TECHNOLOGICAL FACTORS AFFECTING PRODUCTIVITY: THE CASE OF TECHNOSTYLE PLC

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TECHNOLOGICAL FACTORS AFFECTING PRODUCTIVITY: THE CASE OF TECHNOSTYLE PLC

By

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Declaration

I declare that this research paper entitled **'Technological factors affecting Productivity: The Case of Techno Style PLC'** is my original work and has not been used by others for any other requirements in any other university and all sources of information in the study has been appropriately acknowledged.

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LIST OF ACRONYMS

IT = Information Technology

RD=Research and Development

AP= Automated Process

SPSS = Statistical Package for Social Science

ANOVA = Analysis of Variance

VIF = Variance Inflation Factor

IV = Independent Variable

DP = Dependent Variable

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ABSTRACT

The purpose of this research was to find out which Technological Factors affect Productivity in Furniture Industry in the case of Technostyle Plc. It tried to order the technological factors according to their significance effect on the productivity. The paper also covered to see if the factors have any different effect across the demographic profile of respondents. The study examined four technological factors that were taken from prior research works which are Information Technology, Research and Development,3D Printing and Automated Process. The study used both primary and secondary sources of data. A quantitative research approach of data collection was used, and 385 questionnaires were distributed out of which 373 of them were returned. Probability sampling (stratified) method was used, and employees were selected from each stratum with a random sampling technique. Data was analyzed using SPSS software to obtain descriptive statistics, comparing mean scores (i.e., independent t-test and ANOVA) and other analyses (i.e. correlation analysis and multiple linear regressions). The result of correlation shows that there is a positive relation between Information Technology, Research and Development,3D Printing, Automated Process and Productivity. Meanwhile, the result of regression analysis indicates, from the four factors three has been indicated that it significantly affects Productivity except Automated Process. The finding of the study showed that there is a significance difference in perceiving the factors between and among the respondents with different demographic profiles. It is recommended that, the Firm is to review its focus regarding the Technological Factors which can enhance and significantly affect its productivity. The study, also, recommends that further research should be done among the different furniture companies considering different affecting factors.

Keywords: *Productivity; Techno-style; Technological factor*

CHAPTER ONE

INTRODUCTION

The introduction chapter consists of the background of the study, statement of the problem, objectives of the study, research questions, significance of the research, scope of the study, limitation of the study, definition of terms and organization of the study.

1.1 Background of the Study

Early studies claim that growth in many countries could be partly explained by growth in capital and labor. The remainder is attributed to the 'Solow residual', which is interpreted as a measure of productivity growth after the seminal work of Solow (1957). Since then, an extensive literature developed attempting to explain this residual with technical change (Griliches, 1996, 1998).

Far from being a concern of advanced countries alone, benefits from technological advancement efforts in terms of the firm performance gains importance especially for developing regions of the world, as technological activity is costly for such countries due to their scarce resources of technology and human capital.

Technological factors are variables that are being used for evaluating available alternatives with respect to technological capabilities. Organizations consider it an important tool for improving operations, functions, and productivity. Technological factors are one of the various external environment factors that affect businesses greatly and are also an integral component of the PESTLE analysis. In the present scenario, utmost dependence on equipment, technological factors can have more effect on business operation and success globally than ever before.

Robert Solow (1959) found that most of the increases in human living standards have come not from working more hours, and not from using more capital or other resources, but from improved productivity that is, increases in the efficiency of production as defined by the ratio of output to input. In turn, productivity growth comes from new technologies and new techniques of production and distribution.

It can be suggested that technological efforts can translate into productivity gains for firms such that advanced technologies can both increase firms' efficiency and improve the products they offer, hence escalates demand, and reduces costs of production (Hall, 2011).

Furniture is now in the digital age. The way that furniture is designed has been profoundly affected by the rapid change of technology. Many companies are trying to develop furniture products that are adaptable, multifunctional, and integrate-able to consumer electronics to enhance productivity. They want to improve the functionality and sustainable methods of furniture production. Technology has helped improve furniture production methods and material selection. Aside from comfort and ergonomics, the future of furniture design will also revolve around technology. It is essential to shift away from traditional models and to be adaptable to changes that can improve human experience and support sustainable living.

Technological factors are becoming prominent factors affecting businesses currently. Using advanced technologies, businesses are transforming their processes, ease of access, operational excellence and thereby productivity. Prior literatures have written different research and articles on technological factors affecting productivity in different times. Heru M. & Subhash C. (2004) Indonesia, Joel M. (2005) America, John B. (2000) Europe, and many more.

