal-to-noise ratio, we can identify design components that increase its value.

The following design principles could contribute to the enhancement of the signalto-noise ratio:
• reduce the interaction of components;
• encapsulate each component;
• create interface standards;
• include safeguards against faulty components;
• do not implement a system that barely meets the set standards or goals;
• use lowered performance variability as a metric for robustness;
• incorporate a self-manager module into the design of information systems;

Encapsulating each component of the information systems and reducing the interactions among them helps reduce the chance of a faulty component contaminating the performance of others. Therefore, the signal-to-noise ratio of each component will be determined by the design of that component, rather than the value of the signal-to-noise ratios of others.

The standard interaction makes it possible to change a component without affecting the design of others. Therefore, if the signal-to-noise ratio of a component is low, one can redesign that component without affecting the signal-to-noise ratio of other components.

Including safeguards for a faulty component allows the system to switch to a backup component if the signal-to-noise ratio of a component falls below a predetermined level, hence maintaining the overall performance of the system.

The design should not barely meet a minimum acceptable level of signal-to-noise ratio because a small variation in the performance of one component pushes the system performance below the acceptable level. Among the major goals of the system should be the reduction of variability in the signal-to-noise ratio and staying on the target level all the time. Similarly, designing a self-manager module into the system increases the signal-to-noise ratio of the system.

Orthogonal Arrays. Selecting the best and most expensive alternative for each component of the system may not guarantee the highest and least variable signal-to-noise ratio for the system. For example, a system with almost unlimited capacity for data may make the retrieval and access to data least efficient and highly variable. An 2824 elaborate self-manager unit that sends warnings and signals for the slightest deviation may make the task of data entry very cumbersome to the point that the data-entry personnel and system manager may ignore all warnings of the system and find a way to bypass the system checks. This defeats the purpose for which die self-manager unit is designed. Furthermore, since the system is designed to rely on the self-manager for error checks, there may not be any manual checks. Therefore, bypassing the self manager unit may lead to a drastic reduction in the signal-to-noise ratio of the system. Thus, it is essential to measure the impact of various design options on the overall signal-to-noise ratio of the system.

One way to measure the impact of various design options is to create prototypes of the system in which various combinations of design elements are tested. Alternatively, one can simulate the system and test the combination of various design options. In order to reduce the number of required prototypes at the same time, to test all major design options in prototypes or the simulation of the system, one can use Taguchi's orthogonal arrays.

The use of orthogonal arrays in the design of information systems would be for the design of complex systems in which either simulation or prototyping of the system is in order. In such cases, one can use orthogonal arrays to find the optimal design diat maximizes the signal-to-noise ratio of the system.

One of the major contributions of the Taguchi methods is the concept of loss junction. The underlying idea is that the system should have the minimum loss to society over its entire life cycle. The cost analysis and comparisons of products and services should take into account all of the following costs: planning, design, implementation, warranties, maintenance and support, disposal, upgrade, replacement [Zahedi, 1995]. Planning, design, and implementation costs. In information systems, the concept of the system's life cost is not new. The costs of planning, design, and implementation are the development costs, which are normally used in determining the development budget. In analysis of development costs, there are hidden quality costs that should be taken into account. These are the cost of non-conformance and the cost of lost opportunities. The cost of non-conformance is when the system is under-designed or overdesigned. An under-designed system lacks some of die features that are of value to the

system customers. An over-designed system has features that system customers do not need or use. A bad design could be both under-designed and over-designed at the same time, in that it lacks what customer's value, and offers what customers do not need or use. The cost of lost opportunities is the lost profits or benefits due to the failure of the information system to provide its customers with the needed information. Although this cost is not an easy cost to estimate before the system becomes operational (or even after it has become operational), its existence should be a significant incentive for the development team to invest adequate time in requirements analysis and careful incorporation of the requirements into the system design. Warranty Cost. Information systems normally do not provide warranties because damage due to wrong information could be hard to assess and is potentially limitless. However, when the information system provides sensitive information to customers or contains information of high value to the corporation, it may take measures to protect against risks, such as buying insurance or extra security measures that would add to the life-cycle cost of systems. In many systems with external customers, the service provider offers customers the option of cancelling their service or getting a full refund. A poorly designed system could generate a substantial cost in this respect. Maintenance and Support Cost. Since maintenance and support represent a large share of information-systems projects expenditure, it is natural to include the maintenance and support cost in the analysis. The projects in which development time is severely limited may require a significant amount of maintenance and support, because systems that lack adequate investment in analysis and design will require a much greater degree of correction and customer support than those with more careful design. Therefore, it is essential to include the maintenance and support cost for various scenarios of systems development in order to give the project decision makers a more realistic sense of trade-offs involved in scheduling and resource allocations in various stages of systems development [Roy, 1990]. Disposal, Upgrade, and Replacement Cost. Disposal of products such as autos and house appliances is a major environmental concern for those manufacturing companies that have a quality-based culture and a proactive approach to social issues. Is there a disposal cost for information systems? It is interesting to observe that information systems have disposal, upgrade, and replacement costs of a different sort. An information system has three major physical components: hardware, software, and people. Once an information system is obsolete, one may ask: What are the costs of disposing of these components? Hardware: The cost of disposing hardware is similar to the cost of disposing any obsolete machinery. Selling, scrapping, reusing, or storing the machinery would involve a cost to the company as well as to the society and environment. This cost is more critical for large projects involving many small computers, specially designed network connections, special input and output devices, or related office equipment. When a company goes into the buying mode for the hardware of a project, it should have a plan that includes the disposal cost and disposal strategies once the equipment becomes outdated. Software: Similar consideration should be given to the obsolescence and disposal of software. The cost of disposing software once it has become obsolete is an even thornier issue. Aside from the investment in preparing the software for the system that now has no value, the obsolete system includes data and knowledge that should be transferred to the new system [Kan, 1995]. Again, considering the issue of obsolescence may have an important impact on the design decisions of the software. For example, the system that allows for a seamless data migration or knowledge transformation could prove to be a cheaper option, although its initial cost is higher than competing products. People: Disposing an information system is also costly for the people who interact with the system:

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• End-users will lose all their invested time in learning how to work with the system;
• Programmers' and technical people's skills in working with the software will be lost;
• All customers will have to incur the cost of dealing with a completely different environment;
• The internal and external customers need to be retrained for the new system. The cost of disposing an information system is so high that the company may end up working with an obsolete system for a long time. This is a hidden cost in that it is rarely taken into account in the optimistic cost estimation of developing a new system. Furthermore, the formal treatment of disposal costs provides incentive to introduce obsolescence-prevention factors in design decisions, hence postponing obsolescence and making disposal less costly.

8.3 Product Design and Measures

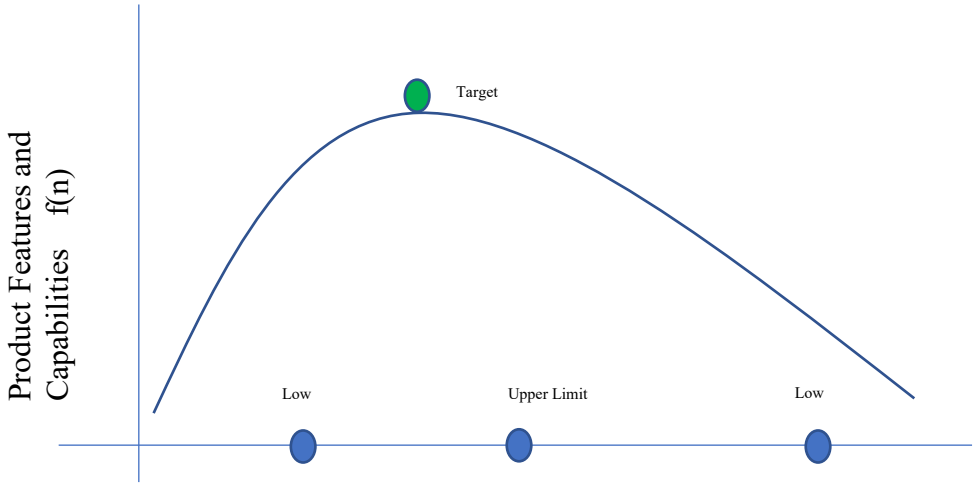
The main focus of Taguchi methods is in design that is robust with respect to internal and external disturbances. The disturbances to an information system include: - Errors by customers who do not follow the instructions for using the system - Data errors entering the system - Errors from employees who do not follow the required procedures - Failure of the network on which the information system operates - The decision to alter one component of the system, such as the manager of a node in a distributed database deciding to change its database software or add a data item to its database

The following design principles could contribute to the enhancement of the signal-to-noise ratio:
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Encapsulating each component of the information systems and reducing the interactions among them helps reduce the chance of a faulty component contaminating the performance of others. Therefore, the signal-to-noise ratio of each component will be determined by the design of that component, rather than the value of the signal-to-noise ratios of others.

8.4 Measure of Product Features

Taguchi defines innovation quality as the minimum deviation from target value. For example, assume that one of the quality measures of a Software product is its capabilities, with the target value of competing software. Obviously the product features and capabilities is not always at top priority; many factors impact the success rate of a software product. It is a random variable with the possible distributions shown in the below Figure 1. Since there are many factors impacting the Product success, one may safely assume that the variable has a normal (parabolic bell shape) distribution.



n: Value distribution on an average



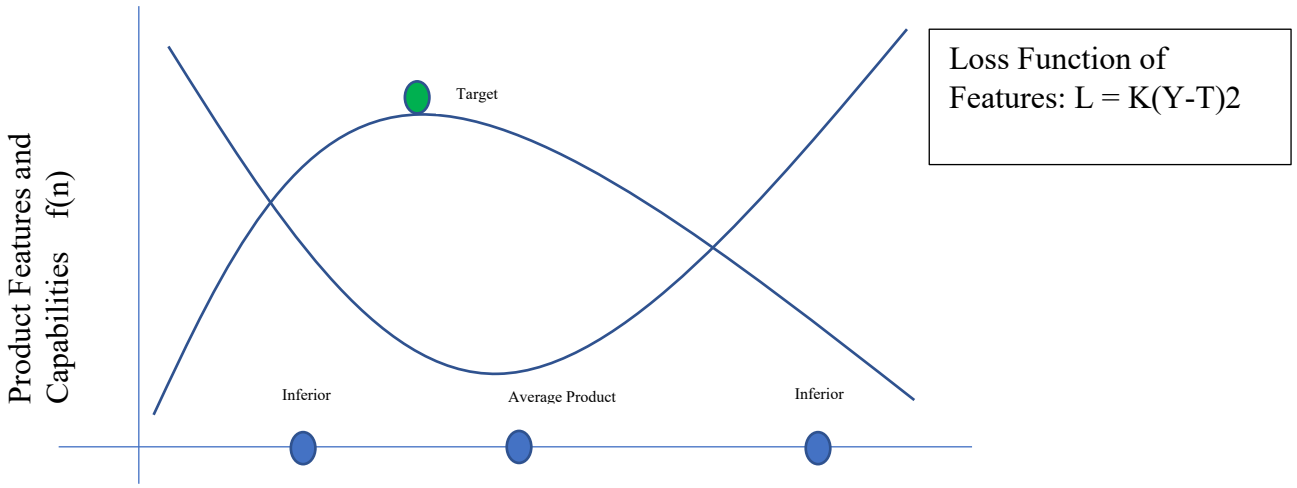
Source: IDC, 2022

The traditional way of interpreting values of the Product Success measure is that if the distribution of the measure falls outside the upper and lower limits, then the software is out of its allowable range (range as Market consolidation scope). Meaning, the product may not win the customers with its product features and capabilities by comparing to the competitive alternates. If a software is within its determined range, then the software company's performance in the market consolidation is satisfactory.

Taguchi disputes this conclusion. He argues that any deviation from the target value is a loss. Based on the desirability of reducing the variability, Taguchi draws the loss function as the loss due to deviation from target value. (Ion Buliguo 2016, University of Craiova)

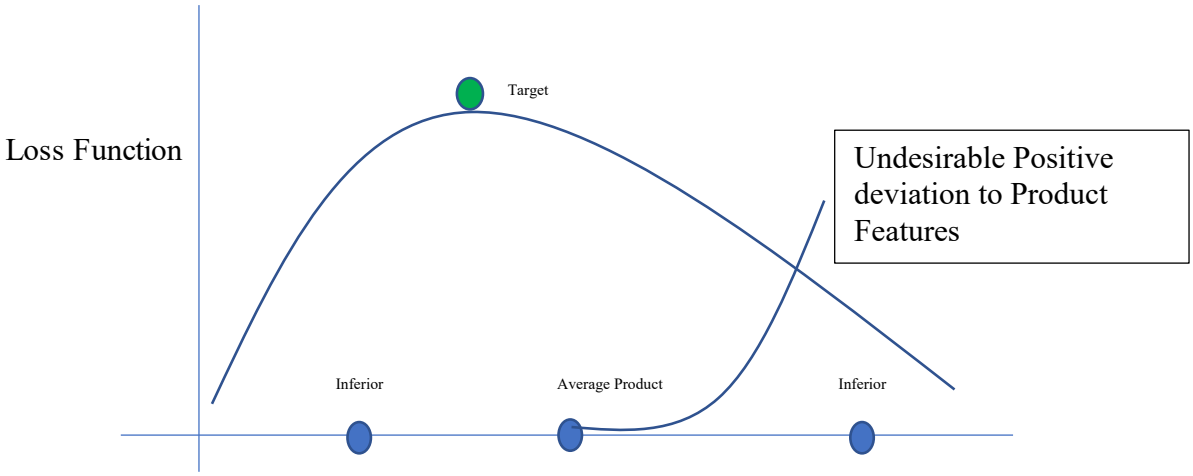
In Figure below, the target value is close to the average of the distribution that reflects lower product feature loss cost. But closeness of the target and average values is not a sufficient measure. There may exist substantial costs because of a large variability in the response time [Card, David, 1992].

