

**IMPACT ON THE PRODUCTIVITY OF IT EMPLOYEES BY
IMPLEMENTING ISO PROCESSES AT BRANDIX I3: CASE
STUDY**

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DECLARATION

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ABSTRACT

For a startup organization employees are the key on their path to success. Innovativeness of employees will be the key factor for their products or services, which cannot be measured. With the growth of startup organizations, standardizing of the work processes is vital to reach to the global market. When the work processes is changing from ad-hoc processes to standardized processes, there is a significant impact to employee productivity with the human nature of resistant to change.

Brandix i3 is a startup organization which was started in 2012 and now it is growing fast. With the fast growing and with the pressure from its customers Brandix i3 obtained ISO 9001:2008 and ISO 27001 certificates and it was recertified in ISO 9001:2015 as the first organization in the world.

Employee productivity is the key to success for a startup organization like Brandix i3 and it can be measured using several factors such as timeliness, autonomy, efficiency, quality, effectiveness, customer satisfaction, innovation and project success. This research is focused on how ISO implementation was affected to knowledge workers at Brandix i3 and it was measured using above mentioned factors.

The outcome of the research is there is a minimal effect on employee productivity by implementing ISO processes at Brandix i3. It had a negative impact only to customer satisfaction factor. Effectiveness, innovation, project success and efficiency had zero impact by the implementation of ISO processes.

Key Words: Knowledge worker productivity, Startup organization, ISO process implementation, Brandix i3

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LIST OF ABBREVIATIONS

ERP	Enterprise Resource Planning
FPA	Function Point Analysis
IBU	Industry Business Units
IEC	International Electrotechnical Commission
ISACA	Systems and Audit Control Association
ISMS	Information Security Management System
ISO	International Standards Organization
IT	Information Technology
ITGI	Information Technology Governance Institute
KPI	Key Performance Indicators
KW	Knowledge Worker
OFA	Operation Function Analysis
PDCA	Plan-Do-Check-Act
PMF	Product Market Fit
QMS	Quality Management Systems
SME	Small and Medium scale Enterprises
SOP	Standard Operating Procedures

1.0 INTRODUCTION

The International Standards Organization (ISO) is the pre-eminent international standard-setting body and is a cooperative of national standard setting organizations that have representation in all aspects of the standards making process at ISO. A standard is a document that comprehensively provide requirements, specifications, guidelines, or instructions on a specific subject matter to ensure consistent and verifiable adherence to the standards document. The matters covered under these standards could range from materials and products to processes and services.

In the context of ISO standards that are focused towards processes and services, organizations that implement such standards are able to identify processes that are deficient of the requirements and guidelines given in the standard. This ability to conclusively identify processes that are inefficient or inadequate is a crucial step towards improving organizational performance. As ISO standards are prepared through the input of a global collection of partner standard-making entities, they have a high level of applicability across different organization types in different operating environments.

When we consider small-scale organization and especially startup companies, it is important to adjust the processes of these companies at the beginning of their establishment. Among the reasons for ensuring correct adjustments to these companies are: (1) the higher probability of failure of the company if early processes are found to be deficient, (2) the need to be mindful of the budgetary constraints due to limited capital availability, (3) the importance of safeguarding the externally visible branding and name recognition of the company, etc.

Among the myriad of ISO standards that companies can implement, the ISO 9000 series of standards on Quality Management and ISO 27000 series of standards on Information Security Management Systems (ISMS) are highly important for the modern IT-driven companies. Specifically, the ISO 9001:2015 standard that sets out the requirements of a quality management system and the ISO 27001:2013 standard that specifies the requirements for establishing, implementing, maintaining and continually improving

an ISMS within the context of an organization are considered critically important to build companies that are efficient, resilient and high performing.

Under the umbrella of ISO 9001 implementation, employees and management of an organization will be able to improve cross-functional cooperation among the many subdivisions of the organization and also fine-tune the business processes. The specific case study company used in this research, Brandix i3, is a startup organization and they are certified with ISO 9001:2015 and ISO 27001:2013 certifications. This research is intended to study in detail how these process implementation has affected knowledge workers at Brandix i3.

The implementation of standards, especially globally recognized standards such as ISO standards, bring technological, economic and social benefits to organizations. They help to blend technical specifications of products or services and make the industry more efficient in order to break the barriers to international market. Aligning to international standards makes a positive attitude on consumers to reassure that the products or services are safe, efficient and ethical.

1.1 Background of the Organization

The company used for the case study in this research, Brandix i3 is a startup organization that commenced operations in 2012 and currently the company employ nearly 200 employees. The main business areas of the company are Enterprise Resource Planning (ERP) (using the Infor Applications suite) and Consulting, Managed Services for businesses, Software Development Services, Business Intelligence and Analytics, and Lean Six Sigma Process Consulting to clients in different diverse industries in the world and to the Brandix group.

In order to assess the startup character of Brandix i3, this section would further elaborate on the salient features and characteristics of modern startup organizations. This is followed by a detailed explanation of the operational structure of the company.

The meaning of the term startup has evolved over time with its use in describing different business models, management strategies, funding schemes, etc. For example, Ries (2011) has defined a startup as a "human institution designed to deliver a new product or service under conditions of extreme uncertainty", which matches well with

early definitions of a startup. In contrast, Blank (2014) has defined a startup as a "temporary organization designed to search for a repeatable and scalable business model". What is evident from the prior work on identifying characteristics of a startup and classifying certain entities as startup is that they are seen as an entirely different type of business venture rather than a particular phase in the development of a commonly seen business.

The definition by Dening (2013) of a startup as an "organization in the creative economy, based on innovation with a paradigm shift in organization management characterized by non-hierarchical management processes" is another timely and relevant classification.

The research work of Adamczyk (2016) have identified seven higher-order characteristics of start-up: (1) Usage of market experiments, (2) business model based on innovation, (3) need for external funds, (4) flexible management style, (5) focus on solving specific problem, (6) lack of income, and (7) tendency to act on global scale.

The term startup is used in a broad spectrum of scenarios ranging from innovative ventures by young technology savvy people (such as NicNac delivery service in Sri Lanka – www.nicnac.club), interesting apps that have mass market appeal (such as TradeHero stock market simulation service in Singapore – en.tradehero.mobi), to large technological companies that have disrupted major business verticals (such as AirBnB in US www.airbnb.com, which is an online marketplace for finding accommodations).

Among the key criteria that defines a startup is "a compelling new product or service" (Cusumano, 2013) offered by the company. Also, originality of a startup project where originality is defined as "a quality of a product that is unique, peculiar and non-standard" defines a startup. This criteria is the most common description to assess the product of intellectual creativity for startup companies created from such an idea. Furthermore, innovation of the project is another of the key characteristics of a startup company. In this context, innovation is required when startup companies grapple with new problems, hitherto unsolved problem or work on providing innovative solutions that are significantly better than existing problems. It common to see that startup companies struggling in moving forward with their original ideas containing innovations as activities such as intellectual property rights protection through

patenting assumes the patent purity, license protection, priority of innovation areas, and competitiveness of the innovation for it to be of use to a startup (Morkovina, et al.,2015).

From the seven characteristics identified by Adamczyk (2016), Brandix i3 incorporates five characteristics in to its organizational genes as (1) Usage of market experiments, (2) business model based on innovation, (4) flexible management style, (5) focus on solving specific problem, and (7) tendency to act on global scale. Even the characteristic (3) on the need for external funds can be adopted as the company is funded by the parent conglomerate with a self-sustainability time horizon. Therefore, Brandix i3 can be clearly seen as fitting into the modern definition of a startup company.

Another type of startup companies are the "One Hit Wonders" where a company has a successful first product, but is unable to follow up this success with additional products of similar success. Many technology startup companies fall into this type (Chesbrough, 2007). The characterization of the business model of a technology oriented company has been used by Chesbrough (2007) to type cast companies in to 6 types:

- Type 1: A company with undifferentiated business model
- Type 2: A company that has some differentiated in its business model
- Type 3: A company with a segmented business model
- Type 4: A company that has an externally aware business model
- Type 5: A company that integrates its innovation process with its business model
- Type 6: A company that has a business model which is an adaptive platform

Considering the above set of types, Brandix i3 can be considered as a mix of Type 3 as Brandix i3 has four Industry Business Units (IBUs); Type 4 as Brandix i3 IBUs for Fashion, Manufacturing and Food & Beverages are based on industry standard ERP technology; and Type 5 as the Brandix i3 Healthcare IBU is primarily innovation driven.

Therefore, while Brandix i3 cannot be easily categorized as a specific type of startup based on available literature, its IBUs have different types of startup characteristics that are in conformity with the above type classification. In fact, the Healthcare IBU can be

classified as a mix of Type 4 and Type 5 as it is a partly innovation driven business based on an established ERP platform.

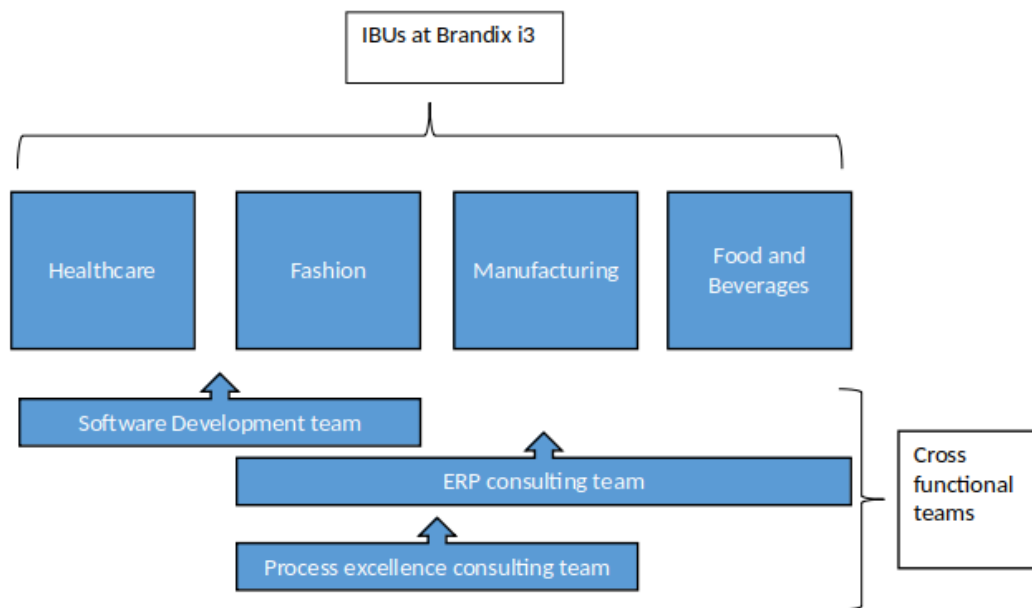


Figure 1.1: Organizational Business Units

According to the four different service providing industries of Brandix i3, namely (1) Health Care, (2) Fashion, (3) Food and Beverage, and (4) Manufacturing IBUs inside the organization; there are three main teams who are working across these four IBUs as (1) ERP consulting team, (2) Software development team and (3) process excellence team. This organization structure in IBU level is depicted in Figure 1.1.

The ERP consulting team is responsible for the following major business activities of the IBUs:

- (a) Performing end-to-end project delivery,
- (b) Business readiness services,
- (c) Project management and advisory,
- (d) BI dashboard and report development,
- (e) Integration and customization of BI tools and accelerators,
- (f) Providing support for managed services, and

(g) Providing resource augmentation.

The software development team builds the solutions for external clients, which are customized to optimally solve varied business problems. Also, these solutions are provided for varied environments including for computer based and mobile based. The main focus areas of the software development team include Healthcare and Fashion.

The process excellence team, which works for a global clientele is focused on following activities:

- (a) Consulting for planning procurement and inventory,
- (b) Consulting for production efficiency and cycle time,
- (c) Consulting for development of Key Performance Indicators (KPIs) and dashboards and
- (d) Consulting for wastage and overhead reduction.

Companies that seek to establish a strong reputation for their software products invariably look to adhere to the key international standards for Information Security (ISO 27001), for Quality Management (ISO 9001), for IT Service Management (ISO 20000), etc (Dennehy et al., 2019). This compliance to international standards is especially important to startup companies as they do not have the benefit of a long established reputation and also as the startup business model envisages rapidly scaling to a global market space. As Brandix i3 was established and operated on the model of a startup, it was essential for the company to establish compliance to these ISO standards.

As companies with a startup culture that develop software products utilize the Minimum Viable Product (MVP) concept along with a tightly coupled "deploy to customer-obtain feedback-integrate changes" development cycle, it is essential to have in place rigorous standards for quality management. Furthermore, as Brandix i3 used this iterative process of learning and pivoting for the validation of their software products in the achievement of Product-Market Fit (PMF), adherence to ISO standards give the higher management a greater sense of security in managing the company image and promotion of its product portfolio.

1.2 Background of the Research Problem

In the initial stage of establishment and operation of Brandix i3 in 2012, it was operating with ad-hoc processes that were initiated by each team among themselves with their clients. In order to standardize those processes, the company management wanted to introduce the ISO 9001:2008 standard based quality management process. The other major requirement of the management for implementing ISO processes was the influence from customers. The main customer for Brandix i3 is the Brandix Group and they have already obtained the quality management process certifications. The ISO 9001:2008 standard specifies requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide products that meet customer expectations and applicable statutory and regulatory requirements. Furthermore, the organization aims to enhance customer satisfaction through the effective application of the quality management system, including processes for continual improvement of the system and the assurance of conformity to customer expectations (ISO 9001:2008, 2015). As a result of this management led initiative, the Brandix i3 has been successful in obtaining the ISO 9001:2008 standard certification on 2013 January and thereafter was re-certified in ISO 9001:2015 standard on March 2016. This was a signature achievement as Brandix i3 became the first organization in the world to obtain the ISO 9001:2015 standard certification.