But it exists contradictory evidence about gains from technology in terms of firm performance where the empirical evidence on this relationship varies among types of firms, measurement of productivity as well as across different types of technologies. Some studies have shown that technology positively affects firms' productivity (Crépon, Duguet and Mairesse 1998; Griffith et al., 2006; Hall et al., 2009; Chudnovsky et al. 2006; Masso and Vahter, 2008) whereas some others have shown that technology negatively effects firms' productivity (Raffo et al., 2008; Duguet, 2006, Janz et al., 2004; Lööf and Heshmati, 2006; Van Leeuwen and Klomp, 2006).

Although there is much less evidence regarding negative effects of technologies on productivity compared to those with positive findings, this conflicting evidence indicates that there are still unidentified issues regarding technology and productivity nexus. Literature further suffers from the lack of utilization of a multidimensional approach to evaluate the productivity gains from different types of technological factors.

As literature and previous studies showed that there are many technological factors that can affect productivity most of them was done in the developed countries which limits the research to be applicable in the case of developing countries like Ethiopia.

Therefore, this study is designed to identifies which technological factors believed to affect productivity significantly from selected four factors Information technology, Research and Development, Automated Process, and 3D Printing and find out the variance of this factor in different demographic profile.

1.2 Background of the Organization

Technostyle is a Private Limited Company which was established in 1988 envisioning the need for modern and quality furniture with two staff members and a modest capital. Today, Techno-style is seen by customers, suppliers, competitors, and the government as one of the most credible

and respectable enterprise in the country. “Techno-style” is synonymous with ethical business practice in Ethiopia. Techno-style is a pioneer leading company in Ethiopia with the highest market share in the supply of elegant, modern, aesthetic, environment friendly, flexible and space saving furniture. By incorporating space planning and interior design.

Techno-style has become a strategic resource for innovative products and services. In support of the government’s new growth and transformation Plan, it has taken the initiative to gear its resources towards manufacturing. The company has laid the groundwork to attain foreign investment and financing to move forward with the plan to manufacture. Setting up additional partnership with local and international companies, they have developed a sustainable solution to manufacture import substitute products.

Technostyle started manufacturing factory located in Oromia Liyu Zone Legetafo Legedadi Administration. Products are Europe standard. The factory is established on 74,000m2 plot of land which we acquire from the state. The factory has home, hotel, hospital, school, and office furniture well established production lines.

1.3 Statement of the Problem

Technological trends affect businesses on many levels. When an employee is efficient, he turns out to be productive. Additionally, when a business is more in touch with its present and potential customers, the more chance it must build a strong customer loyalty base. Advancement of technology can make this possible. Strategic leaders are constantly looking for development and updates within the technological environment. In this way, they not only improve their operations but, they will also be aware of business transformational phase. They will derive groundbreaking strategies to grow exponentially.

The technological environment of business has changed the way in which businesses function. Advancements in information technology have almost taken over every department of the organization. Now, information is stored in data servers and cloud technology as against the old way of storing data in registers and files. Furthermore, development of technology has also introduced digital marketing strategies through which companies are able to sell their products and services. Even the research and development R&D divisions in companies have changed its way of functioning and more advanced techniques in the development of products and services have been introduced only through technological advancements.

Technology has helped improve furniture production methods and material selection. Aside from comfort and ergonomics, the future of furniture design will also revolve around technology. It is essential to shift away from traditional models and to be adaptable to changes that can improve human experience and support sustainable living.

Some of the cross-country studies which included both developed and developing countries in its samples (such as: Dewan & Kraemer, 2000; Pohjola, 2001; Kraemer & Dedrick, 2001; Plice & Kraemer, 2001; Lee et al., 2005) have agreed that, in contrast to the developed world, IT investment has not had a significant positive impact on the productivity and economic growth of the developing countries during the period of the 1980s and early 1990s. Even though these studies have used different methodologies, they reached nearly the same results. These studies consent that this conclusion is due to the fact developing countries have a low level of IT investment relative to GDP. In addition, developing countries lack complementary assets necessary to benefit from the payoffs of IT investments such as the needed infrastructure and the knowledge base which is essential to support the effective use of IT. In other words, even though some of these studies have shown that there is generally a positive correlation between economic growth, productivity,

and IT investment for the full set of countries in their samples; but the results seemed less obvious for the subset which included only developing countries.