In determining the target value for the response time, it is a given fact that the product will not constantly be on the target value. Therefore, we establish the acceptable upper and lower limits for the end result time. The traditional way of interpreting values of the product's performance measure is that if the distribution of the measure falls outside the upper and lower limits, then the system is out of its allowable range. If a system is within its determined range, then the system's performance is satisfactory. Taguchi disputes this conclusion. He argues that any deviation from the target value is a loss. Based on the desirability of reducing the variability, Taguchi draws the loss function as the loss due to deviation from target value, shown in Figure2 below. For cases where both positive and negative deviations from the target are considered undesirable, the loss function has a quadratic form, as shown in Figure 2-a. If only positive (or negative) deviation is unwanted, then the loss function consists of half of the quadratic function, as shown in Figure 2-b for the case when the negative deviation from the target is undesirable and 2-c when the positive deviation from the target is undesirable.



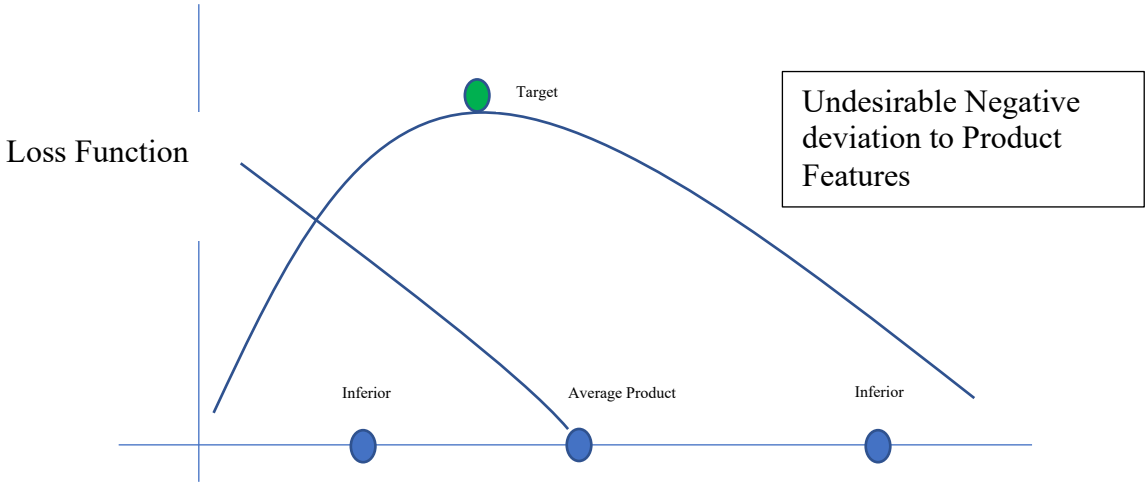
Loss function when both positive and negative deviations are undesirable – Figure2a

s



Target product couldn't be achieved with Positive Deviation

Figure – 2b



Target product couldn't be achieved with Negative Deviation – Figure 2c

Taguchi argues that the major focus of the design should be in reduction of the variability of performance. For example, if the reduction in the response time translates into more variability in response time, then the system's performance goes down. This is especially crucial for information systems, where large fluctuations in a system with Frequency of x x Response Time f(x) 4 Target value Loss Function L= K(Y-T)2 x Response Time 4 Target value x Response Time 4 Target value Loss Function Loss Function 2822 a good performance record could be considered worse than a fair but consistent and predictable performance. Compare accessing a system that gives a response in one second or in ten minutes as opposed to another system that the responds in five seconds 99 percent of the time. Most people would prefer the system with five-second response because of its predictability. Thus, in designing a system, it is not enough to consider the average performance parameters of the system; the important factor in the design is the variability of the system performance. According to Taguchi methods, the loss function of deviating from the target can be measured by: $L = C \cdot D2$ where C is the cost of unit deviation and D is the amount of deviation from the target. Furthermore, quality is not what we measure and control after the system is implemented. Instead, quality should be designed into the system. This is a concept that is not commonly addressed in the design of information systems, partly due to the lack of a formal method. The next section discusses using the Taguchi methods in designing systems that have low variability and are robust with respect to uncontrollable environmental factors.

9 Data Analysis, Conceptual Findings and Hypothesis testing

9.1 Sampling – Probabilistic

The sampling strategy is based on the guidelines of Daniel (2012), who postulates a model that includes 4 distinct steps to generate a proper, representative sample for a study. The four steps are highlighted in the table below.

Step1	census vs. sampling
Step2	nonprobability vs. probability
Step3	choice of sampling method
Step4	determine sample size

Regarding the sampling strategy the first choice a researcher has to make is to choose between taking a census (analysing all elements in the target population) and sampling (analysing a subset of the entire population) (Daniel, 2012). Taking a census may look advantageous, as the results of the research will be highly representative for the population as the entire population is investigated, but it has downsides as well. The following table 5.10 highlights advantages and disadvantages of both strategies.

	Census	Sample
Advantages	accuracy and reliability	less resources necessary (manpower, money, time)
Disadvantages	more resources necessary (manpower, money, time)	less accurate and reliable

It is obvious that the advantage of one approach represents the disadvantage of the other approach and vice versa. If the focus of the study is the generation of highly accurate and reliable results, the census approach seems to be the right choice. However, in most cases it is not possible to access data of the entire population for a study due to limited budgets regarding manpower, money and time. In cases that result in the loss or damage of the examined units (e.g. trying out software products), such an approach is not applicable at all (Srivastava & Rego, 2008). There are nearly 1,000,000 software product companies worldwide in its subsidiaries (Source:https://chiefmartec.com/2017/11/1-million-software-companies-2027-gonna-need-bigger-chart/) . For a couple of reasons that are listed below in Table, it is not possible to analyse the product feature capabilities and their design with market insights for all these companies.

Reasons for not choosing census

Voluntariness	The participation in a Researcher's survey is voluntarily and no customer is forced to participate.
Researcher's accessibility	Researcher has a deep background of Product Engineering and Product design with limited accessibility in terms of balancing the above mentioned advantages and disadvantages
Focussed Products	Market insights are focussed with top tier participants and so the competitive Products are to be considered in the research

For the mentioned reasons it is not possible to apply a census approach to this study and a proper sampling method has to be defined to generate a reliable sample of the entire population. Sampling strategies can be divided in two main streams, probability and non-probability sampling. In contrast to non-probability sampling, probability sampling gives every unit of the entire population a known and equal chance of being selected (Daniel, 2012). This implies that the results of a non-probability sampling strategy cannot be generalised from the sample to the population, as not every unit has the same chance to be represented in the sample (Fairfax, 2012) and this is the reason why such sampling strategies are normally not applied to research projects (Daniel, 2012). This study aims to provide the groundwork for future research in the field of Robust Design in Software Product Engineering. For this purpose it is mandatory to

work on a robust statistical base and this necessitates a probability sampling approach, as it allows to estimate the amount of sampling error that should be expected in the given sample and this is mandatory to achieve statistically solid results (Rubin & Babbie, 2010). Probability sampling strategies can basically be divided into four main groups and more complex approaches, that combine those basic strategies to more complex multi-stage sampling approaches (S. Thompson, 2012). The four main strategies are described earlier are census vs. sampling, nonprobability vs. probability, choice of sampling method and determine sample size

Probabilistic Sampling

Simple random sampling	Simple random sampling is the most fundamental technique in probability sampling (Rubin & Babbie, 2010). Simple random is a sampling strategy that collects a defined number of units from a population in such a way that every possible combination of drawn units is equally likely to be the sample selected (S. Thompson, 2012). That means that the researcher doesn't influence the probability to be drawn of any unit in the population. To draw simple random samples without researcher bias, computerized sampling programmes and sampling tables are used today to select the sample for a research study (Fairfax, 2012).
Systematic random sampling	Systematic random sampling is very similar to simple random sampling and just adds a systematic approach to the actual drawing of units (Daniel, 2012). While simple random sampling works with computer based randomization functions, that pick the units, the idea of systematic random sampling is that all units of the whole population are organised in a list. In a next step an integer x is decided and every xth unit of the population is drawn until the defined sample size is reached. This strategy is typically chosen if the sampling process cannot be supported by computerized randomize functions (Rubin & Babbie, 2010; S. Thompson, 2012).

Stratified random sampling	In stratified sampling approaches, the population is first partitioned into distinct sub groups and a sample is selected by some design within each of these sub groups (S. Thompson, 2012). The principal of this so called stratification is to partition the population in such a way, that the units within a sub-group are as similar as possible in the analysed demographics (Daniel, 2012). The main advantage of a stratified random sampling approach over a simple random sampling approach is the assurance that the sample is not only representative for the whole population, but also for the distinct sub-groups that are analysed (Rubin & Babbie, 2010; S. Thompson, 2012).
Cluster random sampling	Cluster sampling strategies are similar to stratified sampling approaches, because the population to be sampled is divided into distinct, mutually exclusive sub groups (Fairfax, 2012). The goal is however not to form distinct sub-groups in a way that the units within a sub group are as similar as possible, but to maintain the heterogeneity of the population (Daniel, 2012; Fairfax, 2012). It is the task of the researcher to form clusters that are representative for the population (S. Thompson, 2012), although this is difficult to achieve in practice in most research efforts (Fairfax, 2012). Normally such clusters have a geographical nature and not for example ethnographic or social characters (Rubin & Babbie, 2010; S. Thompson, 2012).

Focusing on the goal of this research study to investigate the influence of market insights on the robust design of a software product, it is obvious that the sample needs not just to be representative for the whole population (software product companies worldwide), but for a specific products which are comparable in their feature capabilities are analysed. This implies that all participating companies/executives need to be properly represented with an adequate sample to allow statistically solid comparisons between the product designs afterwards. Simple random sampling with all possible software companies globally are therefore not possible, as it cannot be ensured that all companies are properly represented in the final sample.

The last step in the sampling process is the calculation of the necessary sample size,that allows the generalisation from the sample to the population and the statistically correct testing of the hypotheses (Daniel, 2012; Fairfax, 2012). There is a lot of literature that discusses the calculation of an optimal sample size if scales are metric and parameters like means and

standard variations are to be examined (P. Mathews, 2010; Rubin & Babbie, 2010; S. Thompson, 2012). For more sophisticated analysis methods the calculation of necessary sample sizes is not trivial and sometimes experience- and evidence-based (K. Backhaus et al., 2008).

The problem with exactly defining the needed sample size for a multiple linear regression is that it requires estimations of the result prior to performing the study (Katz, 2006). To evaluate the right sample size, it is important to define the goal of the regression model. The needed sample size differs a lot if just the multiple R value is tested for statistical significance or if the testing of the beta weights of the predictors for statistical significance is part of the research (Maxwell, 2000). Typically it is not sufficient just to the test multiple R value for statistical significance (P. Mathews, 2010). This study follows this general guideline, as it is part of the research goal to evaluate the influence of each dimension of market insights on the design of a software product and continuous improvements. Maxwell (2000) developed a precise calculation methods based on the estimated quality of the regression model and the magnitude of the correlations between the independent variables as well as the magnitude of the correlations between the independent and the dependent variables in the model. However, these parameters are very hard to estimate in advance. While the correlation between the different dimensions of national culture can be calculated based on the scales that are published by Hofstede (2010), the results for the dependent variables cannot be estimated in advance as there is no comparable data set published so far (Katz, 2006).

For similar situations several authors developed rules of thumb based on their experience with regression analysis models. Green (1991) developed a simple formula to calculate the minimum sample size for linear regression model by stating that x plus the number independent variables is a sufficient sample size to achieve a good model quality. In this study this would equal y respondents. Compared to the recommendations of other authors, such a sample would be comparatively small. The goal of this study is therefor to collect at least a sample of 3 comparable and competing software products by using Simple Random Sampling with a specific set of criteria.