During the ISO 9001:2015 standard certification process implementation, Brandix i3 introduced several new work task processes to employees including:

- (a) Escalations processes,
- (b) Validation processes,
- (c) Business continuity tasks,
- (d) Combining ISO tasks into goals,
- (e) Documentation processes, and
- (f) Interaction with customers during the process.

It is relevant to note that these newly introduced tasks along with adhering to new standardized processes has resulted in an extra effort to employees' day today tasks.

At Brandix i3, more than 80% of the organization's businesses are based on IT systems. Therefore, adherence to an IT security oriented process was identified as a vital need for Brandix i3. As a result of this requirement, the company initiated the development of ISO 27001:2013 standard for information security management systems since it is adding a higher value to the organization. The ISO 27001 family of standards helps organizations to keep information assets secure. Using this family of standards helps the implementing organization to manage the security of assets such as financial information, intellectual property, employee details or information entrusted to the company by third parties. The ISO 27001:2013 standard implementation process was commenced at Brandix i3 in September 2014 and the company was successfully certified in April 2015 for this particular standard. The main challenges faced by Brandix i3 in the implantation of the standard were,

- (a) Making all employees aware about the process
- (b) Development of amendments to policies
- (c) Incorporating amendments to ongoing processes
- (d) Development of amendments to standards

All the policies, procedures and standards that are relevant for this research study are noted in Appendix B.

In this proposed case study it is intended to conduct an in-depth study of how Brandix i3 faced to the plethora of problems encountered during their implementation of ISO standards and how it has affected to the productivity of IT employees.

Quality management systems are well established in modern era for every industry with well-rehearsed guidelines and methodologies for both implementing such system and improving existing systems. Furthermore, a multitude of frameworks, techniques, and tools exist for assessing the current state of quality management systems as well as evaluating progress of further improvements being done to such systems. However, a common characteristic of these techniques and tools is the requirement of the organization being mature and stable. Thus, there exists a need for a specialized approach for establishing quality management systems as well as evaluating the performance of such systems for startup companies that are often in a strong growth phase (Klute-Wenig & Refflinghaus, 2020).

By their very nature as innovation driven organizations, start-ups face a considerably high external and internal risks in comparison to similar-sized but contemporary organizations. However, these same risk profiles provide startup companies with higher chances for growth. These operating characteristics, business models and product offerings make implementation of quality management systems in startup companies a daunting task exacerbated by quick decision making, higher dependency on key personnel for knowledge and opinions, etc.

In their study on the suitability of ISO 9001 for quality management for startup companies, Klute-Wenig & Refflinghaus (2020) discuss risk-based approaches for implementation of standards as a widely preferred technique. The idea is to pre-identify the risks and evolve mechanisms for removing or mitigating these risks during the adoption of standards and adaption of the organization to improve its quality management processes. The authors pay special emphasis on the need to pay critical attention of the quality management principle of "engagement of people" for the project to be successful.

In a study done by Ingason (2015) on the implementation of ISO 9001 quality management systems for companies in Iceland, it was found that more than 90% of the respondents have viewed the implementation to be a project by itself with clearly

defined budgets, time-lines, project deliverable, and documentation. Further, the author has determined through his research that participation of employees in the implementation of ISO 9001 and strictly adhering to a pre-agreed project plan to be cornerstones of successful implementation of quality management systems. However, it is necessary to realize that this study was not conducted for companies considered as startups.

The case study done by Stålhane (2006) on the implementation of ISO 9001 certified processes in a Norwegian company has the important lesson of reuse. The author shows how the high level of reuse of as much of the current processes along with controlling of risk and opportunities, the involvement of all stakeholders, and the introduction of the process in a step-wise manner leads to a higher project success rate. The starting point for a successful ISO 9001 implementation identified by Stålhane is the performing of a survey or set of interviews in order to identify risks and opportunities that are relevant for the planned changes.

1.3 Motivation

For startups, human power in the form of creativity and commitment is the key to success. The innovativeness of employees is a key factor for the emergence and success of products or services of the company. However, the innovativeness of employees is an attribute that cannot be measured. In this context, the best measurable factor is employee's productivity.

The productivity of employees is a major concern when introducing processes to any organization but is crucial for startups. When implementing ISO processes at Brandix i3, it was clearly understood and expected that the exercise would affect to the work culture of employees. With the human nature of resistant to changes, the team tasked with implementation of ISO processes had to manage the transition carefully to minimize conflicts that arose due to the gap between previous way of working and the new way of working.

Knowledge worker collaboration is considered crucial to success of technology startups (Allen et al., 2016). However, for this success to be sustainable, the employees must

perceive meaningful and tangible outcomes from their collaboration. For the IT startup companies, this translates to not only innovative products and market share acquisition but also higher quality of the product that is seen objectively. In measuring the performance of startup companies, Reid & Smith (2000) has focused on the three objective measures of employment growth, rate of return and productivity. For Brandix i3, which can be considered an early stage startup company poised for rapid growth, the most important measure from this trio would be productivity. For a knowledge worker dominated IT startup, the productivity measurement would naturally be the knowledge worker productivity rather than the classical measure based on company turnover.

The research on the impact of ISO 9001 standard on employees and employers by Levine & Toffel (2010) was the first large-scale study on organizational impact due to adoption of such standards. The study covering nearly 1,000 companies clearly showed that organizations which adopted ISO 9001 for quality management systems had a far fewer "organizational death rate" than those who did not. Therefore, as an early stage startup company, Brandix i3 can gain valuable insights through a case study research on its ISO standards implementation and employee productivity.

Also, as noted by Hernandez (2010), companies that have their foundation in R&D, which is the scenario for innovation driven startups like Brandix i3, require a different approach to implement and certify their quality management system. Leveraging from this study, the proposed research would be able to assess the impact of processes in the independent business units on the standards implementation and eventual impact on the employee productivity.

In this research, a careful study is done on how Brandix i3 has implemented ISO processes and how it has affected to the productivity of employees. The main benefit of this research from a management perspective is as a lesson on how to manage the people and tasks for startup organizations who are willing to introduce ISO processes to standardize their work.

1.4 Research Problem

The employee productivity is a central concern when organizations introduce new processes or change existing processes in any of their significant business activities. As discussed in detail in chapter 2, previous studies have discovered that there are many factors involved in measuring the knowledge worker productivity. The main research problem being addressed in this case study is on identifying how the implementation of ISO processes affect the productivity of knowledge workers at Brandix i3.

1.5 Research Questions

This research study attempts to answer following questions:

- How ISO implementation and recertification processes impacted the productivity of knowledge workers at Brandix i3?
- What aspects of productivity got impacted by ISO implementation?

1.6 Research Objectives

The main research problem and the research questions for this case study research are focused on the impact on the knowledge worker productivity by implementing ISO processes at Brandix i3. This study is intended to explore the extent to which specific areas of productivity got affected with implementation and recertification on ISO 9001 and 27000. Therefore, the research objectives are:

- Identification of productivity factors for knowledge workers.
- Evaluation of impact of productivity factors on Brandix i3's knowledge worker productivity with ISO implementation and recertification.
- Providing of recommendations on ISO implementation to management of startups in the IT industry.

1.7 Thesis Outline

This study is an attempt to explore how ISO process implementation has affected to knowledge worker productivity at Brandix i3. The chapter 1 describes the research background, motivation, research problem, research questions, and research objectives. This chapter sets the background to the study and motivation associated with the research area. The chapter 2 consists of a broad review of literature on IT governance, work culture and impact of standards adoption by companies to identify factors relevant to the research study. The chapter 3 develops a mixed model research methodology consisting of both qualitative and quantitative approaches and setup the data collection instruments and process. The chapter 4 consists of data analysis providing a reliability analysis of the research instrument, the data collection questionnaire, using Cronbach's Alpha Coefficient followed by a descriptive analysis and a correlation analysis. Finally, chapter 5 provides research results and a discussion based on the analysis from previous chapter and presents a set of recommendations through the interpretation of research results.

2.0 LITERATURE REVIEW

This literature review provides a study of 4 core areas consisting of IT governance, work culture, knowledge worker productivity and ISO standards that are central to the issues addressed. Through IT governance; organizations align their IT resources including people, process and technology with the vision and the core mission of the organization. This management control activity impacts the work culture of the institution and conversely, the work culture impacts how an organization goes about achieving this realignment as well as the level of success achieved in this exercise. The realignments imposed by the IT governance and the impact of work culture in turn has a bearing on the knowledge worker productivity in organizations. The literature review was used to understand these concepts, their inter-relationships, and factors that need critical study to understand the impact these different factors have on the overall outcome on the organization objectives.

2.1 IT Governance

A survey done by Information Systems and Audit Control Association (ISACA, 2011) has revealed that enterprise-based IT management and IT governance is the second top important business issue. According to Weill & Ross (2004), IT governance is crucial for every firm that is expecting major returns from its IT investments and also in gaining competitive advantages over other companies which do not have effective IT governance.

2.1.1 What is IT governance?

Different researchers and experts have presented different definitions on IT governance based on their experience, best practices and knowledge. IT Governance Institute (ITGI) defined IT governance as “the responsibility of the board of directors and executive management”. In the book *Organizational culture and leadership* by Schein (2010), it is articulated as an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization’s IT sustains and extends the organization’s strategies and objectives”.

Luftman (1996) says IT governance is the selection and use of relationships such as strategic alliances or joint ventures to obtain key IT competencies. This is analogous to business governance, which involves make- vs.-buy choices in business strategy. Such choices covers a complex array of inter firm relationships, such as strategic alliances, joint ventures, marketing exchange, and technology licensing.

2.1.2 IT governance implementation in organizations

Van Grembergen and De Haes (2009) have defined enterprise IT governance as “an integral part of enterprise governance and addresses the definition and implementation of processes, structures, and relational mechanisms in the organization that enable both business and IT people to execute their responsibilities in support of business/IT alignment and the creation of business value”. The elements of this framework are interrelated and cannot form the IT governance separately. The diagram in Figure 2.1 shows how structures, processes and relational mechanisms are involved in IT governance framework.

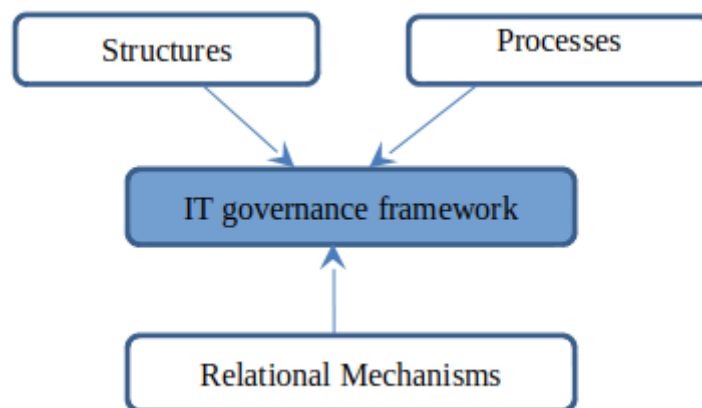


Figure 2.1: IT Governance Framework (Van Grembergen and De Haes (2009))

2.2 Work Culture

The work culture can be viewed from different perspectives and in different levels. There are also various definitions of it among the researchers and practitioners in various fields. The work culture gets formed where there are some elements shared among a group. These elements can be shared experience, shared history, common

activities, common colleagues or managers and shared places. Schein (2010) defines culture as “a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems”. This research adopts the same definition for work culture as in IT organizations in general and startups in particular have a major requirement in external adaptation and internal integration.

2.2.1 Startup Culture

Every startup has their own vision and mission, their own culture and a way of working. When organizations are established and subsequently when they expand, it is vital to change their practices from ad-hoc processes to practices that are process oriented. In addition, startups must also grapple with the other major problem of managing creativity, which is the key to success in startup companies. However, as creativity is not a directly measurable aspect of an employee, organizations must rely on the related factor of productivity to take a meaningful measurement.

In the world of startups, a pivot is a sharp course correction in a fledgling company’s business model, often in response to setbacks or as a result of new and emerging insights. Nobel (2012) explains that there is a core problem inherent in pivoting—the risk of looking disloyal to the company vision. A startup's founders have worked so hard to sell employees, investors, customers, and partners on an idea that switching gears can feel almost like a betrayal. Such strong emotionally oriented behavior in startups contributes to a complex and complicated culture in the organization.

2.2.2 Work culture of employees and management

Baron & Hannan (2002) concluded that in poring over the transcripts of interviews with founders and CEOs of startups, it could be said that their notions about how work and employment should be organized vary along three main dimensions—attachment, coordination/control, and selection— each characterized by three or four fairly distinct options or approaches from which organizational architects seemed to be selecting.