On the other hand, other few cross-country studies (such as: Balimoune, 2002; Lee & Khatri, 2003; Chen & Dahlman, 2004) which have included only developing countries in their samples reached contradicting results. It may be deduced, accordingly, that having a positive relationship between IT investments and growth has been recently more obvious for subsets that included only developed countries but there has been a clear disagreement among the studies tackling the impact of Technology usage on the developing countries. This disagreement makes testing the hypothesis for developing countries yet to be interesting. Thus, the main motivation behind this study is to fill in the gap in the literature of developing countries specifically taking Techno-style firm.

Technostyle firm is a company working in a market which is characterized by a perfectly competitive market. For the firm to stay in the business and be competitive to outfit the fierce competition in the industry, use of advanced technologies is indispensable through operational excellence, cost reduction and thereby enhancing productivity. But it is particularly important for a firm to identify which technological factors are highly affecting productivity. And technological obsolesce will result the business to go out of the market because of a fierce competition in the industry and among competitors. Hence, Technostyle firm is expected to know which technological factors is affecting its productivity. So, this paper tries to identify those technological factors which are affecting the company's productivity. Moreover, it tries to show the magnitude, direction and relationship between independent variables and dependent variable and figure out if these independent variables vary across demographic profile of respondents which is the unlike feature in other related literatures.

1.4 Research questions

- Which technological factors (Information-Technology, Automated system, Research & Development, or 3D printing) affecting productivity in Techno-Style PLC?
- What is the direction, magnitude, and relationship between the dependent and independent variables?
- To what extent the determinant technological factors affecting productivity differ across demographic profile of the respondents?

1.5 Objectives of the study

1.5.1 General Objective of the study

The general objective of this study is to identify the technological factors affecting productivity in Techno-style plc.

1.5.2 Specific Objectives

- To identify which technological factors (Information-Technology, Automated system, Research & Development, or 3D printing) affecting productivity in Techno-style PLC.
- To describe the magnitude and relationship of technological factors affecting productivity in Techno-style PLC.
- To find out if there is any variation in the determinant technological factors of productivity in the demographic profile of the respondents.

1.6 Significance of the Study

This research is believed to identify the major technological factors which significantly affects productivity in Techno-style PLC. In addition, the research also helps the Technostyle firm management, the type of technological investments to be made to gain competitive advantages in

the market and thereby enhance productivity. Moreover, it helps the management to forecast the proactive future competitions and develop the latest industry products. It guides the firm on how to increase its efficiency through investing more on technologies and thereby having the latest industry products. It fills the gap or the void in the related literatures and can be used as a reference for further related literatures.

1.7 Scope of the study

This study is delimited to permanent employees of Technostyle Plc. Even though it's very important to cover all branches across the country, yet due to the wide geographical dispersion of branches as well as time and money constraints, outlined branches were not included; the study included only head office at Addis Ababa & the factory which is located in Lege Xafo Legedadi Town. The study focused on the group of respondents from top management, department heads section heads and experts. Lower-level employee like security guards or messengers were not included. Questionnaire was used as data collection tools on the study. The analysis technique employed in this study restricts the inclusiveness of detail items in the questionnaire and limits the respondents to elaborate their answers.

1.8 Limitations of the Study

The quality of the output of this study depends on the genuine data acquired from the selected representative. This implies that, the finding and the analysis of this paper depend up on the selected representatives" reliable data. So that, lack of willingness, for various reasons like suspect of miss use of the company's confidential information for non-academic purpose limits the reliability of the research paper to achieve its objectives. In addition, shortage of pervious similar research in Ethiopian case, and limited resource may affect the qualities of the study output. The

study was conducted amid the outbreaks of pandemic COVID-19. As a result, it was challenging in due time of data collection on the ground of fear of infection.

1.9 Definitions of Terms

Technology- is the sum of techniques, skills, methods, and processes used in the production of goods or services.

Productivity - is the efficiency of production of goods or services expressed by some measure. Measurements of productivity are often expressed as a ratio of an aggregate output to a single input, or an aggregate input used in a production process, that output per unit of input, typically over a specific period.

Technological Factors Technological factors are variables that are being used for evaluating available alternatives with respect to technological capabilities.

1.10 Organization of the paper

The paper is organized in five chapters. The first chapter deals with the introduction that includes background of the study, statement of the problem, objectives, significance of the study, scope of the study, organization of the study and limitations of the study. On the second chapter, it deals with related literature review (both theoretical and empirical). On the third chapter, data was be analyzed and presented by using various statistical measurements and tools including SPSS. The fourth chapter was provide finding or the results obtained, and the last chapter was providing conclusion and recommendation based on the findings from the study.