Simple Random sampling was used for participating in the survey, though all the participants must comply with the business in Software Product development

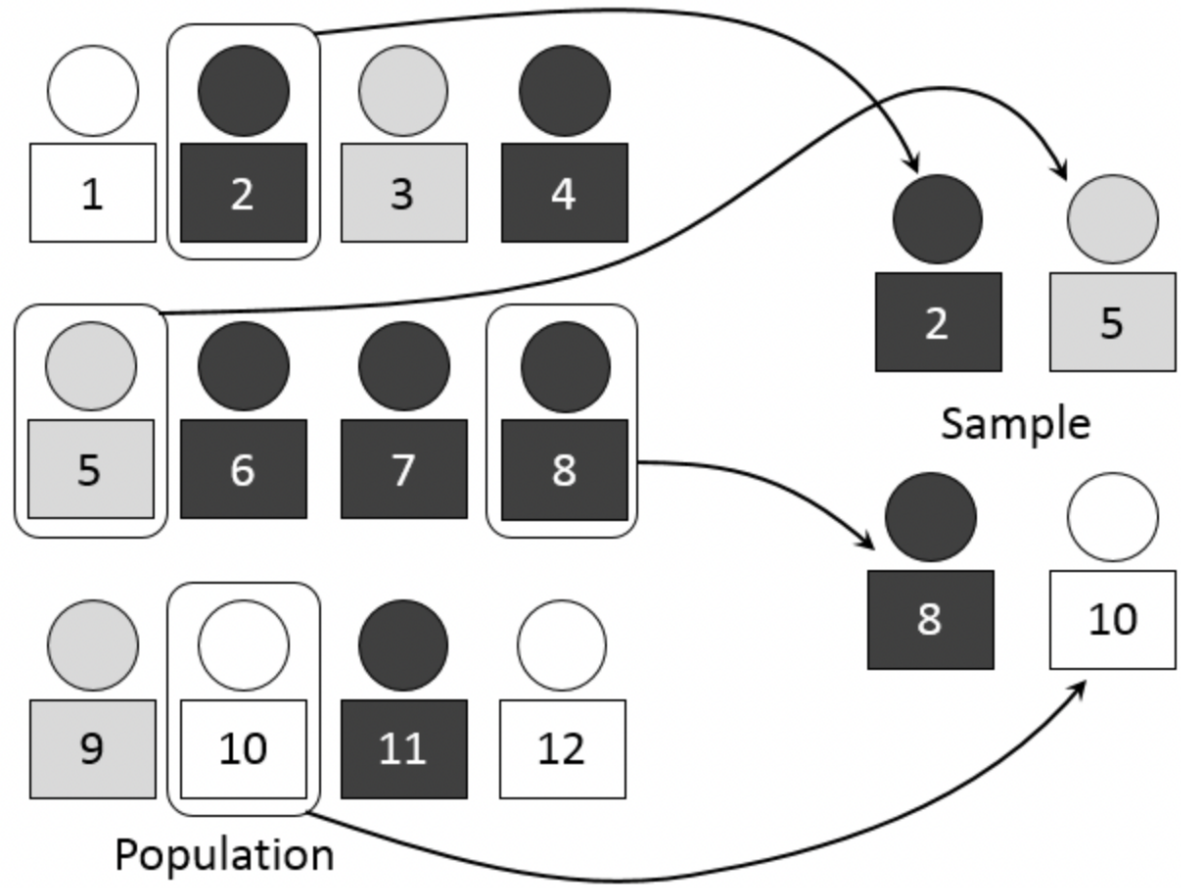
In a simple random sample (SRS) of a given size, all subsets of a sampling frame have an equal probability of being selected. Each element of the frame thus has an equal probability of selection: the frame is not subdivided or partitioned. Furthermore, any given pair of elements has the same chance of selection as any other such pair (and similarly for triples, and so on). This minimizes bias and simplifies analysis of results. In particular, the variance between individual results within the sample is a good indicator of variance in the overall population, which makes it relatively easy to estimate the accuracy of results.

Simple random sampling can be vulnerable to sampling error because the randomness of the selection may result in a sample that doesn't reflect the makeup of the population. For instance, a simple random sample of ten people from a given country will on average produce five men and five women, but any given trial is likely to over represent one sex and underrepresent the other. Systematic and stratified techniques attempt to overcome this problem by "using information about the population" to choose a more "representative" sample.

Also, simple random sampling can be cumbersome and tedious when sampling from a large target population. In some cases, investigators are interested in research questions specific to subgroups of the population. For example, researchers might be interested in examining

whether cognitive ability as a predictor of job performance is equally applicable across racial groups. Simple random sampling cannot accommodate the needs of researchers in this situation, because it does not provide subsamples of the population, and other sampling strategies, such as stratified sampling, can be used instead

Visual representation of SRS
Source Reference



Criteria considered for the population

Criteria	Consideration
Is the Software Company a Software Product Development Company?	Mandatory
Is the Software company has competition in the Market for their software Products?	Mandatory
Is the Software company has detailed list of Product Features and Capabilities	Optional

9.2 Data Analysis

For qualitative data, the researchers summarized some highlighted points to answer the objectives of the study. For quantitative research, information has been analysed using statistical data, such as ratio analysis of data that obtained from number of Customer Wins in five years starting from year 2020 until 2025 including the pipeline to see in clear picture how does Product Design affect the company performance. After data were obtained from survey responses, in order to test the validity and reliability of the data for this study. The data was intended to examine the effects of independent variables on dependent variables. All the data collected were analysed using Researcher's forecast Excel sheet formulas

For this paper, we have considered two identical products from different software provider as explained earlier in section5.1 as dependent construct, the non-identical product is considered as independent construct. Since FrankieOne is a Platform Tech and its products are non-existence relationship, thus concluding the average reliability is not applicable

Variable	Dependent	Independent
SAP	Fioneer	
SAP		FrankieOne
Fioneer	SAP	
Fioneer	FrankieOne	
FrankieOne		SAP
FrankieOne		Fioneer

Since there is not relationship between the above mentioned companies, researcher considered the option of using both divergence hypothesis and convergence hypothesis and further explained in the section 9.5

9.3 Research Population and Sampling

Since company X applied the same systems to all competing companies in order to monitor their Products and their features, researchers picked few companies via SRS for interview and Survey methods in order for the respondent to answer the entire question regarding the Product Engineering and their management which are SAP, Frankie One and Adapt IQ

9.3.1 SAP

SAP is a global software giant and 77% of world transactions run thru SAP systems. Founded in 1972, the company was initially called System Analysis Program Development (Systemanalyse Programmentwicklung), later abbreviated to SAP. Since then, it has grown from a small, five-person endeavor to a multinational enterprise headquartered in Walldorf, Germany, with more than 105,000 employees worldwide. The company's integrated applications connect all parts of a business into an intelligent suite on a fully digital platform, thereby replacing the process-driven, legacy platform. Today, SAP has more than 230 million cloud users, more than 100 solutions covering all business functions, and the largest cloud portfolio of any provider.

What is SAP software used for?

Traditional business models often decentralise data management, with each business function storing its own operational data in a separate database. This makes it difficult for employees from different business functions to access each other's information. Furthermore, duplication of data across multiple departments increases IT storage costs and the risk of data errors.

By centralising data management, SAP software provides multiple business functions with a single view of the truth. This helps companies better manage complex business processes by giving employees of different departments easy access to real-time insights across the enterprise. As a result, businesses can accelerate workflows, improve operational efficiency, raise productivity, enhance customer experiences – and ultimately increase profits.

https://www.sap.com/australia/about/company/what-is-sap.html

9.3.2 Frankie One

In the Research the question arises to why Frankie one?
Each year, The RegTech Association awards a Founder-Led RegTech firm with best pitch by awarding our #AccelerateR award. In 2021 we saw the momentum building around Environmental, Social and Governance (ESG) impacts for companies and institutions across multiple sectors and the growing level of importance of ESG to investors. This year's PitchFest focus is based on this momentum with applicants asked to show how their solutions aligned with ESG and how it demonstrates deep connection and potential impact to ESG goals and objectives.

FrankieOne were the judges choice due to being the best at articulating the problem they solve, the solution and market appetite, the business model and scalability, relevance to ESG and most of all, the best pitch delivery on the day.
Source : https://regtech.org.au/news/12697526

This made the conclusion that Frankie One was awarded for its best or fastest approach in pitching the Go-to-Market with their delivery

Information about Frankie One :
https://www.frankieone.com
https://www.frankieone.com/about-frankieone
https://www.fintechaustralia.org.au/frankieone-from-melbourne-startup-to-global-regtech-in-4-years/

9.3.3 Fioneer Gmbh

Emerged from SAP, a market leader in enterprise application software, SAP Fioneer can build on a heritage of outstanding technology and a thorough understanding of both corporate and consumer demands.

SAP Fioneer has been ranked first place in core banking/back-end systems in the Fintech Leaders 2022 report by the Center for Financial Professionals (CeFPro). The

international research organization also named SAP Fioneer among the top 30 companies in the overall fintech ecosystem

This gives us a head start to bring financial services industry(FSI) to the next level with innovative software solutions and platforms. We are helping companies in the financial services industry to meet their needs for speed, scalability, and cost-efficiency through digital business innovation, cloud technology, and solutions that cover banking and insurance processes end-to-end.

Fioneer products and services fully focus on accelerated innovation in banking, insurance and solutions specific to the financial services industry(FSI). We enable our customers to innovate and transform their business by meeting the needs for digital innovation and cost efficiency in financial services
https://www.sapfioneer.com/company/
https://banking-insurance.cioreview.com/vendor/2021/sap_fioneer

9.4 Sources of Data

For the purpose of this study, the researchers used both primary and secondary data to complete this study as required for both qualitative and quantitative methods has been used which data was obtained from structured interviews and surveys as primary sources and secondary sources such as their performance in winning the customers, market insight reports, journal, articles and publications.

9.5 Development of Research Hypothesis

As these Product design practices found the base for the use of Product development methodologies and its lifecycle that are offered in Information Technology industry in different phases of software sales such as preventive maintenance, predictive maintenance or remote services, this research stream may serve as a starting point for further review. In line with the tradition of comparative management research, the empirical work in this field can be divided in three main streams as highlighted in

Convergence hypothesis	Divergence hypothesis	Product Design specific hypothesis
The “convergence” hypothesis assumes that globalisation leads to global standards, as the best practices will prevail and those companies that try to resist this converging trend will be eliminated by the market	The “divergence” hypothesis builds the counterpart of the “convergence” hypothesis. It questions the universal applicability of business practices as markets will keep their national character and business practices need to adapt to be successful.	The "product-design" specific hypothesis is in line with "divergence" hypothesis but in contrast to it doesn’t specifically consider any other factors as such political, geographical presence etc., besides the pure product features and its capabilities solely on software company success

It is arguable if all these studies support the hypothesis that the willingness to adopt robust design of a Product is influenced by Market insights. Some of these studies are linked to organisational issues that are aligned with the implementation of quality management procedures, but not with the actual adoption of specific quality management measures. However, all these studies support the idea that the attitude towards quality procedures is moderated by winning the customer.

Based on the discussed findings further in the subsequent sections of the study, an influence of Market Insights on the attitude towards Product design is likely. The following sections will develop working hypotheses for the influence of each dimension of Product design model

9.5.1 Linking Constructs to Findings

Consolidation in the enterprise software space is not entirely bad news for customers, analysts say. Despite drawbacks such as limited product options and fee negotiation, consolidation could also spur innovation, faster time-to-market, and facilitate integration among rival software offerings--all of which benefit customers.
However, while the ongoing industry consolidation can be problematic for customers, there are also positives to be gotten, analysts argued.
The "bright spot" in the longer run comes as the bigger IT vendor may "lose some of the smartest, most ambitions, and well-connected staff" from the acquired company. These people would then launch a new company using the latest technology, which in a few years could become a formidable force in the marketplace.
Ultimately, given the increasingly volatile software marketplace, companies need to develop an approach that would "future-proof" their IT strategy and procurement tactics

9.5.2 Influence of Market highlights of a Product features and capabilities

Emphasizing key features when discussing the product ensures that customers understand the most attractive characteristics of the item. Here are several steps Market Research Analysts suggest the Software Product Companies take to accentuate product features on a website, product description or advertisement:

9.5.2.1 Define your unique selling proposition

Start by identifying what makes the product unique and different from competitors. Understanding what attracts consumers to the product can help you determine the best strategy for highlighting that product's specific features. While it's important to provide a comprehensive overview of all the product's characteristics, knowing your unique selling proposition can help you start with the features that your target audience is most interested in and wants to learn more about

9.5.2.2 Create a features section

When writing about a product on a website, add a separate section that lists the features in a clear, scannable way. Including a bulleted list of specifications and features that are separate from the product description can make the page more readable and provide consumers with a quick, convenient method to find facts about the product. If a customer simply wants to educate themselves about the product or learn a particular fact, being able to access details about product features in a simple list format can encourage them to continue browsing the site.