Following is a brief discussion of these 3 dimensions of organizing work and employment:

Attachment – There are three bases of employee attachment which can be labeled *as love, work and money*. Creating a family-like feeling and an emotional bond with workforce would cause the employee to give superior effort and cause an increase in retention of most valuable employees. What binds the employee to the firm in this model is a sense of personal belonging and identification with the company—in a sense the concept of *love*. Many organizations assume that cutting-edge technology is the primary motivator for their employees desire to work at the technological frontier and do so with great enthusiasm and commitment. Therefore, organization consider that providing opportunities for interesting and challenging *work* as the basis for attracting, motivating, and (perhaps) retaining employees. In startup organizations employees are not expected to be loyal to the organization, the supervisor, or even co-workers, but instead to a project. In that setting, founders that were interviewed by Baron & Hannan (2002) have stated that they regarded the employment relationship as a simple exchange of labor for *money*.

Basis of coordination and control - The most common conception from the study by Baron & Hannan (2002) involved extensive reliance on informal control through peers or organizational culture in startups. The other aspect is professional control, which is granted that workers were committed to excellence in their work and could perform at high levels because they had been professionally socialized to do so. Another conception is the traditional view of control as embedded in formal procedures and systems.

Selection – This element concerns about the primary basis for selecting employees. Some founders' responses in Baron & Hannan (2002) study suggested that they conceived of the firm as a bundle of tasks, seeking employees to carry out particular tasks effectively. The time and money tended to be of the paramount concerns here, so the focus was on selecting employees who could be brought onboard and up-to-speed as quickly and cheaply as possible. In these cases, founders envisioned selecting employees having the skills and experience needed to accomplish some immediate tasks. Other founders focused less on immediate and well-defined tasks than on a series of projects, often not yet even envisioned, through which employees would move over

time. Accordingly, these entrepreneurs emphasized long-term potential over short-term delivery of results. Finally, some founders focused primarily on values and cultural fit, emphasizing how a prospective hire would connect with others in the organization.

2.2.3 Why culture is important?

The broad literature review that was done has indicated that the most effective organizations have the most strong and clear cultures. Specifically, Schein (2010) provides some details of experiences in globally operating companies that use culture for providing an environment for the employees and managers in situations such as changing from decentralized to centralized organization or in aiming to reach a higher level of innovation or become more flexible in response to the changes in the business. In all of these cases, culture was an important factor. Furthermore, Leidner and Keyworth (2006) claim that culture at all levels can influence the people and the organizations and can play a role in sharing information, communication and sharing the experience to prevent the repetition of mistakes that could be fatal to an organization.

2.3 Knowledge Worker Productivity

The well-known management guru Peter Drucker (1999) suggested that the world is heading for an era of unprecedented change and pointed out that knowledge-worker productivity is the biggest of the twenty first century management challenges. In industrialized countries increasing of the knowledge-worker productivity is the first survival requirement of companies.

Prior to the Age of the Internet, the average life expectancy of a successful business was about 30 years. In today's world of knowledge economy, business life-expectancy is more likely to be measured in Internet years where one internet year is the equivalent of seven calendar years. Drucker (1999) also pointed out that work on the productivity of knowledge workers has barely begun, a view supported in the literature review that identified only limited works measuring knowledge-worker productivity. The review did not find any empirical research conducted in the field of integrating knowledge-worker productivity with business operations.

2.3.1 Why knowledge worker productivity is important?

As noted for in this era of knowledge economy, the biggest gain in productivity is to be obtained from knowledge workers and it is critical to develop a knowledge-worker productivity model that will be accepted by organizations moving in the direction of improving knowledge-worker productivity.

Wong (2012) has worked on developing a practitioner's approach to integrating organizational work processes with Drucker's six major factors determining knowledge-worker productivity theory. It aims to confirm the existence of the perceived professional problem to develop a model for knowledge-intensive organizations to study their level of organizational readiness and alignment issues when integrating organizational work processes with Drucker's six major factors determining knowledge-worker productivity. The six factors are summarized as follow:

1. Knowledge-worker productivity demands that we answer the question:
“What is the task?”
2. Maximizing knowledge-worker productivity demands imposing the responsibility for productivity on individual knowledge worker themselves. Knowledge workers have to be autonomous and manage themselves.
3. Creating continuous innovation is part of the work, the task and the responsibility of knowledge workers. Continuous innovation has to be built into a knowledge worker's job.
4. Knowledge work requires continuous learning and equally continuous teaching on the part of knowledge workers.
5. Knowledge-worker productivity is not—at least not primarily—a matter of quantity of output. Quality is at least as important.
6. Finally, knowledge-worker productivity requires the knowledge worker to be seen and treated as an ‘asset’ rather than a ‘cost’ and they should want to work for the

organization in preference to all other options. Unlike manual workers, most knowledge workers own most of the means of production with which they generate wealth for their organization.

2.3.2 Knowledge worker measurement methodologies

There are several methodologies proposed to measure the productivity for specific types of Knowledge Workers (quality, output, cost, etc.). These are structured methods to measure productivity in one or more dimensions. Some have seen applications across a range of industries, while other methods have seen little application.

1. Function Point Analysis (FPA)

FPA is a method for measuring knowledge worker productivity among software developers that has been applied to over 250 programming languages. This method was created to measure software size and productivity at IBM, using functional, logical entities such as inputs, outputs, and inquiries that tend to relate more closely to the functions performed to other measures, such as lines of code. For certain number of desired commands the worker receives a function point.

2. Operation based productivity measurement

This methodology measures Knowledge Worker (KW) productivity that entails three main steps.

i. Classify the types of knowledge work jobs;

Jobs are classified in to two types, routine or repetitive jobs and non-routine or non-repetitive jobs.

ii. Determine relationships between those types;

Relationships of the characteristics of jobs to performance and indices are created that will be used for the calculation of the final productivity measure.

iii. Develop appropriate productivity measurement and evaluation models.

Uses results from above steps to develop a productivity measurement. The method is applicable to both individuals and groups and considers various criteria including;

- Varied nature of jobs

- Independence for decision making or job completion at initial and final stages
 - Dependence for job completion at intermediate stages
 - Group activity
 - Variability in job completion time
 - Involvement with outsiders
 - Co-ordination among sub-functions/activities
 - Multi facility arrangement
 - Direct operational time
3. Data envelopment analysis

This is a method which measures the relative efficiency of individual units in a population of interest such as knowledge workers or teams. Paradi et al. (2002) used data envelopment analysis method to examine productivity, efficiency and effectiveness of an engineering design team.
 4. Operation Function Analysis (OFA)

OFA ratio considers demand for the “product” that KW is delivering, since demand determines how much needs to be produced. The ratio measures number of customer orders processed in a given time to the number of employee hours.
 5. Engineering operations analysis

This method is designed to measure jobs that involve long cycle work, considerable mental activity and creative or innovative skills. The method focuses on measuring productivity in multi-dimensional areas to determine time standards for “work units”. This is helpful to determine an optimal skill mix to segregate intellectual routine tasks, a normal distribution of effort, and time standard for work units with the help of work sampling and multiple regression data.
 6. Administrative productivity indicator and multiple output productivity indicator

This method uses various measures of productivity for processes that produce single and multiple outputs. If the process has just one output it can be used as an administrative productivity indicator, which is given by work output per unit of labor hour input.
 7. Multi-minute measurement

This method measures the productivity of KWs by making work sampling observations at predetermined periods of time rather than random times during the work day. The method meets the need for relative accuracy in group situations and its flexibility, simplicity, and low cost, make it applicable in organizational settings. This method can be summarized in four steps.

- i. Establish activity element lists and review with supervision.
 - ii. Predetermine and establish codes for any special classifications to be used.
 - iii. Develop employee reporting procedures and implement them.
 - iv. Select the measurement interval and prepare an observation form for each employee whose work will be observed.
8. Achievement method : completion of goals

Ramírez & Nembhard (2004) measures productivity by evaluating how much of what needed to be done was actually done. In this method, productivity is the ratio of the number of accomplished tasks to the total number of assigned tasks. No indicator for quality is provided, although one could be incorporated into the ratio as part of the number of accomplished tasks.

As explained by Ramírez and Nembhard (2004) there are six methods of measuring knowledge worker productivity quantitatively. They are,

- i. Function point analysis
- ii. Efficiency = $\frac{\sum_{i=1}^n N_i S_i}{\sum_{j=1}^r R_j}$ (2.1)
 where N_i = number of occurrences of service type i
 S_i = standard time for service type i (hours)
 R_j = time input resource j is available for use (hours)
 n = total number of services types provided
 r = total number of resources available
- iii. Operation Function Analysis (OFA)
- iv. Engineering operations analysis
- v. Administrative productivity indicator and multiple output productivity indicator
- vi. Multi-minute measurement

In addition to these, Paradi et al. (2002) explains a new method, Data Envelopment Analysis (DEA), as a design and activity model using equivalent number of employees. The model outline is shown in Figure 2.2.

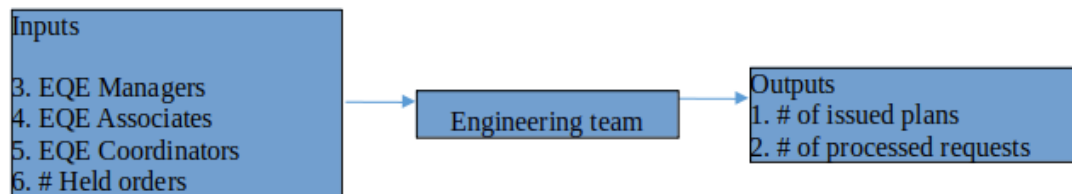


Figure 2.2: EQE for Engineering Team (Paradi et al. (2002))

(EQE= Total number of hours logged per month by team members/ Number of work days per month Number of work hours per day)

Ramírez and Nembhard (2004) explains some other non-numerical factors which are supporting to measure knowledge worker productivity as:

- Timeliness
- Autonomy
- Efficiency
- Quality
- Effectiveness
- Customer satisfaction
- Innovation/creativity
- Project success

2.3.3 Work tasks measurements

Bosch-Sijtsema et al. (2009) conducted a research in knowledge work productivity in distributed teams and according to them, work tasks measurement has 2 main steps. First, it sets minimum requirements for the resource pool (knowledge, skills and competencies) needed by team members. Secondly, the primary focus of team-

member's activities determining the workflow structure and coordination demands that are needed to accomplish task. Task interdependency increases support feelings of connectedness, communication, cohesion and trust.

Another way of task based productivity measurement methodology was explained by Ramírez and Nembhard (2004) in three steps.

1. Classify the types of knowledge work jobs (routine or repetitive jobs and non-routine or non-repetitive jobs.)
2. Determine relationships between those types (relationships of the characteristics of jobs to performance are established and indices are created that will be used for the calculation of the final productivity measure)
3. Develop appropriate productivity measurement and evaluation model criteria:

2.4 ISO Standards

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electro-technical Commission (IEC) on all matters of electro-technical standardization.

2.4.1 ISO 9001

ISO 9001 is a standard that sets out the requirements for a quality management system. It helps businesses and organizations to be more efficient and improve customer satisfaction. The latest version of ISO 9001 family is ISO 9001:2015 which replaced the earlier ISO 9001:2008.

ISO standards are reviewed every five years and revised if needed. This helps ensure they remain useful tools for the marketplace. The challenges faced by business and organizations today are very different from a few decades ago and ISO 9001 has been updated to take this new environment into account. According to ISO 9001:2015 the

adoption of a quality management system is a strategic decision for an organization that can help to improve its overall performance and provide a sound basis for sustainable development initiatives.

The potential benefits to an organization by implementing a quality management system based on this international standard are:

- The ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements;
- Facilitating opportunities to enhance customer satisfaction;
- Addressing risks and opportunities associated with its context and objectives; and
- The ability to demonstrate conformity to specified quality management system requirements.

ISO 9001:2015 international standard services the process approach, which incorporates the Plan-Do-Check-Act (PDCA) cycle and risk-based thinking. The process approach enables an organization to plan its processes and their interactions. The PDCA cycle enables an organization to ensure that its processes are adequately resourced and managed, and that opportunities for improvement are determined and acted on.

Risk-based thinking enables an organization to determine the factors that could cause its processes and its quality management system to deviate from the planned results, to put in place preventive controls to minimize negative effects and to make maximum use of opportunities as they arise.

Consistently meeting requirements and addressing future needs and expectations poses a challenge for organizations in an increasingly dynamic and complex environment. To achieve this objective, the organization might find it necessary to adopt various forms of improvement in addition to correction and continual improvement, such as breakthrough change, innovation and re-organization.

ISO 9001 is designed to be used by any organization, even it is large or small, whatever its product or service. A management system is simply the way an organization

manages its processes, people and other resources so that its products or services meet their objectives and customer requirements. The system should be both flexible and scalable to the business and help embed a culture of continual improvement. The Plan-Do-Check-Act (PDCA) cycle is the operating principle of all ISO management systems standards, including ISO 9001. By following this cycle, it can effectively manage and continually improve organization's effectiveness.

Plan - Establish objectives and draft plans (analyze organization's current systems, establish overall objectives, set interim targets for review and develop plans to achieve them).

Do – Implement Plans

Check – Measure and monitor actual results against planned objectives

Act – Correct and improve plan to meet and exceed planned results

Sousa-Poza et al. (2009) explains main challenges for ISO 9001 effective implementation as lack of financial and human resources, inadequate technical knowledge of quality management, lack of knowledge of formalized systems and lack of internal auditing. Although the heterogeneous nature of SMEs (Small and Medium scale Enterprises) makes it difficult to generalize, managers and employees in SMEs are typically well focused on core activities such as production, sales, and customer service. However, they are generally not knowledgeable about Quality Management Systems (QMS) requirements or on how to improve processes.