CHAPTER TWO

RELATED LITERATURE REVIEW

This chapter provides an insight to readers about the theoretical view of the topics under study. In line with objective of the study, the chapter covers topics related to productivity, information technology, technology strategies, theories and models and a conceptual framework drawn from a theoretical ground taking four factors that are believed to affect productivity in techno-style firm.

2.1 Theoretical Review

2.1.1 Technology

Technology has brought in a transformation through which companies collect, record, retrieve and utilize data and which also helps them in coming up with groundbreaking business strategies. Through to be had data, groups are capable of reveal and examine purchaser tendencies and their needs for a selected product. Thanks to the improvement of various technologies, groups can apprehend customer conduct and behavior a macro surroundings evaluation and broaden advertising and marketing techniques accordingly.

Technology is not always most effective beneficial for gathering and the use of statistics but, it is also being utilized by agencies to research statistics and make significant conclusions in addition to knowledgeable decisions. Having extra cognizance at the customers, commercial enterprise techniques will honestly show out to be powerful for the fulfillment of an organization.

2.1.2 Productivity

Productivity is one of the maximums carefully watched signs of long-time period economic prospects. Rising productiveness is the important thing to creating feasible everlasting will increase withinside the general of living. In Productivity Growth withinside the 1990s:

Technology, Utilization, or Adjustment (NBER Working Paper No. 8359), authors Susanto Basu, John Fernald, and Matthew Shapiro gift new estimates of the function of technological extrude in developing the uncommon will increase in measured productiveness for the duration of the second one 1/2 of the 1990s.Changes in technology are the only source of permanent increases in productivity, but a number of transient factors can affect both true and "measured" productivity. For example, workers may work harder during periods of high demand and firms may use their capital assets more intensively by running factories for extra shifts; both factors can lead measured productivity to be too high relative to actual technological progress. Similarly, during periods of high demand, productivity can rise because firms take advantage of increasing returns to scale; the authors argue that this effect is not permanent and should be discounted when measuring long-run technical change. The strength of the latest economic expansion in the second half of 1990s has led many commentators to argue that the rapid increases in measured productivity during that period were attributable to bad measurement or to temporary factors of this type.

Productivity measures embody indexes for man or woman elements of production, e.g.exertions or capital, and indexes for a weighted common of man or woman elements of production. Productivity measures for man or woman issue inputs are called partial issue productiveness indices. Productivity measures encompassing all input factors are known as total factor productivity indices. Hence, labor productivity is an index of a series of real output divided by a series of real labor input.

The most common index of labor productivity is real output per hour worked. Similarly, capital productivity is an index of a real output series divided by a real capital input series. In fact, output per labor hour is the most widely available productivity measure for international comparisons, as well as inter-industry comparisons, (Bartholomew 1997).

2.1.3 Technology Strategies

For many years, American and European managers were instructed with the aid of using control professionals that era techniques ought to accept unique interest because they have a look at on era techniques has turn out to be more and more important (Ford, 1988; Smith and Rogers, 2004).

Ford (1988) in his studies states that generation techniques are not just like an R&D method; the latter is involved best with obtaining generation thru in-residence activities. A generation method is a factor of that method involved with exploiting, growing, and preserving the sum general of a company's understanding and abilities. The improvement of a generation method is the premise to foster destiny strategic conduct that, in turn, ends in improving competitiveness and growth. This is supported by Zahra (1996) who verifies that by possessing a technology strategy, manufacturing companies can contribute and cope with its external environmental effects and demands. To address this uncertain environment, manufacturers should continue to examine their strategies, practices, capabilities and, in so doing, identify their impact and performance (Ketokivi and Schroeder, 2004; Germain et al., 2008).

Having a longtime and embedded era approach is a crucial component in growing an organization's strategic position (Zara and Boner, 2000). It is a crucial precondition that takes benefit of modern and effective era. It works as a fundamental tool for rivalry and establishes practical and physical alternative actions (Itami and Numagami, 1992). Comparably, corporations' center abilities are depending on generation as a number one foundation. As a variable, generation has emerged as important for income or not-for-income corporations to maximize aggressive blessings and to degree adjustments in performance. Zara (1996) emphasized that generation has been broadly identified as a cornerstone of an organization's competitiveness through numerous mechanisms, which includes developing boundaries to entry, attracting new markets and

customers, or even converting the policies of opposition in industry. Gillespie and emphasized (1977), in Technology and the Study of Organizations, increase the significance of beyond generation to contain system or device conceptualization and include sensitive improvements and usage features of present-day industry.