9.5.2.3 Rank your top features

Decide which features are most important and mention those characteristics first when discussing the products or making a list. By ranking each product's features, you can more clearly understand which ones to highlight and which ones to mention in a complementary manner. You can consider conducting market research to learn which features are more exciting to your audience and list those first, then include the other features later in the description.

9.5.2.4 Discuss outcomes

Mention the results and outcomes that consumers can achieve by using the product features. Talking about the purpose of the features and their functions helps customers envision how they may use the product as part of their daily life. This highlights the usability and practical value of the product features, encouraging customers to try the features for themselves and enjoy the positive outcomes in their own lives.

9.5.2.5 Use quality images

Many people are visual learners, making images a highly effective method for explaining a product's features. Incorporate images into your promotional materials to highlight the appearance of a product and demonstrate how each feature looks on the real product. Having high-quality pictures, videos and 3D models can provide users with a more in-depth understanding of the product and make them feel more comfortable making a purchase. This is especially true when they're buying a product online and don't have a chance to see the product before they decide to but it.

9.5.2.6 Add testimonials

Incorporate reviews and other testimonials from real users who can vouch for the product's features to highlight their quality and show that they have practical applications for real users. You can do this by including featured quotes from real users or having a prominent review section where users can submit their own comments and photos of the products. Having testimonials builds confidence that the information you include about the product features accurately highlights its true functions and characteristics.

9.5.2.7 Consider your audience

Think about your target market and what kind of advertising methods they find to be the most persuasive. Each demographic and audience may have its own preferences for

how they want to learn about a product's features, so it's important to conduct research on what type of messaging and advertising is most effective for your customer segments. Create customer personas and profiles and adapt your copywriting style to match the voice and taste of your key consumers.

9.5.2.8 Incorporate descriptive language

Use accurate, powerful adjectives that help customers envision each detail of the product's features. Even when you have photographs available, using descriptive language can help you explain other aspects of the product and add extra value to the product description. Include numbers and measurements to explain the exact specifications of physical features or the extent of the product's performance. You can also create a narrative to tell a story about the product for a more creative approach to highlighting certain features.

9.5.2.9 Offer how-to, Knowledge Base Articles and guides

When releasing a new product, consider providing articles, newsletters or blog posts that share in-depth information on certain product features. Detailed how-tos and guides can be a valuable tool for current customers that highlight features from a new perspective. They provide valuable education for your users and can attract attention from future customers who want to learn more about similar products.

9.5.3 Need for a faster Go to Market Strategy with a specific Product

Before we get details into the pitching of GTM strategy, what is GTM?
A go-to-market (GTM) strategy is a step-by-step plan created to successfully launch a product to market. A good GTM strategy generally identifies a target audience, includes a marketing plan, and outlines a sales strategy. While each product and market will be different, a GTM strategy should identify a market problem and position the product as a solution.

In simpler terms, a GTM strategy is how a company brings a product to market. It’s a handy roadmap that measures the viability of a solution's success and predicts its performance based on market research, prior examples, and competitive data.

It's also worth noting that go-to-market strategies aren't exclusive to physical products. You can create a GTM plan for a new service, a new branch of your company, or even an entirely new business.

When IT companies are unveiling a new product, the last thing they want is to launch it. Without a proper go-to-market (GTM) strategy framework, Without proper planning, it’s impossible to know if a company is chasing the wrong audience, are too early or too late to a given market, or targeting a market that's too saturated with similar solutions and you don't want to run the risk of wasting time and resources on launching an unprofitable product.

To avoid those potentially disastrous hitches and hang-ups, you need to craft a thoughtful, actionable, effective go-to-market plan. But more often than not, that process is anything but easy to navigate.

In a competitive market, It is proven that the Faster the company pitches in the better chances of the company winning the customer with a right GTM strategy would give the competitive advantage when the right product features and capabilities of a Software product is highlighted in their strategy

There is also detail explanation of GTM strategy link referenced below which is a useful definition, however the research is not about GTM, the Researcher would further not dig deep into the topic
https://www.techtarget.com/searchitchannel/definition/go-to-market-strategy-GTM-strategy

9.5.4 Long term Orientation on this approach

Long term orientation is the fifth dimension in Hofstede's cultural model. It is defined as the extent to which a society looks forward to the future rather than resorting to the past to solve the problems in the present or the future. Making decisions based on past experiences and actions clearly has different implications in compare to looking forward in dealing with issues. Long term orientation shows how flexible a national culture is with regards to change. It also indicates the basis on which they make decisions. This dimension ranges from long term orientation to short term orientation, flex humility to monumentality. When it comes to the Long term orientation of a Software Product depends directly on the Continuous improvements and adapting the market insights as innovations into the Product. If the product is outdated , nobody would be interested in continuing with the product. So the summary of long term orientation on this approach is to adapt directly the competitive market insights into the product for the betterment and improvement of product.

10 Questionnaire

10.1 Survey Questionnaire

Answers have been gapped as shown below and have been deleted in the questionnaire section after the Guttman scaling process to form the construct. However to have the evidence of the survey answers recorded, it is researcher's responsibility to hold the data for the next 5 years and recorded these under Auxiliary information of this thesis paper in the appendix. At the end of the questionnaire the Researcher will perform a scalogram with different techniques and so the participants are not required to edit the score column

General Questionnaire

Construct	**#**	**Feature**	**Score**
Plan to Discover	1	Briefly describe about your product ?	1
	2	Are there any competitive alternates for your product in the market?	1
	3	Is your product Cloud based product / On-Premise / Hybrid(combination of Cloud and On-Premise) ?	1
Survey Responses	1a		
	2a		
	3a		

Construct	**#**	**Feature**	**Score**
Plan to Discover	4	Briefly explain the licensing metric for your product ?	1
	5	What are the dynamics behind the licensing metric against your product?	1
	6	Do you know if the competitive alternate of your product license metric matches to the license metric of your product?	0
Survey Responses	4a		
	5a		
	6a		

Construct	**#**	**Feature**	**Score**
Plan to Discover	7	Does any of the Market Analysts or Research Companies recognize your product as Market Leader?	1
	8	If the above question(#7) isn't applicable, does your company or you have any statistics to explain that your product is evolutionary in its own aspects?	0
	9	How many customers do you have against your product and answer the customer segmentation briefly?	0
Survey Responses	7a		
	8a		
	9a		

Construct	#	Feature	Score
Plan to Discover	10	Who are the target customers for your software product?	1
	11	Can you share any customer references and corresponding links available publicly in the internet?	1
	12	Did you lose any customers against your competitor and if so can you share against highly the number and the reasons? Example : Bid 10 customer, Won 7 customer, Lost 3 customers for so and so reasons if any?	0
Survey Responses	10a		
	11a		
	12a		

Further to Product Design and Go to Market questions

Construct	#	Feature	Score
Plan to Discover	1	What was your concept plan of action in discovering a new product within your product engineering line?	1
	2	How/What is the gap that was identified in the market to realize the concept into a successful software product ?	1
	3	Do you have any unique features to your product addressing the gaps in the competitive alternates with any Market insights ?	1
Survey Responses	1a		
	2a		
	3a		

Construct	#	Feature	Score
Design thinking and prototype	4	What makes your company to plan and discover that your product will sustain in the market	1
	5	What are the actions taken to make your product planning successful	1
	6	What features are unique to your product to address the competitive market	1
Survey Responses	4a		
	5a		
	6a		

Construct	#	Feature	Score
Launch and GTM	7	Does Market Insights play any key roles in your product development ?	1
	8	What do you consider from Market insights as your design parameters against your product design?	1
	9	Does the customer feedback play any vital role in redesigning your product in the Realization?	1
Survey Responses	7a		
	8a		
	9a		

Construct	#	Feature	Score
Support Services	10	What strategy do you use for Continuous improvement of your product?	1
	11	How do you gather your customer feedback, via what channels and mediums?	1
	12	In what aspects of your product development cycle do you intend to implement the design changes?	1
Survey Responses	10a		
	11a		
	12a		

Construct	#	Feature	Score
Sustain and upscale	13	What design methodology does you or your product development team follow?	1
	14	What are the key metrics that you consider in a successful product design	1
	15	How do you measure your product success ?	1
Survey Responses	13a		
	14a		
	15a		

Construct	#	Feature	Score
Retire and Revisit	16	What is the Go to Market strategy for your product?	1
	17	How do you compete against your competitive alternatives ?	1
	18	Winning the Customer, what does this mean to you esp. based on the unique features within your product and how would you achieve this?	1
Survey Responses	16a		
	17a		
	18a		

10.2 Demographic Questions

Position (of respondent in the company)
- Executive board
- Product management
- Sales
- Internal Product Maintenance/Support
- Operator/End-User
- Other _____

Industry (of respondent's company)
- Information Technology
- Retail
- Financial Services
- Automotive
- Other _____

Product Portfolio (the complete collection of products or services that the respondent business/ company sells)
- 1 – 10
- 10 - 100
- 100 - 1000
- 1000+
- Other _____

Revenue (of respondent's company or group of companies)
- 1 – 1M EUR p.a. (M = Millions)
- 1M – 5M EUR p.a.
- 5M – 25M EUR p.a.
- 25M – 100M EUR p.a.
- 100M+ EUR p.a.

Employees (of respondent's company or group of companies)
- 1 - 100
- 100 - 500
- 501 - 1000
- 1001 - 5000
- 5001+

11 Data Management Plan

Project Admin Details
Project Name: DBA plan

Project Identifier: Dissertation with SRS-1

Researcher: Bhargav Mylavarapu

Description: The study investigates the link between Market Insights and Product design services. For this purpose preference data will be collected with an online questionnaire.

Institution: European International University

11.1 Data Collection

What data will you collect or create?

The data the study is generating and analysing will consist of approximately an hour of Video/Audio recording, Communication of data via emails, survey responses and analytical view of these artifacts. A multiple data sets with different set of attributes per data set on a case by case. The data will have a digital character and will be saved in a .xlsx or .csv file. The total data set will add up to a needed storage space of around 1 GB with each Participant. The data will be generated for the study and there is no use of other existing data planned.

How will the data be collected or created?

The data for the study will be generated by an online survey. The survey software automatically generates data base entries for all respondents. To guarantee that the survey generates data of good quality a pilot study will be conducted and the final questionnaire will be adjusted if necessary. The results of the pilot study will not be stored long-term. The software will be advised that only completed questionnaires will be stored to ensure data quality.

11.2 Data Sharing

How will you share the data?

The results will be discussed in the DBA thesis that will not be made public. Furthermore it is intended to publish the results in an academic journal that deals with Robust design from Market Insights in IT products in the future at researcher's own discretion. If this creates interest in the original data set, other researchers can contact the researcher of this study to get access to the original data set via email bhargav.mylavarapu@live.com. After a check of the academic nature of the research project, the researcher will make the data set accessible to the requesting party aligning to the disclaimers in the appendix. Data transfer and storage strategy will be decided on a case-by-case basis.

Are any restrictions on data sharing required?

The raw data will only be made accessible to academic entities and researchers review committee. Professional bodies will not have access to the raw data. This will be valid for the whole storage period of five years. The access request will be checked on a case-by-case basis by the researcher and will be granted if the project or entity has an academic character.

11.3 Responsibilities and Resources

Who will be responsible for data management?

The researcher will be responsible for the data management in all periods of the project. He will be responsible for the data integrity and backup during the collection phase and after that he will be responsible for the storage and access management of the raw data for ten years until the data will be deleted completely.

What resources will you require to deliver your plan?

Researcher will store the data in a secured Network Attached Storage device that is used to collect the survey data and will be paid by the researcher himself and he will as well be the responsible person to store the data for five years after the completion of the study. He will be responsible to cover all costs that are aligned to the generation or storage of the data. This cost will not exceed 25 NZD per year and will be tolerable.

11.4 Preservations

Which data are of long-term value and should be retained, shared, and/or preserved?

The whole data copy the researcher is responsible for will be stored for five years to support further studies that deal with Robust design in Product engineering from market insights. The researcher does not allow to store the data on a publicly available research data repository as it may be accessible for former, current or future competitors and the generated knowledge is seen as a competitive advantage that should not be shared with those enterprises. The agreement with participating respondents on the survey questionnaire and interviews further states that academic use of the data is allowed also these results may find their way to those enterprise in a second step. The researcher is responsible to store the data for five years after the completion of the study and handle all requests regarding the data set according to the interest of Participant respondents.

11.5 Ethics and Legal compliance

How will you manage any ethical issues?