Latest ISO 9001 standard is ISO 9001:2015 and according to ISO the following will be the major changes in terminology between ISO 9001:2008 and ISO 9001:2015:

- From Products to Products and Services.
- Exclusions not used anymore.
- Documented Records will change to Documented Information.
- Work environment will be Environment for the operation of process.
- Purchased product will change to externally provided products and services.
- Supplier will now be External provider.

Fonseca (2015) concludes that ISO 9001 users rely a lot on bureaucratic models and organizational culture. In bureaucratic models the problem is divided and coordinated by activating organizational actors who have special capacities plus standard operating procedures (SOP's) for parts of the problem, conducting sequential attention to objectives through localized searches until problems are resolved. Action is guided by available routines. Within organizational culture actors seek expression and fulfillment of identity, and organizational culture is the medium for it. Through ritual expression, members either align with or act against the organization's mission and identity. But with ISO 9001:2015 it will have to be much closer to total quality management and business excellence as of today.

2.4.2 ISO 27001

Information and information systems are an important foundation for companies. According to Disterer (2013), in particular more and more internal and inter-company data transfer and utilization of open networks increase the risks that information and information systems are exposed to. In order to reduce risks and avoid damages to companies care must be taken to assure adequate information security. For the protection of the information and information systems the standards ISO 27000, ISO 27001 and ISO 27002 provide control objectives, specific controls, requirements and guidelines, with which the company can achieve adequate information security. In doing so ISO 27001 enables the company to be certified against the standard, whereby information security can be documented as being rigorously applied and managed in accordance with an internationally recognized organizational standard.

ISO 27001 implementation also follows Plan-Do-Check-Act (PDCA) cycle.

Plan - As in all compliance and certification initiatives, consideration of the organization's size, the nature of its business, the maturity of the process in implementing ISO 27001 and commitment of senior management are essential. The most important departments and activities that will be vital to the success of the project include:

- Internal audit - During the initial planning phase, the input from internal audit will be useful in developing an implementation strategy, and early

involvement of internal auditors will be useful during the later stages of certification that require review by management.

- IT—The IT department will have to dedicate resources and time to the activities associated with the ISO 27001 initiatives. An inventory of existing IT compliance initiatives, procedures and policies, and the maturity of existing IT processes and controls will be useful to gain an understanding of how the existing processes align with ISO 27001 requirements.

Do –

- Manage the risks, and create a risk treatment plan.
- Set up policies and procedures to control risks.
- Allocate resources, and train the staff

Check -

- Monitor the implementation of the ISMS.
- Prepare for the certification audit.

Act – Conduct periodic reassessment audits:

- Continual improvement
- Corrective action
- Preventive action

ISO 27001 is designed to assure the confidentiality, integrity and availability of information assets, is exclusive to information security, and only addresses that issue. Susanto et al. (2012) explains that the key areas identified by ISO 27001 for the implementation of an information security management system are:

- An information security policy
- Allocation of information security responsibilities within the organization
- Asset classification and control
- Personnel security, responsibilities and training
- Physical and environmental security

- Communications and operational systems security
- Access controls

In order to implement on these areas, organizations tend to introduce policies, procedures and standards.

2.5 Chapter Summary

This chapter examined in detail the existing knowledge regarding IT governance, startup culture, knowledge worker productivity and ISO standards. This chapter also described on IT governance processes and related mechanisms of IT governance. In startup culture, it described the worker and management culture and the importance of startup culture towards the employee productivity. In knowledge worker productivity measurement, it identified eight key factors of productivity measurement. Under the topic of ISO standards it identified key characteristics of ISO 9001 and ISO 27001.

3.0 RESEARCH METHODOLOGY

This chapter introduces the research methodology used for the research study and how it was used to guide the data collection, data analysis and development of a framework to interpret the results. It elaborates the methodology used to investigate the research problem and find answer to the research questions in order to achieve the objectives defined in the first chapter. A set of guidelines to model the development of a research design and the conceptual methodology are formed with the use of the concepts and models related to the study collected during the literature review chapter and based on other findings by the researcher through interviews with practitioners. The conceptual framework is composed of research variables which are related to the ways of measuring knowledge worker productivity. The dimensions of variables along which measurements were taken and the basis of measurements taken have been discussed along with the main variables in this chapter.

3.1 Approach

This is a case study based research targeted for Brandix i3 ISO 9001:2015 recertification and 27001 implementation initiative. In the research literature, there are two main ways of productivity measurement described as quantitative and qualitative. Quantitative measurements are used to measure how the ISO 9001:2015 implementation affected to the knowledge worker productivity at Brandix i3. Qualitative measurements are used to measure the impact from the ISO 27001 towards knowledge workers at Brandix i3.

3.2 Conceptual Framework

The focus of the research presented in this thesis is to study the impact on the company workforce due to implementation of rigorous international standards for quality management and security management at Brandix i3. Specifically, the research study evaluated the impact on productivity of employees who can be classified as knowledge workers in this IT startup company. Research on productivity of knowledge workers in IT industry has been done on key organizational components such as business processes, organizational structures and human resource practices (Ruohonen et al., 2002), especially in the context of industry upheavals, emergence of new economic models, and creation of innovative businesses such as technology startups.

As ICT industry transforms itself into more nimble business entities that are able to respond to customer requirements and business environment changes rapidly, cost effectively, and with innovative solution, the productivity of employees have become even more important. As economic activities get globalized and companies are faced with the prospect of competing internationally with companies having diverse workforce characteristics, it has become imperative to maintain a careful review of employee productivity and put into practice methods that seek to enhance those organizational processes and practices impacting positively on productivity.

At the same time, it is important to study and identify those practices and operating models that have a negative impact on the productivity of employees. This is especially important for knowledge workers, who are generally considered as high value assets in terms of the contribution they make to the success of an organization. This importance given to IT employees is markedly higher in startup companies that are in rapid growth stages. At Brandix i3, the implementation of ISO 9001 and ISO 27001 standards were treated as critical activities for the further development of the company and crucial for the meeting of company vision and mission. As the ISO standards implementation process impacted the IT employees across the board at the company and created a high pressure work environment, it became an important task and a valuable opportunity to conduct a research.

In explaining a model for use and reuse of strategic knowledge in the digital age for evolving a holistic approach to business strategies that deliver long term competitive advantages to organizations, Sousa & Rocha (2019) elaborate on the role of a

knowledgeable worker, continuous improvement and better productivity. The implementation of ISO standards by Brandix i3 also had this goal in the mission of the organization.

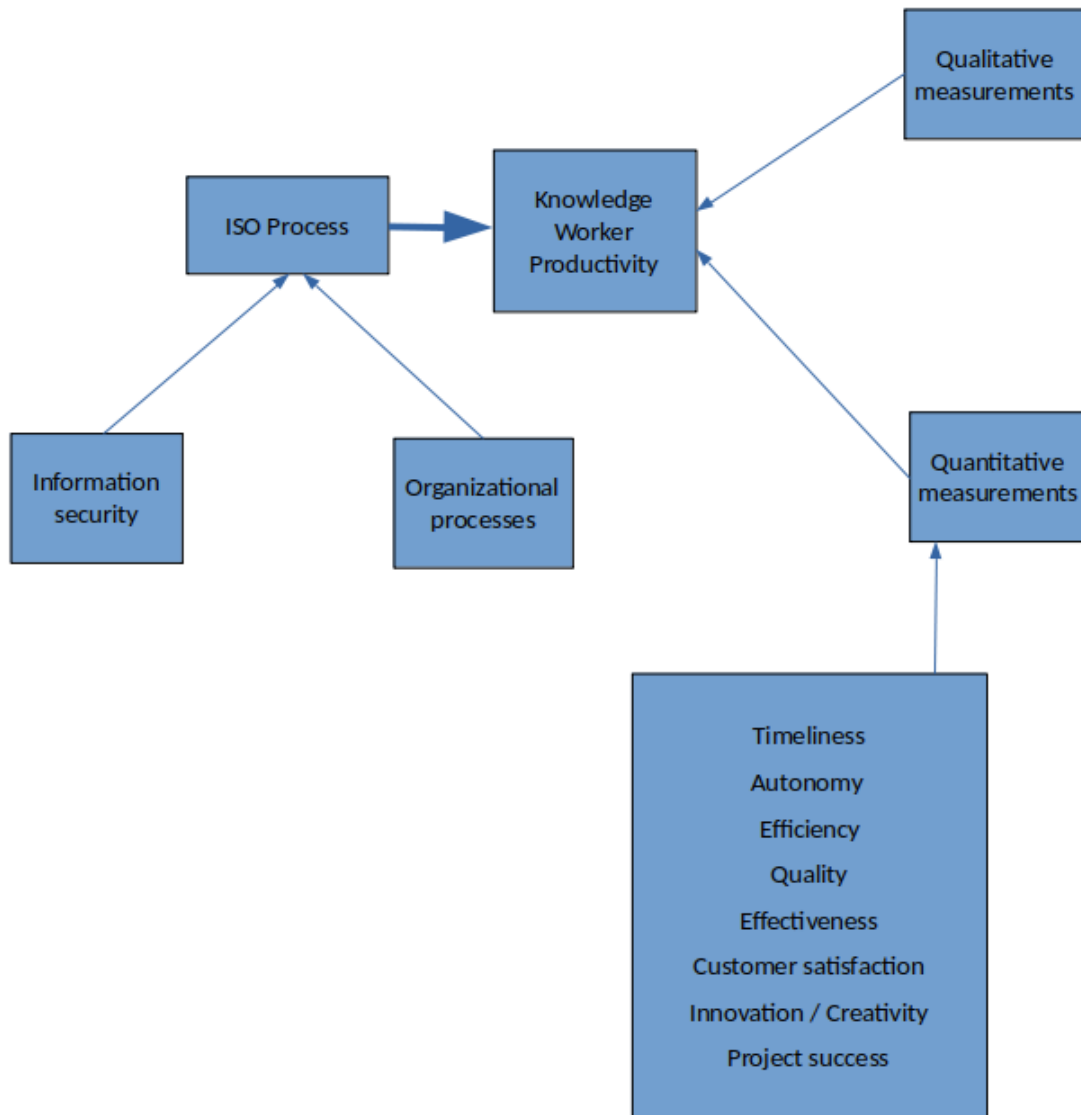


Figure 3.1: Conceptual Framework

In collecting data through the use of a structured questionnaire on knowledge worker productivity, it is possible to drill down to obtain insights to significant relationships among factors and value of methods used by organizations to achieve higher levels of productivity (Hybbeneth et al., 2014). At the same time, for more case study oriented

research into knowledge worker productivity, particular domain area dependent issues are better elicited using semi-structured interviews that facilitate a dialog between the interviewer and interviewee leading to data that embody the knowledge worker intuition, experience and social aspects of organizational work environment (Warren et al., 2009).

The figure 3.1 is a visualization of the effect of ISO implementation on knowledge worker productivity. In the left side it explains ISO implementation at Brandix i3. It has two main attributes denoted as information security and organizational processes. Information security attribute represents ISO 27001 policies, procedures and standards. Organizational processes attribute represents ISO 9001:2015 standardized organizational processes implemented for work tasks in Brandix i3. The objective of the research is to examine how these ISO processes could make an impact on the knowledge worker productivity using ISO processes as independent variables and knowledge worker productivity as dependent variable.

As noted earlier, in order to measure employee productivity, the research methodology used two main ways as qualitative measurements and quantitative measurements. The qualitative measurements were collected through the conduct of interviews with key stakeholders of ISO 27001 implementation at Brandix i3. These interviews focused on the impact on productivity in ISO 27001. The quantitative measurements were collected using a self-administered questionnaire distributed among employees from all IBUs at Brandix i3.

In the quantitative approach to data collection, productivity measurements were made using eight factors such as timeliness, autonomy, efficiency, quality, effectiveness, customer satisfaction, innovation/creativity, and project success.

3.3 Operational Definitions of Productivity Measurement Factors

All of the variables used for this study were identified during the literature review and their relevance to this specific case study was established through interviews held with practitioners. Table 3.1 describes the operational definition for each of the productivity factors and their type as well as the scale used to measure the variable.

Table 3.1 Productivity Measurement Factors

Productivity measurement factor	Description	Measurements	References
Timeliness	Accounts for meeting deadlines, overtime needed to complete the work and other time related issues	1. Time spend on ISO related tasks	Card (2006)
		2. On time delivery (Tasks and projects)	
Autonomy	Accounts for independence and how many things a worker can do at once.	1. Accomplishing goals	Aligned as objectives of implementation the processes. (Interview with management representative)
		2. Response time	
		3. Work transfer	
Efficiency	Accounts for “doing things right”. Refers to any task, even if it is not important to the job. The task is done meeting all the standards of time, quality, etc.	1. Time spend on ISO related tasks	Aligned as objectives of implementation the processes. (Interview with management representative)
		2. Work transfer	
		3. Meet all customer requirements	
Quality	Accounts for how good the work is	1. Work documentation (error free documents) and maintain in a repository	Main goals of ISO9001:2015 implementation and extracted from process maps.
		2. Maintaining the reliability	
		3. Responding to customer requirements as promised	
		4. Knowledge transfer speed	
Effectiveness	Accounts for “doing the right things”. Refers to just the tasks that are important to the job, even if they are done without meeting standards of time, quality, etc.	1. Work documentation and maintenance.	Interviews
		2. Working on multiple tasks	
		3. Maintenance of error free records	
Customer satisfaction	Accounts for the fact that the product needs to add value to the customer.	1. Responding to customer needs quickly and courteously	Aligned as objectives of implementation the processes. (Extracted from process maps)
		2. Customer’s engagement with ISO processes	
Innovation/ Creativity	Accounts for the ability of creating new and ideas to improve productivity.	1. Doing things differently in less time	Midgley & Dowling (1978)
		2. Work on multiple tasks	
		3. Stressfulness	
Project success		1. On time delivery	

Table 3.1 Productivity Measurement Factors

	Accounts for the overall result of the work, considering decision-making, team interaction, communication, predictability, crisis management, documentation, transferability of work, etc	2.Deliver promised scope	Interview with head of project managers
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3.4 Population and Sample Sizes

This research investigated the impact on the knowledge worker productivity in implementing ISO processes at Brandix i3. Therefore, all employees who were working for Brandix i3 at the time of research work was considered as the population relevant for this research.