2.1.4 Technology and Productivity

While technological change is sometimes identified synonymously with productivity change, the two are distinct, albeit related concepts. Specifically, technological change is a contributor (of greater or lesser importance) to productivity change. Identification of the contribution of technological change to productivity change, in turn, requires some precision in the measurement of the latter.

Productivity in a company is one of the main axes of success, because through it you can measure the quality of the products and the profitability that is taking place. Technology has also played an important role in enhancing the productivity of firms specially in the furniture industry.

Productivity in furniture-making workshops will depend on a clever mix of people, equipment, and efficient processes. To make improvements in all these areas, it is necessary to review current practices and adjust systems, staff training and even the equipment used to generate parts and components.

Furniture manufacturing is an industry in which an employee cannot be as productive as his tools. While machines, such as cutting machines or CNCs, can be expensive in terms of initial configuration and training, advanced equipment can have a long-term positive effect on production.

There is evidence that manufacturers who perform regular machine maintenance manage to remain competitive in a market as competitive and innovative as that of the furniture sector. But it is equally important to invest in software that drives not only a machine, but often the entire machine fleet, as well as the rest of the operations, in a continuous flow of information. Hence the importance of using a flexible and precise software, adaptable to any type of machine configuration and multi-brand.

2.1.5 Theories and Models

Today, technology is universally regarded as an essential tool in enhancing the competitiveness of firms. There is consensus that Technology has significant effects on the productivity of firms. These effects will only be realized if, and when, Technologies are widely spread and used. It is essential to understand the determinants of Technology adoption. Consequently, it is necessary to know the theoretical models. There are few reviews in the literature about the comparison of Technological models at the individual level, and to the best of my knowledge there are even fewer at the firm level. This review fills this gap. In this study, I reviewed theories for adoption models at the firm level used in information systems literature and discuss two prominent models: diffusion on innovation (DOI) theory, and the technology, organization, and environment (TOE) framework.

2.1.5.1 Diffusion on Innovation Theory

The DOI found that individual characteristics, internal characteristics of organizational structure, and external characteristics of the organization are important antecedents to organizational innovativeness. The TOE framework identifies three aspects of an enterprise's context that influence the process by which it adopts and implements a technological innovation: technological context, organizational context, and environmental context. I made a thorough analysis of the TOE

framework, analyzing the studies that used only this theory and the studies that combine the TOE framework with other theories such as: DOI, institutional theory, and the Iacovou, Benbasat, and Dexter model. The institutional theory helps me to understand the technological factors that influence the adoption of organizational systems; it postulates that mimetic, coercive, and normative institutional pressures existing in an institutionalized environment may influence the organization's predisposition toward an IT-based organizational system.

Adoption of a new idea, behavior, or product (i.e., "innovation") does not happen simultaneously in a social system; rather it is a process whereby some people are more apt to adopt the innovation than others. Researchers have found that people who adopt an innovation early have different characteristics than people who adopt an innovation later. When promoting an innovation to a target population, it is important to understand the characteristics of the target population that will help or hinder adoption of the innovation. There are five established adopter categories, and while much of the general population tends to fall in the middle categories, it is still necessary to understand the characteristics of the target population. When promoting an innovation, there are different strategies used to appeal to the different adopter categories.

1. Innovators - These are people who want to be the first to try the innovation. They are venturesome and interested in new ideas. These people are very willing to take risks and are often the first to develop new ideas. Extraordinarily little, if anything, needs to be done to appeal to this population.
2. Early Adopters - These are people who represent opinion leaders. They enjoy leadership roles and embrace change opportunities. They are already aware of the need to change and so are extremely comfortable adopting new ideas. Strategies to appeal to this population

include how-to manuals and information sheets on implementation. They do not need information to convince them to change.

3. Early Majority - These people are rarely leaders, but they do adopt new ideas before the average person. That said, they typically need to see evidence that the innovation works before they are willing to adopt it. Strategies to appeal to this population include success stories and evidence of the innovation's effectiveness.
4. Late Majority - These people are skeptical of change and will only adopt an innovation after it has been tried by the majority. Strategies to appeal to this population include information on how many other people have tried the innovation and have adopted it successfully.
5. Laggards - These people are bound by tradition and very conservative. They are very skeptical of change and are the hardest group to bring on board. Strategies to appeal to this population include statistics, fear appeals, and pressure from people in the other adopter groups.

This theory is related to my thesis in a sense that, how technology or new product gains momentum and diffuses or spreads through a specific population or social system i.e. a firm in this case Techno-style firm and thereby factors which are affecting productivity in a firm.