The type of data that is generated by the study does not have a sensitive character. It deals with general service preferences that the respondents frequently discuss within their corresponding Product Engineering verticals, the researcher uses a leading NAS survey tool and also act as the host of the survey. For this reason there will be no specific attempts to transfer data insecurely. The survey software transfers data SSL coded by default. This security standard is the same standard that is used for online banking transactions and can be assumed as secure. All participants are asked to give their consent on the analysis, storage and re-use of their responses before they are able to start the survey. This ensures that all participants actively agree on the intention to use the data for further analysis. It will not be able to identify any participant of the survey as the data will be analysed anonymously. For this purpose the survey is prepared to delete any data such as email address, IP address etc. that are according to the Data Sensitive standards are not stored and if in case of technical challenges to get this data to be stored in secured storage in researchers NAS that allows an identification before the data is stored. A detailed discussion of the ethical considerations can be found in the ethical application. At this point it is sufficient to state that the study is fully in-line with the concordat to support research integrity of the University – European International University.

How will you manage copyright and Intellectual Property Rights (IPR) issues?

The data that is generated during the study is owned by researcher and will not be licensed for any Private use except for the academic use. The generated data will be made accessible for academic projects on demand and this will be handled by the researcher. This is in line with an agreement the researcher has with participating companies. The raw data will not be made accessible to other professional bodies that have been, or could be competitors of participating companies in future.

12 Findings

12.1 Introduction

This chapter presents the empirical findings of the study. The chapter is divided into four parts. It begins with an overview about the respondents that participated in the study, followed by an evaluation of the quality of the scale by checking if the data is valid and reliable. The next section presents a descriptive review of the measured strategies towards Robust product design and the results of the actual model testing to examine the Market insights and its influence on Product Engineering. The chapter ends with an investigation of the influence of demographic parameters in winning the customers.

12.2 Respondents Profile

The data of the study were gathered from three different and independent product engineering customers who got present in more than one country, including the diversification between the three companies scaling from Start-up to Corporate giants, who got presence in all important geographical regions in such as Germany, Australia, North America and South America. The below Table gives an overview of the participating companies in the study, the valid responses per product and the respective response rates.

Company	Product	Group Invitation	Valid Individual responses	Response Rate
SAP	Digital Payments	1	0	0%
	Advanced Payment Management	1	19	100%
SAP Fioneer	FS-PE	1	2	100%
	Cloud for Banking	1	1	100%
Frankie One	AML/KYC	1	27	100%
Adapt IQ	Salesforce	1	0	0%

Industry	Number of Employees	Annual Revenue	Participant Role
SAP – IT, EAS, BS, CC, PS	100,000+	27.84B EUR	Product Owners and Principals
Fioneer – IT, FSI	1,000+	500M EUR	Vice President & Product Management/Owners
Fioneer – Platform & FinTech	100+	15.5M EUR	Product Manager

Demographic representation

The last demographic question targeted the function of the respondent in the company. For the following analysis it is important to ensure that the respondents are in the position to actually influence the Product Engineering decisions of their companies in the context of Features and Capabilities analysing the Market Insights. For this purpose, the target audience were Product owners or Product managers or respectively heads of production in Small, medium and bigger sized companies. The vast majority of the respondents can be allocated to these three positions with 60% defining their position as the Executive levels of the company, 70% being employed as the head of product development and 20% function as the Product managers, while only 10% cannot be allocated to these three categories which was excluded from the survey. Having presented the demographic structure of the sample, the next section will address the validity and reliability of the measurement scales.

12.3 Validity and Reliability of Scale

As described in the methodology section, the validity of the scale is tested with Guttman scales that favour one-dimensionality. One-dimensionality is linked with construct validity All questions that form a construct were arranged to receive a Guttman scale as it is explained as, the dichotomous items a Guttman (1944) scale can be built to assess the unidimensionality of each dimension of the scale. A Guttman scale is based on dichotomous items with increasing extremity of the measured dimension or construct, meaning that the items are measuring the construct in different intensities(Gehring & Weins, 2004). For example, salt, rock and diamond can be ordered according to their hardness. On a purely unidimensional scale a respondent that accepts salt is hard, must accept that rock is harder (Ekinci & Riley, 2000). However, the order of the items is not predetermined and based on empirical analysis (Gehring & Weins, 2004). To test whether several dichotomous measures build a Guttman scale, the items are ordered by the level of agreement. In a perfect Guttman scale all respondents that agree to an item with a high level of agreement should agree to items with lower levels of agreement. A perfect Guttman scale is shown in the Table below

Item A	Item B	Item C	Item D	Total Score
1	1	1	1	4
1	0	0	0	1
1	1	1	0	3
1	1	0	0	2

If the items can be ordered in a way that a Guttman scale is built the underlying construct of the measures is unidimensional. As it is hard to observe an ideal Guttman scale in real life, the construct needs to pass through an error assessment procedure (Ekinci & Riley, 2000). In this process every set of items that violates the ideal order of the scale is counted and compared to the total amount of item sets. Guttman (1950) sets the acceptable level of error to 10% and therefore a construct needs an average reliability of total score. To achieve this goal, the initial set of items in this study will be reduced by a successive process of elimination to reach the quality criteria by checking the non-existence of competing software. The goal of this process is to have three companies participating in the survey per questionnaire that are both relevant(is a direct competitor) and non-relevant(not a competitor) However the survey is straight opinions from the software product owners, the researcher interprets this as not necessary and the score it given purely based on Guttman scale proportionate to the number of respondents.

The Guttman scale measures the participation of each question in the survey as a respondent towards the specific construct. The scores can be interpreted as indicated in the respondent's score for a Guttman scale of a construct of Survey questions, Survey response and notes are referenced in the document as auxiliary information

Further to the findings, the following research areas that can be explored by future researchers based on this paper on publication based are defined below in the respective area based approach

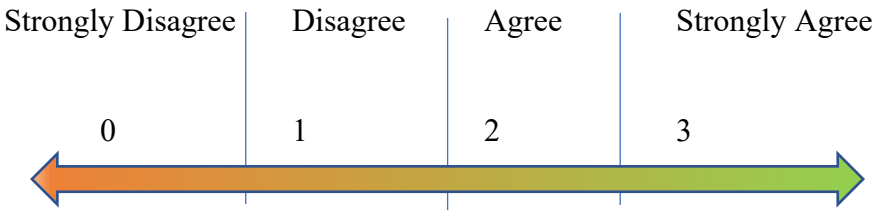
1. Hypothesis based: Exploratory research is undertaken when few or no previous studies exist. The aim is to look for patterns, hypotheses or ideas that can be tested and will form the basis for further research. Typical research techniques would include case studies, observation and reviews of previous related studies and data. This can be achieved by comparing likewise software's and measuring which product is successful in a particular market segment by measuring the two things
   a) Number of sales against that particular software compared against the competition
   b) Sustainability of the software
   c) Customer happiness / defined with OKR

2. Descriptive based: Descriptive research can be used to identify and classify the elements or characteristics of the subject, e.g. number of days lost because of industrial action. Quantitative techniques are most often used to collect, analyse and summarise data. This thesis based on descriptive based from the surveys analysis and summarising the data. However the focus of this analysis is on the robust design particularly in product features capability with the inputs from market insights where in there are several other divisions or processes within IT industry which can be taken up forward with a research as such, improvement on business processes within Product Engineering with the number of days gained with a particular methodology etc

3. Analytical based: Analytical research often extends the Descriptive approach to suggest or explain why or how something is happening, e.g. underlying causes of a particular action, esp. based on this research it is focusing on the combination of multiple factors as such Market Insights, GTM, Robust Design of a product, Product feature capabilities, winning the customer etc. This can further be narrowed down. An important feature of this type of research is in locating and identifying the different factors (or variables) involved.

4. Predictive based: The aim of Predictive research is to speculate intelligently on future possibilities, based on close analysis of available evidence of cause and effect, e.g. predicting when and where future action might take place esp. in the case of Robust design at what stage of the software product production can it be for example in the exploration phase, ideation phase, realization phase or build phase.

Validity of Guttman Scale – Average Score Reliability



13 Conclusions

Understanding the functional software design parameter is an essential step improvement in the quality of sales of a software product. The Taguchi method of experimental design for the software recommends that optimal design parameter are one requirement per module, low coupling and cyclomatic complexity should be less than 5 in order to reduce the number of errors per module to one or less. Most notable of all this study demonstrates that high quality can be obtained at a low cost, by avoiding the faults to be identified at the later stages of the development phase, which was the central theme of Taguchi quality philosophy. Philosophically speaking, the software programmer can do very little alone, it is the process that has to be improved and this requires action from management. This method could be applied to any radial dimension of the spiral model to obtain the optimized parameter and to improve the quality of the final product.

To sum up the data analysis procedure, it can be said that the data analysis procedure is conducted in four steps. Initially the sample size is tested for its sufficiency. The sample size should at least be 3 independent responses and each participating company should contribute 6 or more construct responses to the final sample. In a second step the measure will be tested for reliability and validity. The reliability will be assessed by calculating Realtime use cases and the success of the Product by their Customer Wins of the scale. To evaluate the validity of the scale Guttman's test for one-dimensionality is applied as it is designed to work with dichotomous items. The actual research model and its hypotheses is tested with several multiple linear regression analyses, that examine the influence of market insights on the robust design of software product.

Having discussed the methodological approach of the study, it became apparent that this study has two major contributions to the body of knowledge. As there has been no scale available to measure product feature capabilities towards the software product design, one major contribution is the development of a valid and reliable scale to approach these constructs. The scale has been designed by rigorously following the scale development decision tree of Barry et al. (2011). In contrast to most scales, it has been decided to rely on dichotomous questions to measure the influence of market insights patterns as they appear on Likert scales. Based on the literature that deals with the influence of market insights on the attitudes towards software product design, this point hasn't been addressed so far and it is likely that many of these results may be biased by market insights response patterns. The survey items themselves have been developed in several loops by the principal researcher to create a questionnaire that is suitable to a Robust product design context for software companies. Before conducting the actual survey, the quality of the scale has moreover been tested in a pilot study privately with a group of friends and family.

The Other major dimension is GTM and is measured with customer wins against the software product with the competing alternatives in the market

13.1 Research Limitations

Considering there was certain limitation around the ethics and compliance office of the participating companies, even in the case of the survey being participated as completely anonymous, there were certain limitations in sharing the company's confidential information

which can be misused/misinterpreted/mislead for the purpose of what they not intend to. For this reason there were certain information that can either be

a) Kept cryptic from the Survey in Principal researcher's individual perspectives
b) Not disclosed and unanswered by Survey Participants

However these can be further refined considering a decent amount of time and budget invested to clear out these boundaries for future studies as referred to in section 13.4

13.2 Recommendations

The research work includes elaborative data analysis from the practical real life experiences from the IT Experts, leaders, executives and end customers on their journey from product design to Robust product design based on the loss function and finally landing into the direction of customer centric product design.

Any software product is not a viable solution if the product is built purely focussing on Customer centric design as this would end up with the millions of product features doing similar things in a slightly different way as different customer would have requested for. The recommendation is to keep these under void until the robust design is achieved.

On successfully completion of a Robust product design by apply the loss function against product feature capabilities these would save the costs during realization as the focus of the build is minimum viable product that key features for all the customers(whether they need it or use it or don't use it doesn't come to consideration. As this is the basic Core Product), everything that was under are subjective to void of individual customers are considered as local/regional/project extensions to the product

13.3 Future Studies

It is important for researchers to consider aforementioned limitations of this research work and provide recommendations to overcome these limitations. It is quintessential to conduct interviews and surveys so that more people can be reached and better awareness can be created in society. Local workshops and campaigns should be entertained to promote the significance of individual participation without any ethics and compliance office involvement. Future researchers should focus on identifying positive aspects of Completely customer centric product design as well, however; interventions required to be implemented during the realization of Robust product design that has any negative outcomes should be identified as well, additional information is captured below

13.3.1 Negative outcomes of Robust Product Design

Most unlikely that there would be any negative outcomes of Robust product design within the epoch of a particular software application until there was any disruption to the Industry or particular Line of Businesses.

Eg: 1990's – Internet Epoch, 2000's – Software, 2010's – Supply chain, 2020's Cloud Business, 2023 – Sustainable . . .. . .20xx – something else

Being said that this research parper didn't consider the topic under the lines of epoch analysis of a particular software product, thus this can be one of the key aspect of future studies

13.3.2 Robust Product Design to No Design

Interestingly possible as the topic might not sound under those lines, to keep any product feature capabilities as efficient as possible measured with the times of usage. So to identify the mechanism of measuring the usage with analytical data instead of referential data, a tool that can be measured this product feature capabilities directly in Realtime is injected to the software to have on-the-fly analytical data which can be used to measure the impact/influence of Design itself with all other circumstances surrounding the lifecycle of a software can further be studied

Productivity software: This includes applications such as word processors, spreadsheets, and presentation software that help users create and manage documents, data, and presentations.
Communication software: This includes email clients, messaging apps, video conferencing tools, and other communication tools that enable people to connect and communicate with each other.
Accounting software: This includes applications designed for managing financial data, such as bookkeeping, invoicing, and budgeting.
Database software: This includes applications that allow users to create, store, and manage data in a structured manner, such as relational database management systems (RDBMS) and NoSQL databases.
Operating systems: An operating system (OS) is software that manages computer hardware and software resources and provides common services for computer programs.