Quantitative measurements – All employees in Sri Lanka office at Brandix i3 (200 employees)

Qualitative measurements – The sample size was selected as 15 due to the fact that during the implementation process organization has selected 15 representatives to make the implementation easier. The researcher was able to successfully interview 11 out of these 15 individuals. It was not possible to interview 4 of the individuals as some have left the organization and others were in abroad during the survey period. Due to that reason response rate for this survey is 73.3%.

- ISO Management representative – Sample size 1
- ISO representatives – Sample size 10

ISO representatives were selected from the various job roles and key stakeholders on security handling of each area such as manager in quality assurance, manager in software development, manager in resource planning, senior executives in IT and admin and delivery team leads. They played a main role in security before ISO implementation. As a result of that outcome, management has decided to involve them in ISO 27001 implementation process.

3.5 Method of Data Collection

During this research study, two ways of data collection were used for quantitative data and qualitative data. A structured questionnaire was administered for quantitative method. This questionnaire is a series of questions about ISO 9001:2015, asked from all 200 employees at Brandix i3 (Sri Lanka office) to obtain information about productivity impact of implementing ISO processes. Quantitative data collection for this research was conducted during February 2016 and the questionnaire was distributed through email for self-administration by the respondents. The full questionnaire is given in Appendix A.

Table 3.2 Questions Mapping with Productivity Factors and ISO Processes

Factor	Question number	Which ISO processes were measured towards productivity measurement factor
Timeliness	5,6,7	Effect on timeliness because of additional tasks due to ISO processes, escalations processes, validation processes
Efficiency	5,11,23	Additional tasks Business continuity tasks
Project success	7,8	Effect on project delivery due to new tasks, escalations
Autonomy	21,22,23	Effect on autonomy by combining ISO tasks into goals
Quality	11,12,13,18,19,20,21,23	Effect on quality by new documentation processes, validation processes, interaction with customer during the process and business continuity tasks.
Effectiveness	11,12,13,15,19	Effect on effectiveness by new documentation processes, business continuity tasks
Customer satisfaction	8, 9, 10,22	Effect on customer satisfaction by interaction with customer during the process
Innovation/creativity	14,15,16,17	Effect on innovation/creativity by entire ISO9001:2015 processes

Qualitative data collection was carried out with a selected set of employees at Brandix i3 who were directly involved in ISO process implementation and auditing processes and head of human resources as well as head of project managers. For this purpose a semi-structured questionnaire was used and those questions centered on ISO 27000 implementation and other inputs for overall ISO implementation process. For data collection, one to one interviews with selected set of people were held and interviews were conducted both before and after quantitative data collection.

3.6 Method of Data Analysis

In this research, different types of data analysis methods were used. First, a reliability check using the Cronbach's Alpha method was carried out on responses in order to measure the internal consistency of the data set obtained. Then, a descriptive analysis was undertaken to determine the basic measurements of the data collected via questionnaires. Finally, a qualitative data analysis was conducted in order to finalize the findings of the study.

3.7 Chapter Summary

The entire research process from the literature review through the conceptual framework construction, and research design to questionnaire instrument design and qualitative research method was discussed in detail in this chapter. Moreover, the data collection and analysis aspects were elaborated.

4.0 DATA COLLECTION AND ANALYSIS

This chapter discusses the data analysis and the focuses is on how the results of analysis can be used to achieve the objectives of the research.

First the reliability analysis was conducted for the data set obtained in order to establish the consistency of the data. Then a descriptive analysis was conducted in order to identify the basic characteristics of the data set and to validate whether the sample chosen represents the target population since the purpose of the study was to determine the impact on employee productivity on ISO implementation at Brandix i3.

4.1 Reliability Analysis for the Pilot

Before sending the questionnaire to all the employees, it was sent to 21 employees to test the reliability of the questionnaire as the experimental setup for the intended data gathering. Table 4.1 shows the results of reliability analysis for the initial 20 responses out of 21 employees as one employee did not respond. The table provide the Cronbach's Alpha Coefficient (CAC) values for the 8 variables using 21 questions.

Table 4.1 - Reliability Statistics using CAC Calculation

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.756	.791	21

The Cronbach's alpha value is in the acceptable range and because of that it was sent to all the employees and disregarded responses which were used for reliability analysis.

The main data gathering effort was carried out during a two week period and a total of 122 responses were received out of the 200 questionnaires sent out in total and resent the questionnaire to 21 employees who were used as the sample. Of the received responses all were accepted as valid for the data analysis. A summary of responses is shown in Figure 4.1.

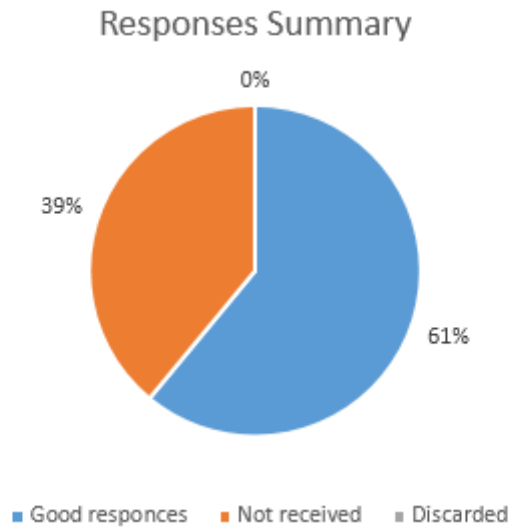


Figure 4.1: Number of Responses

As discussed in the Section 3.5 this research data collection was estimated to obtain 200 responses from Brandix i3 employees. The data collection effort can be concluded as a success as nearly two-thirds of the potential respondents provided usable data for the analysis.

The reliability of the full data set was again established using the CAC value. The internal consistency of the collected data set as given by CAC is an indirect measure of reliability of the variables as used for experimental setup. The CAC reliability test has targeted all the main dimensions which were discussed through the research. In general, the acceptable level of Cronbach’s Alpha for the data is considered as 0.70. Thus, Cronbach’s Alpha should be 0.70 or higher for a set of items to be considered reliable. Below table shows the Cronbach's Alpha value for all the responses for 21 questions.

Table 4.2 - Reliability Statistics for Population

Variable	Cronbach's Alpha Coefficient
Autonomy	0.805
Quality	0.843
Timeliness	0.824
Effectiveness	0.802
Efficiency	0.781
Project success	0.764
Innovation/ Creativity	0.722
Customer satisfaction	0.719

The CAC reliability analysis for each of the scale variables was conducted and the results are shown in Table 4.2. According to the table, the minimum CAC value is 0.719 which is in the acceptable level. Thus it can be considered that the reliability of data set as proven.

4.2 Descriptive Analysis

Descriptive statistics are used to describe the basic features of the data in the study and more importantly to show that the sample from which the data was collected is representative of the overall population. As this was a case study based research, it is important to note that the data collection focused on the full population. The descriptive analysis provide summaries about the sample and the measures and based on the analytical model and other findings, the following areas have been taken in to analysis under descriptive analysis. This section performs a descriptive analysis of responses received in terms of the demographic aspects such as respondents' distribution, internal business unit, experience at Brandix i3, etc.

During the descriptive analysis knowledge worker productivity measurement factors such as timeliness, customer satisfaction, autonomy, efficiency, effectiveness, quality, innovativeness/ creativity and project success were evaluated according to the responses obtained from the questionnaire. The data used in the descriptive analysis

has been collected using a 0 to 5 Likert scale and the mapping with questionnaire answers is as follows:

- 5 – Always
- 4 – Most of the time
- 3 – Sometimes
- 2 – Seldom
- 1 – Never
- 0 – No response

The questionnaire was prepared for the entire Brandix i3 organization and as listed in the question number 2 of the questionnaire, there are 51 job roles being targeted for data collection. Due to this wide range of job roles, it was evident that some questions may not be relevant to certain categories of job roles when presented with answers in the form of a Likert scale. For example, the question number 8 inquire from the respondent whether the "Customer interacts well with you to follow the processes", which may not be relevant to those employees who are not customer facing in their job roles. Therefore, the questionnaire allowed for no responses to be marked by the respondent and in the enumeration of the collected data such responses were marked as 0 for tabulation purposes.

4.2.1 IBU level distribution

The demographic details of the sample are such that there were 42.9% of respondents from Group delivery, 19.9% from Healthcare, 15.7% from Manufacturing, 14% Business enablers and 7.4% from Resource Pool of the total sample as shown in Figure 4.1. The sample is not representative of the general population with respect to the IBU. However the highest portion of responds are from Group Delivery which is directly working with Brandix itself and adds a more value to the research on measuring factors such as customer satisfaction, timeliness, etc. About 20% is from Healthcare IBU which is providing innovative healthcare solutions and it aids well on measuring innovativeness, efficiency, project success, and quality. 7.4% is the lowest from Business Enablers IBU which is having lowest number of knowledge workers and having the lowest portion of responds is supporting to give the most correct analysis of knowledge worker productivity.

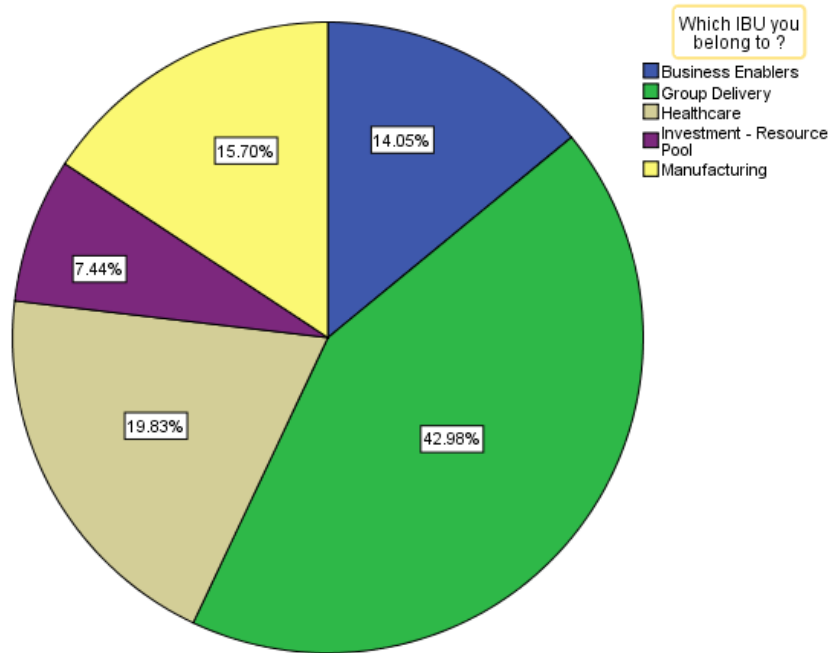


Figure 4.2: IBU Level Distribution

4.2.2 Job role at the organization

This research has mainly targeted knowledge workers. Figure 4.2 describes job role level distribution of the sample. Highest distribution is on Consultants and Software engineers who are the main knowledge workers in the organization and they are always highly following ISO processes. Having high number of responses from main knowledge workers increases the accuracy of the research.