2.1.5.2 Technology, Organization, Environment (TOE) framework

The technology-organization-environment framework, also known as the TOE framework, is a theoretical framework that explains technology adoption in organizations and describes how the process of adopting and implementing technological innovations are influenced by the technological context, organizational context, and environment context.

The Technological Context

The technological context consists of all the technology which might be applicable to the organization both, technology which might be already in use on the organization in addition to the ones which might be to be had with inside the market however now no longer presently in use. A firm's existing technologies are important in the adoption process because they set a broad limit on the scope and pace of technological change that a firm can undertake (Collins et al. 1988). Innovations that exist but are not yet in use at the firm also influence innovation both by demarcating the limits of what is possible as well as by showing firms ways in which technology can enable them to evolve and adapt. So, this context is related to my thesis in identifying technological factors which are highly affecting the firm's productivity looking at the latest industry and/or market practice.

The organizational context

The organizational context refers to the characteristics and resources of the firm, including linking structures between employees, intra-firm communication processes, firm size, and the amount of slack resources. There are several ways in which this context affects adoption and implementation decisions. First, mechanisms that link internal subunits of the organization or span internal boundaries promote innovation (Galbraith 1973; Tushman and Nadler 1986). The presence of informal linking agents – such as product champions, boundary spanners, and gatekeepers – is associated with adoption. Cross-functional teams and employees that have formal or informal links to other departments or to other value chain partners are additional examples of such mechanisms. So, this context is related to my thesis in a sense that resources like technology is a major indispensable factor in a firm to compete the fierce competition in the industry.

The Environmental Context

The environmental context includes the structure of the industry, the presence or absence of technology service providers, and the regulatory environment. Industry structure has been investigated in several ways. For instance, intense competition stimulates the adoption of innovation (Mansfield 1968; Mansfield et al. 1977). Also, dominant firms within the value chain can influence other value chain partners to innovate (Kamath and Liker 1994). So this model is related to my thesis in a sense that, identifying the latest technology in the industry and technological factors affecting productivity is very important to be a customer centric firm and win the local and global competitors business.

2.1.5.3 Theory of Manufacturing

Technology and materials. "Up until the 1960s, all of this century's big furniture successes were dependent, in some manner, on technology improvements," argues Sparke (1986, page 105). She refers to both new machines and innovative construction materials, which she carefully lists for each successive time. Sparke lists the following types of wood, excluding traditional straight-jointed wood.

Beside materials and machines, important points of departure when planning the manufacture of furniture items are ecology and economy. Both are discussed on their respective pages: Ecology of products and Economy of products.

Ecology of manufacture

The general principle of industrial ecology, which is summarized on the page Ecology of Products, can be simply applied to furniture design and manufacture. When analyzing production and use of furniture with the standard model of ecological life cycle analysis (figure on the right) it turns out that furniture generates seldom grave ecological disadvantages: raw materials, especially wood,

are replenishable, there is a lively recycling market, and disposal of materials is relatively simple because it is typically easy to disassemble furniture and waste materials are not toxic.

Of fact, the existence of a reliable ecological theory does not imply that it is always employed. Designers and makers of furniture could often do better work in minimizing the use of material and energy and facilitating recovery of materials.

Economy and management

The main divisions of business economics are illustrated on the page Economy of Products, and it includes several powerful processes that are frequently utilized when optimizing a new produc.

Likewise, there are useful techniques for optimizing the marketing mix, that the assortment of the company's products. By comparing incomes with fixed and variable costs, it is possible to define for each product the break-even quantity of sales that the company must surpass to get positive profit. This method also points out the least profitable products which the company then can consider abandoning. It is explained in Optimizing Production and Pricing.

There are economic optimization methods for the customer, as well. When selecting a piece of furniture among several alternatives, the cost-benefit method is often used.

2.2 Empirical Review

2.2.1 Information Technology and Productivity

Most studies, since the mid of 1990s to 2014, have observed effective outcomes of IT on productivity (Cardona et al,2013). Firm-level research has shown that there are large and persistent gaps between the productivity of IT-using industries and traditional firms. The utilize of more and

superior ‘‘tools’’ by makers is perfect way “the most perfect way of expanding the efficiency. In other words, the utilize of suitable apparatus, hardware and computer program moves forward the efficiency (Romer 1990). Badescu and Garces-Ayerbe ,2009) have examined the effect of IT on Tunisian fabricating businesses.