There are many software which doesn't have a design, These are just a few examples of software that do not involve design studying these principles further and apply to the software products

Software development without design can be further studied in relevance of low-code or no-code approach. Low-code platforms typically require some programming knowledge and provide more flexibility for advanced customization. No-code platforms, on the other hand, require no programming knowledge and are designed to be accessible to non-technical users.

Some examples of low-code and no-code platforms include:

- Bubble
- Wix Code
- AppSheet
- Airtable
- Zapier
- Webflow
- PowerApps (by Microsoft)
- Google App Maker (discontinued)
- Salesforce Lightning
- Betty Blocks

These platforms can be used to create a wide variety of applications, from simple web pages to complex business process automation tools, without requiring the user to have extensive programming experience.

14 Reference:

1. Bagchi, T. P. (1993) - Taguchi methods Explained: Practical step to Robust Design, Prentice-Hall;
2. Zahedi, Fatemeh (1995) - Quality Information Systems, Thomson Publishing, USA.
3. Lead-to-Account Matching and Routing Software Market, Future Market Insights, USA.
4. SAP CMI – Capital Market Insights competence Newsletter 2019, 2020, 2021, 2022, SAP SE, Germany
5. Austin Kronz, Kurt Schlegel, 2022 Magic Quadrant for Analytics and Business Intelligence Platforms
6. Gartner Peer Insights 2022, Enterprise Integration Platform as a Service Reviews and Ratings
7. Card, David and Glass, Robert L. (1990) - Measuring Software Design Quality, Prentice Hall, Englewood Cliffs, NJ;
8. Kan, S. H. (1995) - Metrics and Models in Software, Massachusetts: AddisonQuality Engineering, Wesley;
9. Roy, Ranjit. (1990) - A Primer on the Taguchi Methods, Van Nostrand Reinhold, New York, NY;
10. Taguchi, Genichi and Clausing, Don. (1990) - "Robust Quality," Harvard Business Review, January-February, Vol. 68, No. 1;
11. Daniel, J. (2012). Sampling Essentials: Practical Guidelines for Making Sampling Choices – Thousand Oaks Sage Publication
12. Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students (5th Edition). Harlow: Financia Timesl Prentice Hall.
13. Beiske, B. (2007). Research Methods: Uses and Limitations of questionnaires, interviews and 163 case studies. München: GRIN Verlag
14. Lodico, M., Spaulding, D., & Voegtle, K. (2010). Methods in Educational Research - From Theory to Practice (2nd Editio). San Francisco: Jossey-Bass
15. Maxwell, S. (2000). Sample size and multiple regression analysis. Psychological Methods, 5(4), 434–458.
16. Hofstede, G., Minkov, M., & Vink, H. (2008). Value survey module manual 2008. Retrieved from http://www.geerthofstede.com/vsm-08
17. Barry, A., Chaney, E., Stellefson, M., & Chaney, J. (2011). So You Want to Develop a Survey: Practical Recommendations for Scale Development. American Journal of Health Studies, 26(2), 97–105.
18. Johnson, P., & Clark, M. (2006). Mapping the terrain: an overview of business and 172 management research methodologies. In P. Johnson & M. Clark (Eds.), Business and Management Research Methodologies. London: Sage Publications
19. Katz, M. (2006). Study Design and Statistical Analysis - A Practical Guide for Clinicians. Cambridge: Cambridge University Press.
20. Fowlkes, W.Y. and Creveling, C.M. (2012) *Engineering methods for Robust Product Design: Using taguchi methods in technology and product development*. Reading, MA: Addison-Wesley.
21. Ekinci, Y., & Riley, M. (2000). The Application of the Guttman Scaling Procedure in the 167 Measurement of Consumer Behaviour: A Marketing Myopia. Journal of Travel & Tourism Marketing, 8(4), 25–42.
22. Hayward, S. and Jacobs, J. (2002) *Magic quadrant: Team colloboration support*. s.l.: Gartner Inc.
23. Ulrich, K.T. and Eppinger, S.D. (2016) *Product design and development*. New York, NY: McGraw-Hill Education.

24. Wedel, M. and Kamakura, W.A. (2003) *Market segmentation: Conceptual and methodological foundations*. Boston, Mass: Kluwer Acad. Publ.
25.

15 Application for Ethical Review – Research Student

15.1 Study Title and Key Dates

15.1.1 Title:

Proactively removing the inefficiencies in Software Product Design using Taguchi Methods by augmenting the Robust Design, Processes and Product Feature Capabilities supplemented by Market Insights

15.1.2 Date of submission:

18.03.2023
Version Number: 1
Ethics Committee Reference Number: 1

15.1.3 Dates of study

Study commencement: 12.05.2021
Projected date of study completion (fully written up): 21.03.2023

15.2 Principal Researcher details and Background:

Name : Venkata Sesha Bhargav Mylavarapu
Course of Study : Doctor of Business Administration

Professional Background : Bhargav has 17+ years of experience in SAP technologies spreading across Full lifecycle end to end implementations, other projects that includes Support, Migration, Conversion & Rollouts. Previous to his SAP career he has 10 months of Shell Programming experience on Solaris systems with KShell, BourneShell. Expert in Financial Services Industry. His current role is Product Engineering Principal Architect for Application Innovation Engineering and his previous role was Global Lead Architect and Product Owner for SAP Cloud4Banking-Payments. C4B is an SAP Inhouse initiative in building Fintech's, Corporates, Banks and Payment solutions in a Single stack S/4 HANA system. He has vast experience on several classic ERP modules. He has experience in Portfolio management, Pre-Sales activities that include RFI, RFPs and Statement of Work. His analytical capabilities has driven him to take very challenging roles in multi-vendor projects with excellent track record. His key skills cover the entire SAP eco-system in Technical, Functional & Integration and Overarching all together (Product Portfolio)
He was one of the top contributor in SAP Community networks and Developer networks in several Forums and Active Platinum medal holder with 14 Publications in SAP Channels as Blogger, Content writer and Research and Development solutions

Educational Background : Bhargav holds a

- Bachelors in Customer Science and Engineering from Anna University Chennai
- Graduate Diploma in Foundations of Psychology from RMIT University, Melbourne Australia
- 8 x SAP Certifications starting from Associate, Professional and Architectural levels within the field of his work

Professional Memberships :

- Member of Computer Society of South Africa
- Member of IT Professionals of South Africa
- Member of New Zealand SAP User Group
- Member of IEEE – Anna University Association

Aspirations : He would like to enrol in Stanford LEAD or MIT Sloan leadership programs in the upcoming years of his career with aspirations to contribute in the strategic leadership roles

15.3 Please complete 14.3.1 &14.3.2 as appropriate

15.3.1 Proofreading (Private review)

Name : Ravi Kiran Vajjah
Title/Role : Proof-reader
Qualifications :
MBA – General and Marketing, Osmania University, India
MS – Information Systems, Carnegie Mellon University USA
PhD – Auckland University - Pursuing
Email : ravikiran.vajjah@gmail.com

Name : Dr. TSS Balaji
Title/Role : Proof-reader
Qualifications :
B.E – Mechanical Engineering, NIT Calicut, India
M.E – Mechanical Engineering, NIT Calicut, India
PhD – Operations Research
Email : tssbalaji@yahoo.com

15.3.2 Review Committee

Name: Prof.Dr.Edward Roy Krishnan
Title /Role: President - EIU
Department of Faculty Management
Telephone: 0033 6 07 59 11 97
Email: president@eiu.ac

15.4 Funding Details

The project is 100% self-funded on Research, However researcher's manager and employer is committed for a financial support from SAP New Zealand Limited in some portion of the Tuition fee only.

15.5 Research Sites

The research will be conducted amongst employees of the researcher's employer and as well as the other companies which is considered in the aspects of Product Engineering verticals only. However the Researcher is not considering if the

participant's responses are of Competing and Non-Competing software products between the participant companies.
The employer, SAP, is a leading multinational Software Company headquartered in Germany that operates in over 180 countries with regional offices and generates annual revenues of roughly 27.8 billion EUR. The customers will be contacted via an invitation to an online survey. All invited persons will answer voluntarily. That means that there is no obligation or expectation that an invited person actually participates in the survey. There will be very slight personal contact between the researcher and the survey participants during the research project for clearing out any context or typo errors in the responses from the participants.

Frankie One, as Frankie One is in the process of defining a new Go-To-Market strategy, the questionnaire was completed in personnel to avoid any Non-Disclosure Agreement and Copy Rights. For this reason there is no specific concern regarding health, safety and welfare of both researcher and participants as both operate in their regular workplaces. Frankie One interview and questionnaire was done via a Zoom meeting invite.

The researcher has also gone thru several other forums as such Public Libraries, OpenLibrary.com and Wikipedia, Pearson Publications and third party open license partner and customer website contents as such Gartner, Forrester, IDC.

There are no special permissions to be obtained from Market Analysts in terms of gather information from the research as the data is available in public domain and the insights from this document and its content to interpret in trademarked assets from Researcher work for any further development of hypothesis including for academic purposes only. However a Special permission is required to be obtained from the Researcher to access any data related to this study.

15.6 Insurance Arrangements

The research project does not raise any specific risk that need to be covered by further insurance policies that extend the indemnity that is provided by the University for ethically approved research.

15.7 Study Summary

15.7.1 Summary of Study

The purpose of the study is to investigate the link between Market Insights and the robust design of a software product by applying taguchi methodologies. Product Design methodologies that are offered by Product Engineering teams within an Organization, in this case a Information Technology giant SAP and the contra counterpart FrankieOne, that enhance or maintain the value of the product design over the life cycle of the Product engineering (e.g. build/development, features and capabilities, consulting, maintenance and support, Sales strategy / GTM etc.). These services already generate up to 60% of chances winning the customer with the unique capabilities of a product and so the revenues of a company. At the investigated company FrankieOne,

these robust design of a product and its features and capabilities generate roughly 15% of the chances in winning the customer. That equals roughly 10 million EUR. The generated data will be analysed statistically. Quantitative models will be used as independent variables in an multivariate regression model to explain certain preferences for taguchi methods. This is in line with the approach of other mentioned studies. Qualitative methods are used for measuring the objective definition of Robust Product design need and GTM strategy.

15.7.2 Ethical Issues

Ethical issues might not be involved as individuals will be asked to participate in the survey voluntarily. However, due to the fact that they are asked to speak from their experience and it could be either for their company's Software Products and not as an individual or as individual or generally from a Software product management experience and the number for responses will guarantee that no individual respondent will be identified, potential ethical issues will be limited. The generated date will not be sensitive as those customers state these preferences very openly in discussions with different representatives of participating companies like SAP, Fioneer and Frankie One, Software companies that was mentioned earlier, in daily business. A minor ethical issue could be aligned to the fact that the study is stressing the concept of Product Features in this context of design, market insights compared against competitive alternates and this might cause some conflicts if the participant does not want to be judged for his intellectual property or even opinions/statements/comments. But as the participation is 100% voluntarily, those customers are free to reject the invite/participation. From a researcher's point of view the entire responses are kept anonymously to keep the violation of intellectual property, however for the context of getting accurate data, the researcher might ask subsequent questions based on the participant's responses which will not be recorded or collected via the NAS survey tool.

15.7.3 Views Expressed

This disclaimer informs readers that the views, thoughts, and opinions expressed in the text belong solely to the research author, and not necessarily to the author's employer, organization, committee or other group or individual

The research study and the information in this document is confidential and proprietary to the Researcher and may not be disclosed without the permission of the Researcher. Except for your obligation to protect confidential information, this document is not subject to your license agreement or any other service or subscription agreement with Researcher. Researcher has no obligation to pursue any course of business outlined in this document or any related document, or to develop or release any functionality mentioned therein

16 APPENDIX

16.1 Survey Invitation Letter

Email:

Dear XY (Name of customer),

Thank you for reading this. I would like to invite you to take part in my doctoral research project by completing the survey in the Synology Survey Collaboration link(sent in a separate email) and join me in the Zoom meeting interview (optional). The research project is in cooperation between the Principal Researcher of European International University (adhering to the academic guidelines) and the Participating companies/individuals. It is entirely up to you whether you participate, but your responses would be valued.

You have been identified as a potential respondent by the Researcher as you are representing a Software Product within the Product Engineering/Product Management verticals and IT customer. My study investigates the influence of Market Insights on the preferences for Product Design with Product Feature Capabilities compared against the competitors and therefore your feedback as a regular customer of such services is highly appreciated.

The data will be used for academic research and in defining a Robust Product Design based on Aftersales portfolios of a Company's response to local needs.