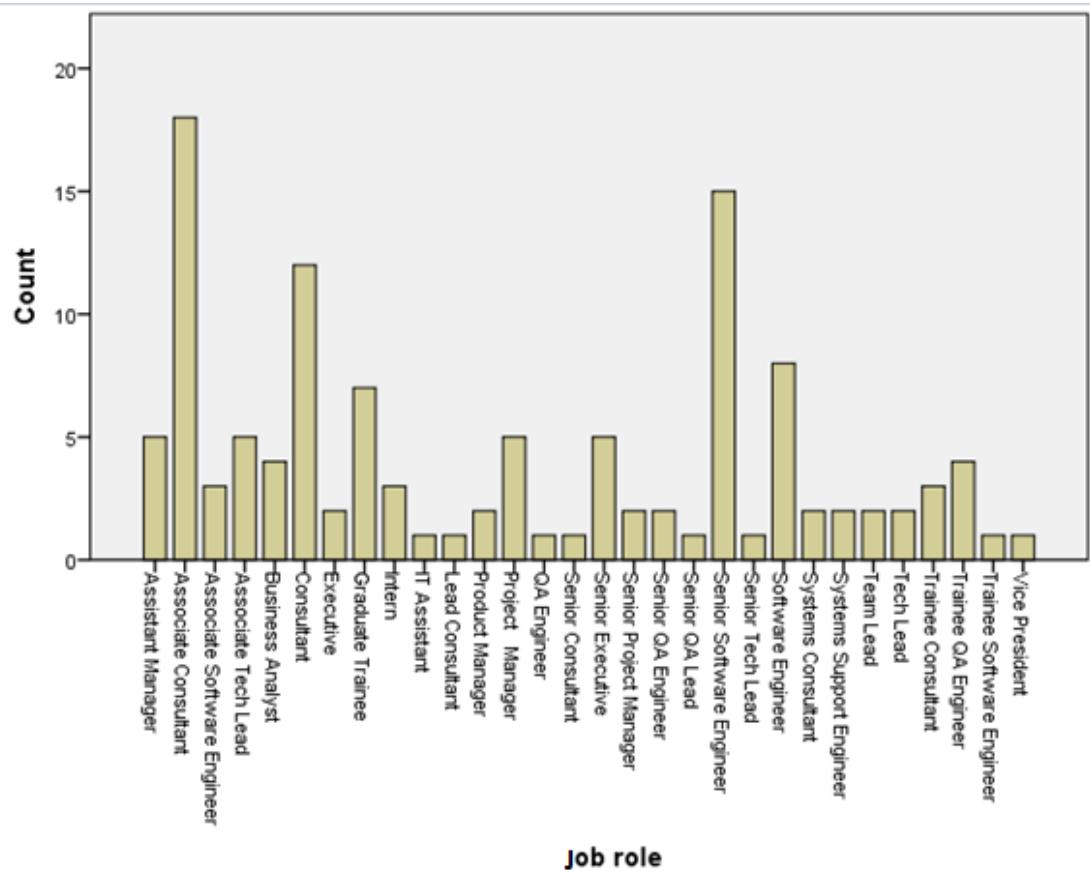


Figure 4.3: Job Role Distribution

4.2.3 Role in ISO implementation process

During ISO process implementation the management has appointed different roles to employees as management representatives, representatives, internal auditors and all other employees were process followers. People who did process following after implementation should be able to give the most accurate answers on the impact on their productivity due to ISO implementation. Figure 4.3 shows the percentage of role based distribution of the sample. More than 75% of responses were from process followers and they were the main target audience of the research.

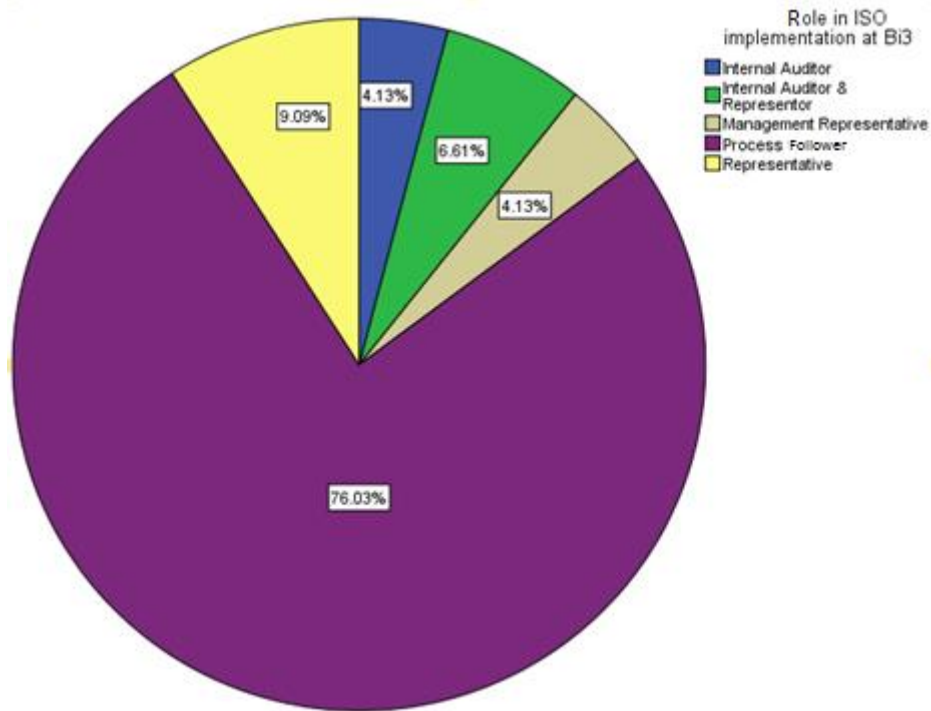


Figure 4.4: ISO Implementation Roles based Distribution

4.2.4 Work experience at Brandix i3

As Figure 4.4 illustrates, more than 30 respondents have less than one year of experience while all other employees are experienced with more than one year at Brandix i3. This aspect is adding more value to the sample, since it gives a good representation of experienced professionals at Brandix i3. Therefore, it can be stated that the study results are mainly dependent on respondents who are most of the time falling in to more than one year work experience band. Furthermore, since there are considerable number of responses from recently joined employees (less than one year experience) it adds more value on measuring work transfer.

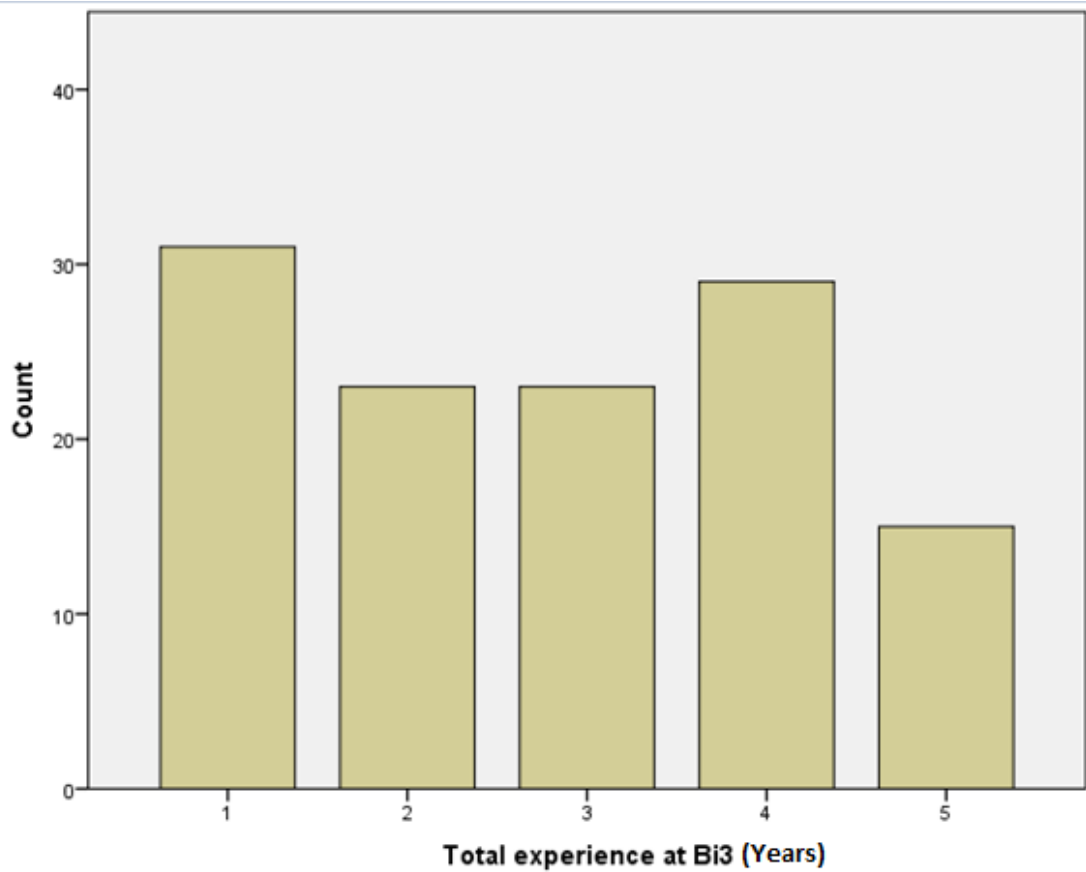


Figure 4.5: Experience at Brandix i3

4.2.5 Impact to employees' timeliness after ISO implementation

This section provides a descriptive analysis of the impact of employee's timeliness by implementing ISO implementation in the organization. Table 4.3 shows a descriptive statistics in terms of mode, mean and standard deviation of each question for the timeliness factor.

Table 4.3 Descriptive Statistics for Timeliness

		Average time you spend on following new ISO process related tasks daily in addition to your daily tasks?	How often do you complete your tasks on time after ISO9001:2015 implementation?	How often do you deliver your projects on time after ISO9001:2015 implementation
N	Valid	121	121	121
	Missing	0	0	0
	Mean	4.00	3.99	3.95
	Median	4.00	4.00	4.00
	Mode	4 ^a	4	4
	Std. Deviation	1.111	.926	1.063
Sum		484	483	478

a. Multiple modes exist. The smallest value is shown

Table 4.3 shows that, the mean of the 3 questions are nearly 4 with a mode and a median of 4. This value means that ISO 9001:2015 implementation at Brandix i3 was impacted to knowledge workers to deliver their project and tasks on time. And also the average time that employee work on ISO related tasks is less than 1 hour since in the Likert scale is used 4 to represent the time between 0.5 hours to 1 hour. According to these values ISO 9001:2015 processes have impacted most of the time to the timeliness factor of employees.

4.2.6 Effect on customer satisfaction

This section provides a descriptive analysis of the impact to customer satisfaction by implementing ISO implementation in the organization. Table 4.4 shows a summary of the descriptive statistics in terms of mode, mean and standard deviation for questions related to customer satisfaction.

Table 4.4 Descriptive Statistics for Customer Satisfaction.

		Customer interacts well with you to follow the processes	Customer is satisfied with the process	If customer is not satisfied, is there a way in the process to make him/her satisfy	ISO9001:2015 processes helps me to respond quickly and courteously to fulfill customers' needs
N	Valid	121	121	121	121
	Missing	0	0	0	0
Mean		3.64	3.71	2.99	3.48
Median		4.00	4.00	3.00	4.00
Mode		4	4	3	4
Std. Deviation		1.114	1.056	1.327	1.093
Sum		444	453	365	424

Table 4.4 shows that, the mean of the customer supportiveness is having 3.64 of mean with a standard deviation of 1.1 and the mode is 4. According to Likert scale this value is more towards to “most of the times” response. This emphasize that customer supportiveness to follow ISO processes is good.

The next question mainly focus on customer’s satisfaction on ISO processes at Brandix i3. The values with median on 4 and where mean is 3.71 with 1.05 standard deviation explains that this is also more towards to “most of the times” response. The flexibility towards customer satisfaction in the processes is measured in the questions of “If customer is not satisfied, is there a way in the process to make him/her satisfy” and this question has low median value and the mode is 3. It indicates that, if the customer is not satisfied with the flexibility on processes in order to satisfy customer is more in to “sometimes” response.

From the last question it targets the ability on quick response to customers with following the processes. According to the received results of mean with 3.48 it means

ISO processes sometimes support to fulfill customer needs quickly and courteously to satisfy them.

The overall result on customer satisfaction factor has two questions regarding to customer interaction and customer's satisfactory level, which are in a good (that is, satisfactory) level. However, when we analyze questions regarding support of ISO to better response to customer and the flexibility of adjusting the processes situationally, it gives results as ISO processes sometimes add a value on those areas.

4.2.7 Impact on autonomy

This section provides a descriptive analysis of the impact on autonomy by implementing ISO implementation in the organization. Table 4.5 shows a summary of the descriptive statistics in terms of mode, mean and standard deviation.

Table 4.5 Descriptive Statistics for Autonomy

		ISO 9001:2015 processes support me in achieving the goals assigned to me	ISO9001:2015 processes helps me to respond quickly and courteously to fulfill customers' needs	Current ISO9001:2015 processes are easy to understand and adopt by new employees
N	Valid	121	121	121
	Missing	0	0	0
Mean		3.50	3.45	3.46
Median		4.00	4.00	4.00
Mode		4	4	4
Std. Deviation		1.170	1.125	1.125
Sum		424	417	417

Table 4.5 explains for three of the questions the mean is almost 3.5 with a standard deviation of 1 which is almost 1. The mode of all the questions is 4 and these results explain that autonomy of the work is supported “most of the times” by implementing ISO 9001:2015 processes.

4.2.8 Impact on employee work efficiency

This section provides a descriptive analysis of the impact to efficiency by implementing ISO implementation in the organization. Table 4.6 shows a summary of the descriptive statistics in terms of mode, mean and standard deviation.

Table 4.6 Descriptive Statistics for Efficiency

		Average time you spend on following new ISO process related tasks daily in addition to your daily tasks?	Effectiveness on work transfer to another resource after ISO9001:2015 implementation	Current ISO9001:2015 processes are easy to understand and adopt by new employees
N	Valid	121	121	121
	Missing	0	0	0
Mean		4.00	3.68	3.45
Median		4.00	4.00	4.00
Mode		4 ^a	4	4
Std. Deviation		1.111	.915	1.125
Sum		484	445	417

a. Multiple modes exist. The smallest value is shown

According to the Table 4.6 mean, and mode (lowest mode) is 4 which means the average time employees spend on ISO related tasks is 1 or less than 1 hour per day. The calculated results in work transfer to another resource and the understandability of the processes for a new employee indicates that sometimes ISO processes are adding value to employees on their work efficiency.

As a summary for employee efficiency, ISO processes are impacted most of the times in time spending, but sometimes on work transfer to another resource and understandability of the processes for a new resource.