They have emphasized the positive affect of IT on the proficiency and accepted that starting planning for the development of IT impacts is to contribute in human capital and complementary concerns.

In addition, GPTs experience quick cost decays and execution enhancements and gotten to be unavoidable as a necessarily portion of most businesses, items, and capacities. They empower downstream advancements in items, forms, trade models and trade organization (Satapathy and Mishra ,2013).

Most of the more recent studies have reached a consensus that the production and/or usage of IT have become one of the main determinants of productivity growth in the developed world (such as: Oliner & Sichel, 2000; Jorgenson & Stiroh, 2000; Schreyer, 2000; Basu et al., 2003).

H1: There is significant association between Information Technology and Productivity.

2.2.2 Research & Development and Productivity

Cororaton et al (1996) came out with efficiency gauges that demonstrate a common decay in efficiency. The decrease in efficiency is primarily caused by the weakening of specialized advance over time.

There is a positive relationship between R&D investment and productivity growth according to, (Parham, 2009). R&D, training, educated and skillful labor has a highly positive impact on the productivity growth according to Mehregan & Soltanisehat, (2014). Bernstein (1988) has

concluded that there is a precise and consistent relationship between research & development and productivity.

H0: There is significant association between research & development and Productivity.

2.2.3 Automated Process and Productivity

Automating internal processes have positive effects by increasing productivity, Acemoglu (2018). According to Automating various production lines allow companies to replace human unskilled tasks with completely machinery ones. This benefits the company by reducing the cost for manufacturers, suppliers, retail stores as well as other parties involved.

H0: There is significant association between automated process and productivity.

2.2.4 3D printing and productivity

3DP is no longer distant from designers in the industry and is within easy reach of the public, including home users (Rayna and Striukova, 2016). A huge number of manufacturers, innovation companies, and even e-commerce companies have already benefited, or will benefit, from this technology by enhancing their productivity and efficiency (Rayna et al., 2015).

The value of 3DP, in common with other digitized fabricating advances, lies generally in its capacity to extend adaptability and efficiency, characterized as the capacity to react to instability within the outside environment (Shoreline et al., 2000).

H1: There is significant association between 3d printing and Productivity.

2.3 Conceptual framework

There are many different articles researched and forwarded by different scholars about productivity. The current study makes use of combined variables of different related literatures and draws a conceptual framework as depicted below.

Table 2.1; Variable and related literature

Variables	Related Literature reviews
Information Technology	✓ Cargona et al (2013) ✓ Romer (2000) ✓ Badescu and Garces-Ayerbe (2009) ✓ Satapathy and Mishra (2013)
Research & Development	✓ Cororaton et al (1996) ✓ Parham (2009) ✓ Mehregan & Soltanisehat, (2014
Automated Process	✓ Acemoglu (2018)
3D printing	✓ Beach et al. (2000) ✓ Rayna et al. (2015)

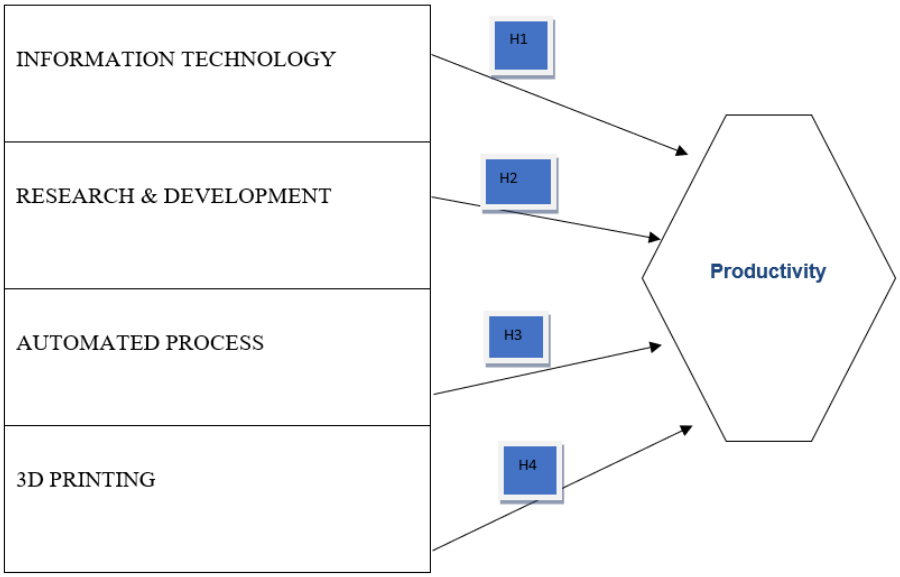


Figure 2.1 Conceptual framework of Technological factors affecting productivity: The case of Techno-style Plc.