A separate email will be sent to you with the Login details containing your User Name and Password to access the Synology Survey tool and a Questionnaire will be shared with you for your participation. The Access is restricted on the Survey tool, however when clicked on the sign-in button, the tool allows you to login with your credentials.

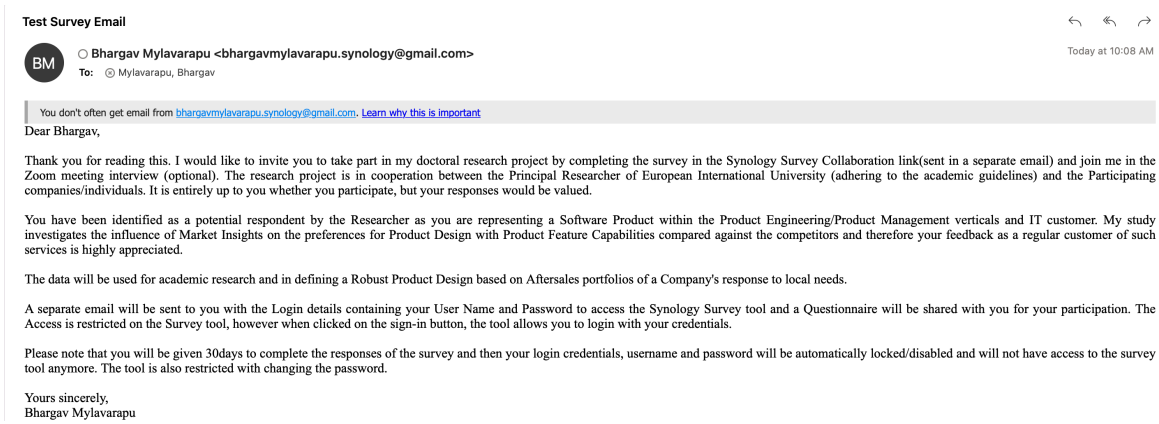
Please note that you will be given 30days to complete the responses of the survey and then your login credentials, username and password will be automatically locked/disabled and will not have access to the survey tool anymore. The tool is also restricted with changing the password.

Yours sincerely,



Bhargav Mylavarapu
Principal Researcher – Dissertation Practitioner

Sample Email to Invite :



Test Survey Email

BM

Bhargav Mylavarapu <bhargavmylavarapu.synology@gmail.com>

To: Mylavarapu, Bhargav

Today at 10:08 AM

You don't often get email from bhargavmylavarapu.synology@gmail.com. Learn why this is important

Dear Bhargav,

Thank you for reading this. I would like to invite you to take part in my doctoral research project by completing the survey in the Synology Survey Collaboration link(sent in a separate email) and join me in the Zoom meeting interview (optional). The research project is in cooperation between the Principal Researcher of European International University (adhering to the academic guidelines) and the Participating companies/individuals. It is entirely up to you whether you participate, but your responses would be valued.

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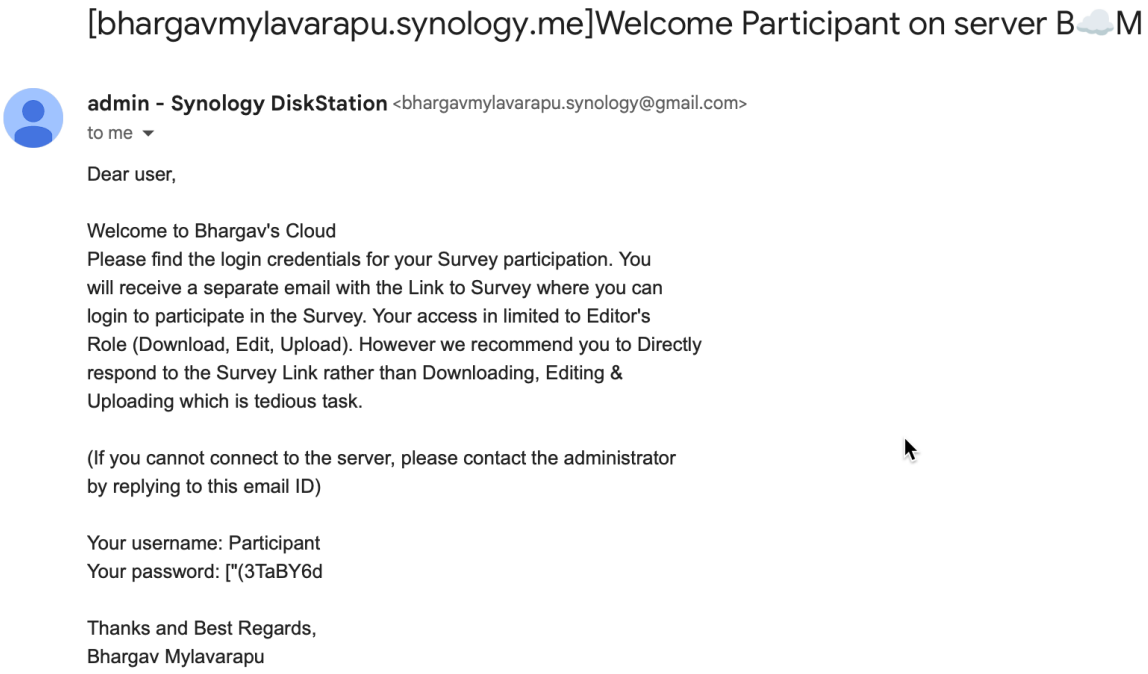
The data will be used for academic research and in defining a Robust Product Design based on Aftersales portfolios of a Company's response to local needs.

A separate email will be sent to you with the Login details containing your User Name and Password to access the Synology Survey tool and a Questionnaire will be shared with you for your participation. The Access is restricted on the Survey tool, however when clicked on the sign-in button, the tool allows you to login with your credentials.

Please note that you will be given 30days to complete the responses of the survey and then your login credentials, username and password will be automatically locked/disabled and will not have access to the survey tool anymore. The tool is also restricted with changing the password.

Yours sincerely,
Bhargav Mylavarapu

Sample Email to Survey :



[bhargavmylavarapu.synology.me]Welcome Participant on server B☁️M

admin - Synology DiskStation <bhargavmylavarapu.synology@gmail.com>

to me

Dear user,

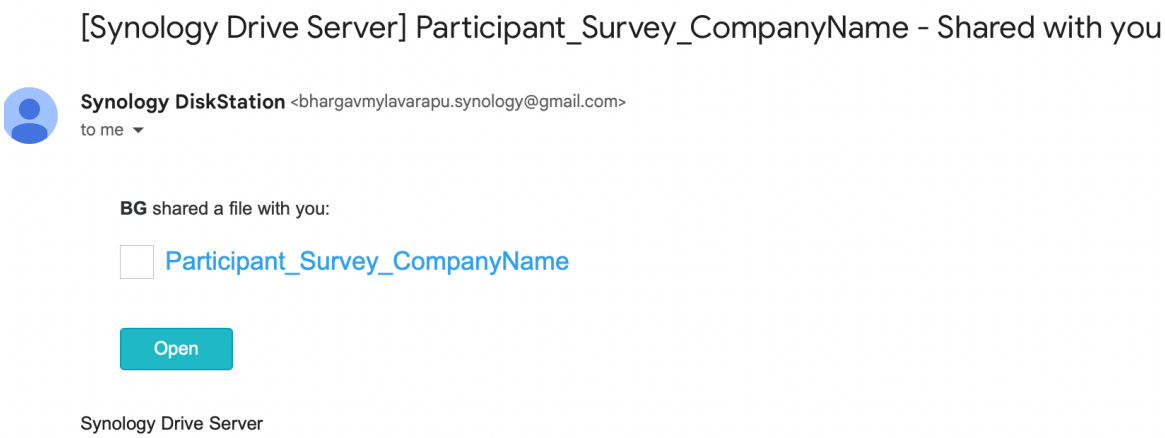
Welcome to Bhargav's Cloud
Please find the login credentials for your Survey participation. You will receive a separate email with the Link to Survey where you can login to participate in the Survey. Your access in limited to Editor's Role (Download, Edit, Upload). However we recommend you to Directly respond to the Survey Link rather than Downloading, Editing & Uploading which is tedious task.

(If you cannot connect to the server, please contact the administrator by replying to this email ID)

Your username: Participant
Your password: ["(3TaBY6d

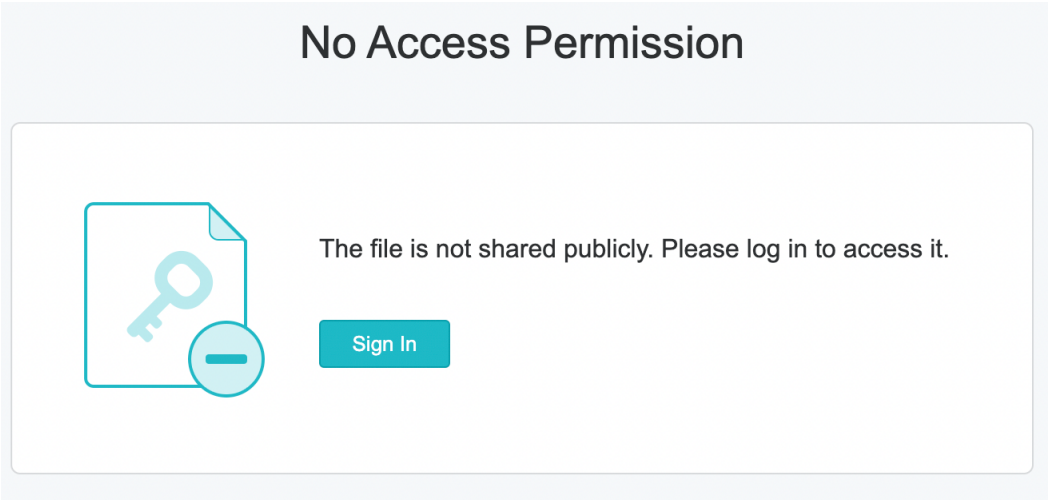
Thanks and Best Regards,
Bhargav Mylavarapu

Shared Survey Email :



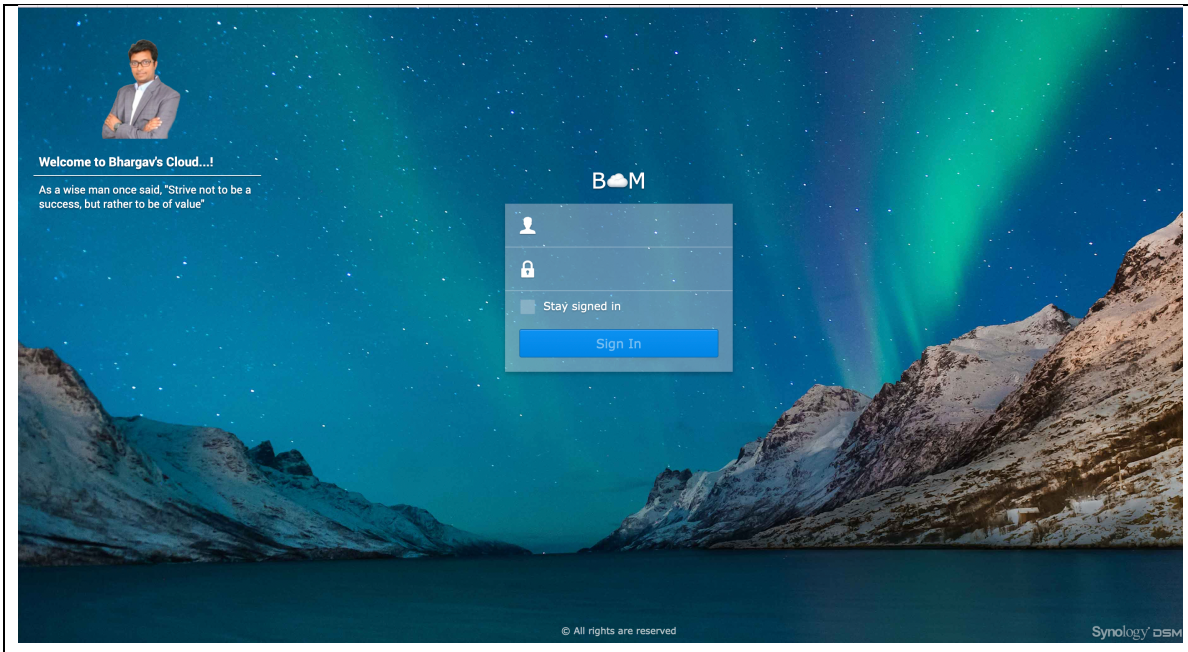
Sample Link to Survey :

As shown in the above email, the Open button will directly lead to login page for entering into the survey. Since the Survey Questionnaire file is not shared publicly, it is very important to sign-in with private and provided user credentials (shared via email) by clicking on the above shared link, it would take you to below screen