4.2.9 Impact on employee work quality

This section provides a descriptive analysis of the impact to efficiency by implementing ISO implementation in the organization. Table 4.7 shows a summary of the descriptive statistics in terms of mode, mean and standard deviation.

Table 4.7 Descriptive Statistics for Quality

	Effectiveness on work transfer to another resource after ISO9001:2015 implementation	All your work is well documented and stored in a repository	All the updates for existing projects are amended to those documents	ISO9001: 2015 processes visibly demonstrates a commitment to maintain the reliability of the product/ service	ISO9001: 2015 processes helps me to maintain error free records	ISO9001: 2015 processes help me to respond to customer requirements	ISO9001: 2015 processes helps me to serve as promised	Current ISO9001:2015 processes are easy to understand and adopt by new employees
N	Valid	121	121	121	121	121	121	121
	Missing	0	0	0	0	0	0	0
Mean	3.68	3.71	4.09	3.82	3.83	3.59	3.69	3.45
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4	4	4	4	4	4	4	4
Std. Deviation	.915	.851	.975	1.204	1.026	1.038	.966	1.125
Sum	445	449	495	462	459	434	446	417

Table 4.6 proves that ISO implementation as affected to areas such as maintaining all the work in documents, responding to customers quickly and serve as promised. Those three areas have median higher than 3.5 and mode is 4. But in measuring the work transfer it is a less than 3.5 median. These values indicates that most of the time there is an impact on employee work quality after ISO implementation.

4.2.10 Impact on effectiveness

This section provides a descriptive analysis of the impact to efficiency by implementing ISO implementation in the organization. Table 4.8 shows a summary of the descriptive statistics in terms of mode, mean and standard deviation.

Table 4.8 Descriptive Statistics for Effectiveness

		Effectiveness on work transfer to another resource after ISO9001:2015 implementation	All your work is well documented and stored in a repository	All the updates for existing projects are amended to those documents	ISO9001:2015 processes helps me to maintain error free records
N	121	121	121	121	121
	0	0	0	0	0
Mean		3.68	3.71	4.09	3.83
Median		4.00	4.00	4.00	4.00
Mode		4	4	4	4
Std. Deviation		.915	.915	.975	1.026
Sum		445	449	495	459

The main impact on effectiveness from ISO processes was documenting the work each employee has done for future references. In order to measure effectiveness it was measured by the way employees document their work and maintain it as error free records. For the questions related to documenting the mean is more than 3.5 and mode and median is 4, which indicates it push to the “most of the time” in Likert scale. According to the results on the questions related to work transfer new ISO processes the mean value is 3.68 with mode of 4 which is more towards to “sometimes” in Likert scale. As a summary, most of the time ISO 9001:2015 processes increased the effectiveness of the employees at Brandix i3.

4.2.11 Impact on innovation/creativity

This section provides a descriptive analysis of the impact to efficiency by implementing ISO implementation in the organization. Table 4.9 shows a summary of the descriptive statistics in terms of mode, mean and standard deviation.

Table 4.9 Descriptive Statistics for Innovation/ Creativity

		ISO9001:2015 processes help me to do things differently in less amount of time	ISO9001:2015 processes helps me to work in multiple tasks	ISO9001:2015 processes cause stress	I am encouraged to come up with new and better ways of doing things because of ISO9001:2015 processes
N	Valid	120	120	120	120
	Missing	0	0	0	0
Mean		3.31	3.29	3.13	3.31
Median		3.00	3.00	3.00	3.00
Mode		4	3	3	3
Std. Deviation		.960	.893	.875	1.151
Sum		397	395	375	397

The table explains that ISO processes have a direct impact on employee's innovation. The mean, median values for the question on doing things differently in less time is more towards to 3. Enabling the ability of working on multiple tasks, processes making stress and coming up with new and better ways of doing things are more towards to 3. As a summary ISO processes sometimes affected to employee's creativity and innovative thinking.

4.2.12 Project success

This section provides a descriptive analysis of the impact to efficiency by implementing ISO implementation in the organization. Table 4.10 shows a summary of the descriptive statistics in terms of median, mode, mean and standard deviation.

Table 4.10 Descriptive Statistics for Project Success

		How often do you deliver your projects on time after ISO9001:2015 implementation	Customer interacts well with you to follow the processes
N	Valid	121	121
	Missing	0	0
Mean		3.95	3.64
Median		4.00	4.00
Mode		4	4
Std. Deviation		1.063	1.114
Sum		478	444

Table 4.10 shows that, the mean of the on time delivery of the projects is 3.9 which is towards to 4 and ISO 9001:2015 processes most of the times caused to project success. Customer's interaction during the projects has the mean value as 3.5. In an overall consideration for project success, most of the time there is an impact from ISO 9001:2015 implementation.

4.2.13 Impact on productivity by ISO 27001

Measuring the impact for employee productivity by implementing ISO 27001 was measured using interviews with 10 selected employees who were directly involved in implementation process and information security related tasks at Brandix i3.

The planned questions set to ask from them was as follow.

- 1.ISO 27001 affected me and my team's productivity
2. ISO 27000 processes are a part of your job or you need to adopt to it with difficulty?
- 3.Do you plan on information security while you plan a project?
- 4.Following ISO 27001 is stressful
- 5.ISO 27001 processes make my work easy?
- 6.ISO 27001 processes helped me to reduce my effort on work
- 7.All the team members are supporting well in ISO 27001 processes following

These questions were prepared as open ended questions. Respondents were able to give their answers and justify the answer. Data collection was done in face to face interviews. Even though it had seven questions, during all ten interviews from the first question the answer received was ISO 27001 had no impact on employee's work productivity.

On further explanations they described that information security is a vital ethical factor for all IT employees and ISO 27001 has implemented a process for it. On further explanations four interviewees have mentioned that when implementing ISO 27001 processes the effort they had to put on was for awareness sessions for employees on physical security. But since it was a onetime task it did not effect on to productivity on their teams. The respondents who are involved in technical projects mentioned that in the beginning of each project they are concerning about the security of the information.

As a summary of the interview results there is no direct impact on employee productivity by implementing ISO 27001 processes.

4.3 Summary of Results

The key findings from the quantitative portion of the research can be summarized as follows:

- ISO 9001:2015 processes have positively impacted most of the time to the timeliness factor of employees.

- While the customer satisfaction has improved only marginally; when considering support of ISO processes to provide a better response to customer and the flexibility of adjusting the processes situationally, the value addition is significant.
- The autonomy of employees in successfully completing their work assignments have improved with the implementation of ISO processes.
- While the ISO processes have been successful in improving the work efficiency of employee at an overall level, there are improvements required in activities related to work transfer to another resource and understandability of the processes for a new resource.
- The work quality of employees have improved with the implementation of ISO processes.
- The effectiveness of employees have significantly improved with the ISO processes and exceeds the gains made on work quality and worker efficiency.
- The gains due to ISO processes on employee's creativity and innovative thinking can only be considered as marginal.
- The impact on project success due to the implementation of ISO processes is significant.

Therefore, it can be stated that the ISO 9001:2015 implementation at Brandix i3 has affected knowledge workers' productivity in different ways as described below on the productivity measurement factors which were identified during the research.

Employee productivity factors like timeliness, quality and autonomy effectiveness, innovative thinking/creativity, project success, efficiency and quality factors most of the times have an impact from ISO 9001:2015 processes while sometimes customer satisfaction and innovation/creativity got impacted. This would be the totality of research finding that any other organization similar to Brandix 3i could use in their consideration of adopting ISO processes.

The qualitative portion of the research based on the interviews with employees who worked on ISO 27001 implementation provide the finding that there is no impact on

employee productivity. It had only a minor impact when it is implementing physical security but since it was only a one time process it can be disregarded.

5.0 CONCLUSION AND RECOMMENDATIONS

This chapter discuss the research findings based on the statistical data on descriptive findings, and interview discussions. Moreover, it provides some recommendations for future studies based on results of this study as well as the literature findings. There were some limitations and other obstacles which this study came across that are noted in conclusion.

5.1 Research Conclusions

The first objective of the research was to find the employee productivity factors and the second objective was to find out how ISO implementation has affected employee productivity at Brandix i3. The research has identified eight factors which can measure knowledge worker productivity. They are:

1. Timeliness
2. Customer Satisfaction
3. Effectiveness
4. Innovative thinking/ Creativity
5. Quality
6. Project success
7. Autonomy
8. Efficiency

The second objective was to evaluate the impact of productivity factors on Brandix i3's knowledge worker productivity with ISO implementation and recertification. With the quantitative survey conducted to measure productivity impact by ISO 9001:2015 it has identified Employee productivity factors like timeliness, quality and autonomy effectiveness, innovative thinking/creativity, project success, efficiency and quality factors most of the times have an impact from ISO 9001:2015 processes while sometimes customer satisfaction and innovation/creativity got impacted.

According to the results ISO 9001:2015 has negatively affected to the customer satisfaction which is directly effect on group delivery IBU since according to demographics 43% of the respondents belongs to Group delivery business unit that the

knowledge workers are directly dealing with customers in Brandix group and other business units have separate teams to work with the customers. By analyzing these problems researcher's recommendation is Group delivery business unit needs to revise their ISO 9001:2015 related processes with more focus on customer satisfaction. In order to do this process needs to adjust as less technical details discussions with customers and increasing flexibility on addressing changes of the requirements. In accomplishing this, the company can apply agile software development methodology for tough customers like Brandix group.

With standardization of way of work and working according to a predefined processes has helped to deliver projects and individual tasks adhering to agreed timelines maintaining the quality of work. Since all the work processes are documented and employees are well educated on them it needs less guidance.

5.2 Recommendations

As the third objective, researcher's recommendation on ISO implementation to managements of startups of IT industry is listed in below:

- ISO 9001:2015 processes should be implemented based on the exact way of working in the organization. Introducing new work tasks in to the processes will cause to increase the complexity and even employees who are having more experience at the organization will take time to adopt with it. This recommendation is based on the result from 4.2.8.
- The processes have to be implemented with more focus on having less interaction with customers. This recommendation is based on the result from 4.2.6.
- The processes needs to be implemented in a way that new employees can easily adopt to it. Since startup organization are growing fast the number of new employees is always a high value. This recommendation is based on the result from 4.2.8.
- Implementing ISO 27000 processes is vital for startups in order to engage with more international business and implementing those processes are having

minimal effect on knowledge worker's productivity. This conclusion is based on the result from 4.2.13.

- In the startup organizations, management team always tend to change their strategies to reach to the market. With these strategy changes ISO processes also needs to be changed accordingly. When implementing ISO processes in startup organizations process changing mechanism is vital. This recommendation is based on the result from 4.2.5.

5.3 Research Limitations

The conduct of this study was limited in several ways and following are some of the main areas.

- The researcher was unable to collect quantitative data from all the knowledge workers at Brandix i3. However, a substantial sample of data was collected.
- The research was conducted to measure only eight knowledge worker productivity factors. The research can be further improved by measuring the productivity using more factor that capture the way in which is aligned with the manner of work in IT startup organizations.
- Employees had a fear of exposing exact truth on their experience since this was a survey conducted only within Brandix i3 and information will be visible to the management. This was explained by employees on casual meetings and during interviews on ISO 27001.
- In data collection for ISO 27001, the research used only 10 employees who were engaged on ISO 27001 implementation and who are playing a key role in information security. A better result could be obtained by expanding the data collection sources.

5.4 Future Research Directions

Brandix i3 is an organization, which is handling their business in different areas such as healthcare, fashion, manufacturing, business intelligence, etc., in several IBUs. A future research need to be conducted to measure the impact of ISO implementation separately in each business unit since the processes are different in each business units.

Based on the results of this study, further research can take different directions, focusing on different populations, in different contexts. Future research can be driven to measure other productivity factors which are more focused towards IT workers in more than one startup organizations. There are many IT organizations which have implemented different process standards. Future research work can focus on how process implementations have affected on knowledge workers productivity irrespective of organization's size and age.

REFERENCES

- Adamczyk, M. (2016). An attempt to define the concept of start-up company based on inductive research. In *QUAERE 2016: reviewed proceedings of the interdisciplinary scientific international conference for PhD students and assistants*, pp. 67-74.
- Aldrich, H. E., & Wiedenmayer, G. (1993). From traits to rates: An ecological perspective on organizational foundings. *Advances in entrepreneurship, firm emergence, and growth*, 1(3), 145-196, JAI Press.
- Allen, T. J., Gloor, P., Colladon, A. F., Woerner, S. L., & Raz, O. (2016). The power of reciprocal knowledge sharing relationships for startup success. *Journal of Small Business and Enterprise Development*, 23(3), 636-651, Emerald.
- Baron, J. N., & Hannan, M. T. (2002). Organizational blueprints for success in high-tech start-ups: Lessons from the Stanford project on emerging companies. *California Management Review*, 44(3), 8-36, SAGE.
- Blank, S. (2014). Corporate Acquisitions Of Startups - Why Do They Fail? *Forbes*. 22 April 2014 at www.forbes.com.
- Bosch-Sijtsema, P. M., Ruohomäki, V., & Vartiainen, M. (2009). Knowledge work productivity in distributed teams. *Journal of Knowledge Management*, 13(6), 533-546, Emerald.
- Card, D. N. (2006). The challenge of productivity measurement. In *Proceedings of the Pacific Northwest Software Quality Conference*, pp. 1-10.

Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. *Strategy & Leadership*, 35(6), 12-17, Emerald.