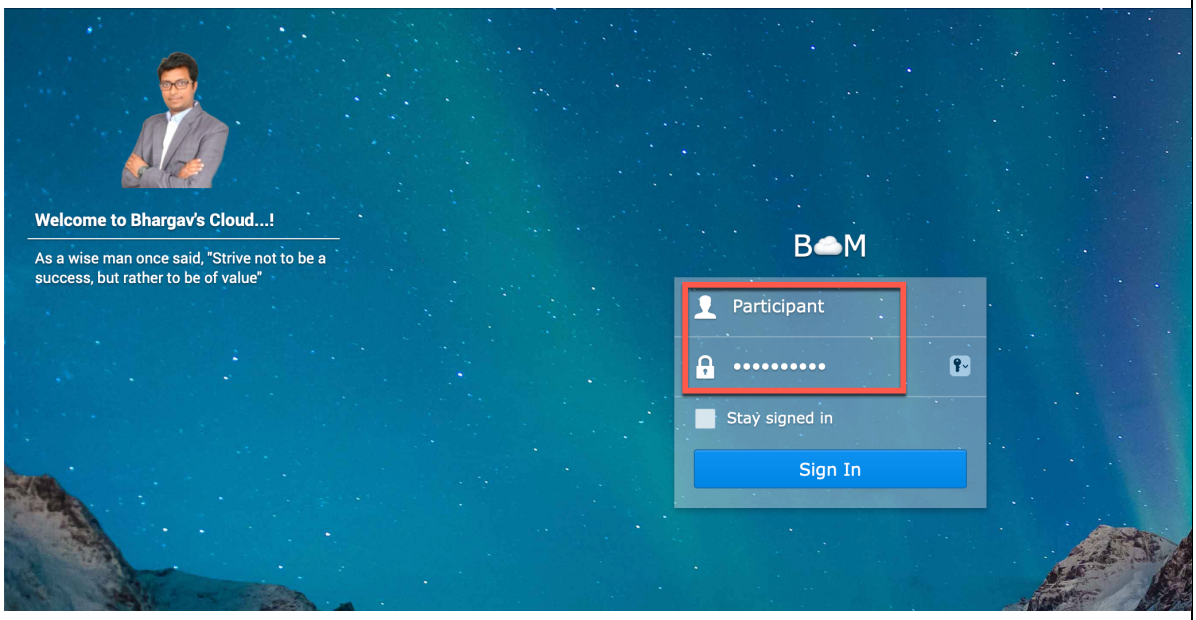
As a next step, click on Sign-In

Which would eventually land on to Login page



Enter the credentials to Login that was shared via email

Example as shown below



The survey page would appear as shown below, starting with introduction and high level overview to the participants on the survey and how they were identified as the right participants/audience for responding to the Survey.
A brief introduction to the research, preservations, responsibilities, ethics and compliance, how the data is maintained for the survey and the Intellectual property rights.

A list of questions are present categorized as follows

1. General Introduction
2. Product Design
3. Competition and Go to Market

4. Extraneous Matter questions which are optional
5. Demographic questions

Additionally participants are requested to provide the following at their discretion and not mandatory if they would like to add to the survey response

1. Any supporting evidence/materials for their responses to the survey questionnaire
2. Suggestions, statements, comments or improvements
3. Auxiliary information

The Survey tool is quite flexible and allow to add any attachments, links from public internet and or any in-line images

Survey Questionnaire

Survey and Interview



Participant011
17.10.2022
Survey Questionnaire Participation

Table of Contents

Introduction

Data Management Plan
- 1.1 Data Collection
- 1.2 Data Sharing
- 1.3 Responsibilities and Resources
- 1.4 Preservations
- 1.5 Ethics and Legal compliance

Questions
- Survey Questionnaire
- Demographic Questions

With the survey questions and introduction and background to survey as explained in the subsequent chapter IV questionnaire

16.2 Declaration

Declaration by Researcher, and, if necessary, the Supervisor

1. The information in this form is accurate to the best of my/our knowledge and belief and I/we take full responsibility for it.

2. I/we undertake to conduct the research in compliance with the European Internation University Ethics Policy, Paris Concordat to Support Research Integrity, the Code of Practice and any other guidance I/we have referred to in this application.

3. If the research is given a favourable opinion I/we undertake to adhere to the study protocol, the terms of the full application as approved and any conditions set out by the Ethics Committee in giving its favourable opinion.

4. I/we undertake to notify the Ethics Committee of substantial amendments to the protocol or the terms of the approved application, and to seek a favourable opinion before implementing the amendment.

5. I/we undertake to submit annual progress reports (if the study is of more than a year's duration) setting out the progress of the research, as required by the Ethics Committee.

6. I/we undertake to inform the Ethics Committee when the study is complete and provide a declaration accordingly.

7. I/we am/are aware of my/our responsibility to be up to date and comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data, including the need to register, when necessary, with the appropriate Data Protection Officer. I/we understand that I/we am/are not permitted to disclose identifiable data to third parties unless the disclosure has the consent of the data subject.

8. I/we undertake to comply with the European International University of Research Data Management Policy.

9. I /we understand that research records/data may be subject to inspection by internal and external bodies for audit purposes if required.

10. I/we understand that any personal data in this application will be held by the Ethics Committee, its Administrator and its operational managers and that this will be managed according to the principles established in the Data Protection Act 1998.

11. I understand that the information contained in this application, any supporting documentation and all correspondence with the Ethics Committee and its Administrator relating to the application: Will be held by the Ethics Committee until at least 3-5 years after the end of the study Will be subject to the provisions of the Freedom of Information Acts and may be disclosed in response to requests made under the Acts except where statutory exemptions apply. May be sent by email or other electronic distribution to Ethics Committee members.

Researcher Date :



Supervisor / Chief Review Committee Date :

17 Auxiliary Appendices

Discover the baseline of the research into realization	19.03.2020	Blueprint
Proposal for Study Assistance from Researcher's Employer – SAP	02.09.2020	Discussion and Verbal Approval
Study Title : Doctor of Business Administration		
Document	Date/Medium	Version No:
Application Form	18.03.2021	1
Participant Information Sheet(s) (list if necessary)		4
Consent Form(s) (list if necessary)		3
Invitation Letter for Survey (Appendix 16.1)	15.08.2022	2
Self-Study completion	19.08.2022	1164 hours
Guide / Independent Review	13.10.2022	7
Research Data Management Plan (section 12)	23.10.2022	4
Email to Applicants Participations	24.10.2022	11
Terms of Reference for Steering / Advisory Group	30.11.2022	1
Thesis Completion	21.12.2023	1957 hours
Survey Instrument	Synology	2
Interview Questions / Topic List	NAS	9
Focus selective Questions / Topic List	NAS	2
Script for Oral Consent	Email	1
Questionnaire (Section 10)	23.09.2022	1
Observational Data Collection Form	Synology	1
Risk Assessment Form	Section 11.5	1
Researcher's Response to the Ethics Committee	17.04.2023	1
Others – if any		

17.1 IDC Survey

IDC Survey - Doc # US46592621



Methodology

In 2021, IDC Manufacturing Insights conducted a survey to assess business drivers, application areas, and investment trends in product innovation and service innovation

- Field Time: April-May 2021
- Method: CATI
- Screener Requirements: Respondents were the primary decision maker or key influencer for decision making regarding investments related to Product Lifecycle Management (PLM) and Service Lifecycle Management (SLM) in his or her company
- 800 USA, Canadian, EMEA, and AP manufacturing respondents indicated current and future plans for PLM and SLM deployment in their organizations, including use of 3rd platform technologies and Innovation Accelerators

IDC ToC © IDC | 34

Survey Sample

Target Regions	Countries	Languages	Country spread	Regional spread
NA	USA	English	Min. 150	Min. 200
	Canada	English	Min. 50	
EMEA	UK	English	Min. 50	Min. 200
	Germany	German	Min. 60	
	France	French	Min. 60	
	Saudi Arabia	Arabic, English	Min. 30	
	UAE	Arabic, English	Min. 30	
APAC	China	Mandarin	Min. 70	Min. 200
	Japan	Japanese	Min. 50	
	Korea	Korean	Min. 40	
	Australia	English	Min. 40	
Total	-	-	**800**	**800**

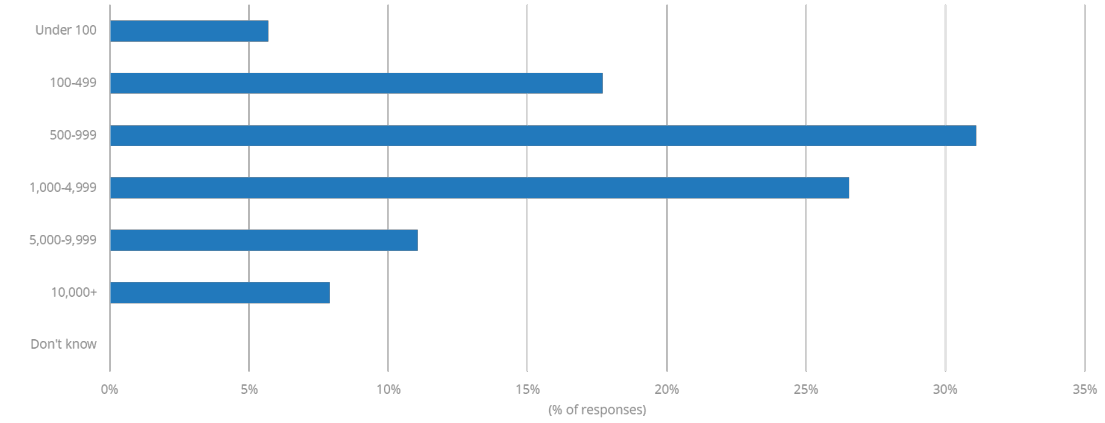
Target Company size	Quota
Less than 1,000 employees	Max. 60%
More than 1,000 employees	Min. 40%
Total	**100%**

Type of Manufacturing	Sample Spread
AOVC	Min. 100
BOVC	Min. 100
EOVC	Min. 300
TOVC	Min. 300
Total	**800**

IDC

Table 2

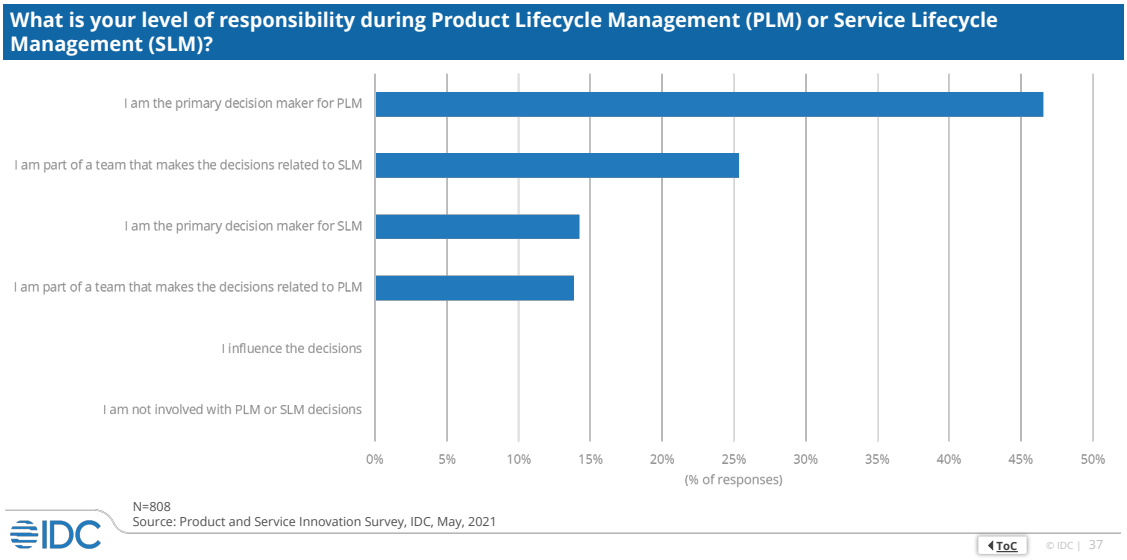
How many full-time employees work at your organization, worldwide, including all locations? Please offer your best estimate?



N=808
Source: Product and Service Innovation Survey, IDC, May, 2021

IDC

Table 6



18 Survey and Interview Doctrine

18.1 Survey Responses

Survey responses are captured within the Synology NAS survey options, however the details below are additional comments/statements/opinions as part of the survey responses

18.2 Interview Notes

The Interview notes are as part of the survey response if there would be any clarifications that may be required to have a clear understanding to researcher from the participants vocabulary and response to the survey questionnaire is taken as rough notes from a meeting invite

18.3 Recordings

The meetings are recorded as part of the survey questionnaire response evaluation from the participants to clarify if there is subsequent discussions as part of the survey. The recordings itself are stored in Synology NAS in a secured shared folder and the links to these recordings are shown below

18.4 Additional Information if any

Any additional supporting information from participants is shown below