Cusumano, M. A. (2013). Evaluating a Startup Venture. *Communications of the ACM*, 56(10), 26-29, Association for Computing Machinery.

Dennehy, D., Kasraian, L., O'Raghallaigh, P., Conboy, K., Sammon, D., & Lynch, P. (2019). A Lean Start-up approach for developing minimum viable products in an established company. *Journal of Decision Systems*, 28(3), 224-232, Taylor and Francis.

Denning, S. (2013). The management revolution's growing army of rebel voices. *Strategy & Leadership*, 41(5), 23-33, Emerald.

Disterer, G. (2013), ISO/IEC 27000, 27001 and 27002 for Information Security Management, *Journal of Information Security*, 4, 92-100, SciRes.

Dreger, J. B. (1989). *Function point analysis*. Prentice-Hall, Inc.

Drucker, P. F. (1999). Knowledge-worker productivity: The biggest challenge. *California management review*, 41(2), 79-94, SAGE.

Fonseca, L. M. (2015). From Quality Gurus and TQM to ISO 9001: 2015: A review of several quality paths. *International Journal for Quality Research (IJQR)*, 9(1), 167-180, University of Montenegro and Center for Quality.

Hernandez, H. (2010). Quality audit as a driver for compliance to ISO 9001: 2008 standards. *The TQM Journal*, 22(4), 454-466, Emerald.

Hybbeneth, S. L., Brunnberg, D., & Gloor, P. A. (2014). Increasing knowledge worker productivity through a 'virtual mirror' of the social network. *International Journal of Organisational Design and Engineering*, 4, 3(3-4), 302-316, Inderscience.

Ingason, H. T. (2015). Best project management practices in the implementation of an ISO 9001 quality management system. *Procedia-Social and Behavioral Sciences*, 194(3), 192-200, Elsevier.

ISACA (2011). Top Business/Technology Issues Survey Results 2011. Retrieved February 13, 2015 from:<http://www.isaca.org/Knowledge-Center/Research/ResearchDeliverables/Pages/Top-Business-Technology-Issues-Survey-Results-2011.aspx>

ISO 9001:2008. (2015, February 13) Retrieved from www.iso.org.

ISO 9001:2015. (2016, June 13) Retrieved from www.iso.org.

ISO/IEC 27001. (2015, February 13) Retrieved from www.iso.org.

Klute-Wenig, S., & Refflinghaus, R. (2020). Quality management for microenterprises and start-ups—is the ISO 9001 suitable?. *International Journal of Quality and Service Sciences*, Emerald.

Lederer, A. L., & Sethi, V. (1988). The implementation of strategic information systems planning methodologies. *MIS quarterly*, 445-461, University of Minnesota Management Information Systems Research Center.

Leidner, D. E., & Kayworth, T. (2006). A review of culture in information systems research: Toward a theory of information technology culture conflict. *MIS quarterly*,

30(2), 357-399, University of Minnesota Management Information Systems Research Center.

Levine, D. I., & Toffel, M. W. (2010). Quality management and job quality: How the ISO 9001 standard for quality management systems affects employees and employers. *Management Science*, 56(6), 978-996, Informs.

Luftman, J. N. (Ed.). (1996). *Competing in the information age: strategic alignment in practice*.(Ed.2) Oxford University Press.

Midgley, D. F., & Dowling, G. R. (1978). Innovativeness: The Concept and Its Measurement. *Journal of Consumer Research*, 4(4), 229–242, Oxford University Press.

Morkovina, S. S., Kolesnichenko, E. A., Spesivtsev, V. A., & Ivanova, A. V. (2015). Principles of Innovative Startup Selection for E-Platforms Placement. *Mediterranean Journal of Social Sciences*, 6(6), 201, Mediterranean Center of Social and Educational Research.

Nobel, C. (2011). Teaching a 'Lean Startup' Strategy. *HBS Working Knowledge*, 1-2, Harvard Business School.

Paradi, J. C., Smith, S., & Schaffnit-Chatterjee, C. (2002). Knowledge worker performance analysis using DEA: an application to engineering design teams at Bell Canada. *Engineering Management, IEEE Transactions on*, 49(2), 161-172, IEEE.

Ramírez, Y. W., & Nembhard, D. A. (2004). Measuring knowledge worker productivity: A taxonomy. *Journal of intellectual capital*, 5(4), 602-628, Emerald.

Reich, B. H., & Benbasat, I. (2000). Factors that influence the social dimension of alignment between business and information technology objectives. *MIS quarterly*, 81-113, University of Minnesota Management Information Systems Research Center.

Reid, G. C., & Smith, J. A. (2000). What makes a new business start-up successful?. *Small Business Economics*, 14(3), 165-182. Springer.

Ries, E. (2011). *The Lean Startup*. New York: Crown Business.

Ruohonen, M., Kultanen, T., Lahtonen, M., Liikanen, H., Rytönen, T., & Kasvio, A. (2002). Emerging knowledge work and management cultures in ICT industry—preliminary findings. *Työn muutos ja hyvinvointi tietoyhteiskunnassa (Work change and well-being in the information society)*, *Sitran raportteja (Sitran reports)*, 22, 7-22.

Schein, E. H. (2010). *Organizational culture and leadership* (4th Ed.). John Wiley & Sons.

Sousa, M. J., & Rocha, Á. (2019). Strategic knowledge management in the digital age: *Journal of Business Research (JBR)* special issue editorial, 94, 223-226, Elsevier.

Sousa-Poza, A., Altinkilinc, M., & Searcy, C. (2009). Implementing a functional ISO 9001 quality management system in small and medium-sized enterprises. *International Journal of Engineering*, 3(3), 220-228, Computer Science Journals.

Susanto, H., Muhaya, F. B., Almunawar, M. N., & Tuan, Y. C. (2012). Refinement of Strategy and Technology Domains STOPE View on ISO 27001. *arXiv preprint arXiv:1204.1385*.

Stålhane, T. (2006). Implementing an ISO 9001 certified process. In *European Conference on Software Process Improvement*, pp. 16-27, Springer.

Van Grembergen, W., & De Haes, S. (2009). *Enterprise governance of information technology: achieving strategic alignment and value*. Springer.

Warren, P., Kings, N., Thurlow, I., Davies, J., Buerger, T., Simperl, E., ... & Tilly, M. (2009). Improving knowledge worker productivity—the ACTIVE integrated approach. *BT Technology Journal*, 26(2), 165-176, Springer.

Weill, P., & Ross, J. W. (2004). *IT governance: How top performers manage IT decision rights for superior results*. Harvard Business Press.

Wong, P. S. S. (2012). *Drucker's knowledge-worker productivity theory: a practitioner's approach to integrating organizational work processes with Drucker's six major factors determining knowledge-worker productivity*. Southern Cross University, Australia, ePublications@SCU.

APPENDIX A: QUESTIONNAIRE

Survey on ISO implementation at Bi3

Dear Sir/Madam,

I am conducting a research on "impact to the productivity of IT employees by implementing ISO processes at Brandix i3". This research is a part of my MBA in IT at University of Moratuwa and this survey is stipulated confidential and anonymous. Your responses will not be identified with you personally and all findings will appear in aggregated form.

Your participation in the research would be greatly appreciated. If you have any queries or wish to know more please feel free to contact me using the details provided below. It will take about 15 minutes to complete the survey.

Thank you very much for your time and help in making this study possible.

Sincerely,

Gayani Balasooriya and Vishaka Nanayakkara,

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Dept. of Computer Science and Engineering,

University of Moratuwa

* Required

1. Which IBU you belong to ? *

1. Business Enablers
2. Group Delivery
3. Healthcare
4. Manufacturing

5. Investment - Resource Pool

2. Your job role? *

1. Assistant Manager
2. Associate Consultant
3. Associate Software Engineer
4. Associate Solutions Architect
5. Associate Tech Lead
6. Associate UI Lead
7. Associate UX Lead
8. Associate Vice President
9. Business Analyst
10. CEO
11. Consultant
12. Customer Support Manager
13. Deployment Engineer
14. Executive
15. Front Office Coordinator
16. Graduate Trainee
17. Intern
18. IT Assistant
19. Lead Consultant
20. Lead Solutions Architect

21. Management Accountant
22. Manager
23. Office Assistant
24. Product Manager
25. Project Coordinator
26. Project Manager
27. QA Engineer
28. Resource Manager
29. Senior Architect
30. Senior Consultant
31. Senior Software Engineer
32. Senior Executive
33. Senior Tech Lead
34. Senior Project Manager
35. Senior QA Engineer
36. Senior QA Lead
37. Senior Systems Consultant
38. Senior Technical Lead
39. Senior Vice President
40. Software Engineer
41. Solutions Architect
42. Systems Consultant
43. Systems Support Engineer

44. Team Lead
45. Tech Lead
46. Technical Writer
47. Trainee Consultant
48. Trainee Executive
49. Trainee QA Engineer
50. Trainee Software Engineer
51. Vice President

3. Your role in ISO implementation at Bi3 *

1. Internal Auditor
2. Representative
3. Internal Auditor & Representor
4. Management Representative
5. Process follower

4. Total experience at Bi3 *

1. Less than 1 year
2. 1 year - 2 years
3. 2 years - 3 years
4. 3 years - 4 years
6. 4 years - 5 years
7. More than 5 years

5. Average time you spend on following new ISO process related tasks daily in addition to your daily tasks?

1. Less than 0.5 hours
2. 0.5 hours - 1 hour
3. 1 hour - 1.5 hours
4. 1.5 hours - 2 hours
5. More than 2 hours

6. How often do you complete your tasks on time after ISO 9001:2015 implementation?

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

7. How often do you deliver your projects on time after ISO 9001:2015 implementation?

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

8. Customer interacts well with you to follow the processes

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

9. Customer is satisfied with the process

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

10. If customer is not satisfied, is there a way in the process to make him/her satisfy

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

11. Effectiveness on work transfer to another resource after ISO 9001:2015 implementation

1. Very high
2. High

3. Medium
4. Low
5. Very Low

12. All your work is well documented and stored in a repository

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

13. All the updates for existing projects are amended to those documents

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

14. ISO 9001:2015 processes help me to do things differently in less amount of time

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

15. ISO 9001:2015 processes helps me to work in multiple tasks

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

16. ISO 9001:2015 processes cause stress

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

17. I am encouraged to come up with new and better ways of doing things because of ISO 9001:2015 processes

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

18. ISO 9001:2015 processes visibly demonstrates a commitment to maintain the reliability of the product/service

1. Always
2. Most of the time

3. Sometimes

4. Seldom

5. Never

19. ISO 9001:2015 processes helps me to maintain error free records

1. Always

2. Most of the time

3. Sometimes

4. Seldom

5. Never

20. ISO 9001:2015 processes help me to respond to customer requirements

1. Always

2. Most of the time

3. Sometimes

4. Seldom

5. Never

21. ISO 9001:2015 processes helps me to serve as promised

1. Always

2. Most of the time

3. Sometimes

4. Seldom

5. Never

21. ISO 9001:2015 processes support me in achieving the goals assigned to me

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

22. ISO 9001:2015 processes helps me to respond quickly and courteously to fulfill customers' needs

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

23. Current ISO9001:2015 processes are easy to understand and adopt by new employees

1. Always
2. Most of the time
3. Sometimes
4. Seldom
5. Never

24. My role in ISO 27001 process implementation

1. Security Steering Committee Member
2. Management Representative

3. Information Security Officer
4. Information Security Coordinator
5. ISMS Internal Auditor
6. Business Continuity Team Member
7. Process Follower

APPENDIX B: POLICIES, PROCEDURES AND STANDARDS OF ISO 27001

Policies

- Acceptable Use Policy
- Access Control Policy
- Anti-Virus Policy
- Application Development, Support and Maintenance Policy
- Asset Management Policy
- Business Continuity Management Policy
- CCTV Policy
- Change Management Policy
- Data Backup Policy
- Human Resources Policy
- Information Security in Project Management
- Information Security Policy
- Information Sensitivity Policy
- Intellectual Property Rights Policy
- Laptop Policy
- Password Management Policy
- Physical Security Policy
- Remote Access, Wireless Usage and Mobile Computing Policy
- Security Compliance Policy
- Security Incident Management Policy
- Software Management Policy
- Third Party Service Management Policy

Procedures

- Antivirus, Patch and Vulnerability Management Procedure
- Application Development, Support and Maintenance Procedure
- Asset Management and Handling Procedure
- Backup and Restoration Procedure

- Business Impact Analysis Procedure
- Capacity Management Procedure
- Change Management Procedure
- Corrective Action and Continual Improvement Procedure
- Disaster Recovery Procedure
- Documented Information Control Procedure
- Lost or Damaged Company Property Reporting Procedure
- Monitoring and Audit Procedure
- Risk Management Procedure
- Security Incident Management Procedure
- Systems and Network Management
- User Management Procedure

Standards

- Applicable Laws and Legislation
- Application List for Remote Access
- Approved list of Software and Application Standard
- Clock Synchronization standard
- Cloud Computing Security and Privacy Guidelines
- Crisis Management Plan
- Device Hardening standard – Servers and Routers
- Group Policy Object (GPO)
- Information Retention Standard
- Internal Audit Schedule Checklist
- List of Special Interest Groups
- Proxy Privilege Levels
- Security Incident Tracker
- Security Organization Member List
- Security Roles and Responsibilities
- Security Roles and Responsibilities
- Standard Disclaimer
- Username and Password Construction