Source: Literature Review

2.4 Research Hypothesis

Based on the literature review and the hypothesized connections presented in the conceptual framework the following four hypotheses have been tested:

H0: Information Technology has no significant effect on productivity.

H0: Research and Development has no significant effect on productivity.

H0: 3D Printing has no significant effect on productivity.

H0: Automated Process has no significant effect on productivity.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This section of the study focuses on discussion of methodology and the methods to be employed in this research. The section consists of research approach, sampling techniques and sampling procedure, data collection techniques and data analysis.

3.1 Research Approach

The researcher used quantitative type of research to identifies the significance of Technological Factors affecting Productivity. Besides, the study tried to test the hypothesis developed based on literature also the targeted population are the permanent employees of Technostyle Plc and self-constructed questionnaires are used to collect primary data therefore quantitative research is reliable in this regard.

3.2 Research design

Research design is a blueprint for fulfilling the research objectives and answering the research questions (Anol Bhattacherjee, 2012). The objective of this research is to identify the significance Technological Factors that affects productivity in Technostyle PLC. Taking the research objective and nature of the study into consideration, the design of the research used is explanatory and Descriptive since its purpose is to identify which technological factors; significantly affect Productivity and Describe the variance between the demographic profile of the respondents.

3.3 Population and Sample design

3.3.1 Research Population

The population of this study is included Permanent employees of Technostyle Plc at head office Addis Ababa and at Factory at Lege Xafo Town. The total number of permanent employees of the bank as of 30 August 2020 was, 1,003. To maximize the response rate and for the purpose of the research the lower-level employees wear excluded from the total permanent employees. Excluding these employees, the population size become 805.

3.3.2 Sample Size

In this research the researcher used Stratified sampling because of the heterogeneous nature of the population. With this stratified sampling, the population was divided into their level of work conditions, which is known as four groups, for this case, the employees were stratified into four different ranks which are top management, department heads Section heads and experts. An employees selected from 805 of the total strata are 385. The researcher used Slovin's formula to figure out what sample size which is written as $n = N / (1 + N*e^2)$ where n = Number of samples, N = Total population and e = Error tolerance. Source (Slovin, 1960).

n = N 1+N*(e) 2

n = the sample size

N = the population size

e = the acceptable sampling error

Table 3.1 Sample Size of Each Stratum

Type	Total Number of Staffs	Sample Size
Top Management	30	28
Department Heads	52	46
Section Heads	80	66
Experts	643	245
Total	805	385

Source: own Survey Data (2021)

3.3.3 Sampling Technique

It is selection method from elements of population in order to be precise and to draw reliable conclusion for population, lagers and Pureto (2014). Probability sampling is the one in which each sample has the same probability of being chosen while, stratified sampling is used when adequate representation from sub sample is desired for more precise information inside sub sample about the variable's lagers and Pureto (2014). Therefore, this study was used probability sampling technique of stratified sampling, within each stratum employees were selected using a sample random method. the stratum of the sample was established based on head office and Addis Ababa district offices.

3.4 Source of Data

The paper is expected to utilize both primary and secondary data sources. The primary data is to be collected using questionnaire with closed ended questions. While the secondary data will include Company materials (like Sales report, financial Statement, activity reports… etc.), industry reports, central statistics reports and fact sheets.

3.5 Data Gathering Instruments

The present study indicates technological factors affecting Productivity in the case of Technostyle Plc. Close-ended questionnaire is employed as instrument of data collection. The questionnaire, which was used as a data collection instrument in this study, consisted of two sections. The first section included a general information for demographic expressions designed to collect the demographic characteristics of respondents. The second section contained the factors Information technology, research and Development, Automated process, and 3D printing into a measurement scale. The items included in the second section were presented using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was first prepared in English language and translated to Amharic.

3.6 Procedures of Data Collection

As far as the procedure of data collection is concerned the questionnaire was distributed to the selected sample of individual employees of Technostyle PLC situated in Addis Ababa and Lege Xafo and collected physically from the potential respondents at their site by the researcher and the personnel assigned by the researcher for the purpose of data collection.

Before full scale survey, a sample of 20 respondents were selected and given the prepared questionnaire to fill. The major objective of the pilot taste was to check if it is possible to get the desired result using the prepared questionnaire and to identify and eliminate potential problems associated with question content and wording. Based on feedback received from the test respondents few modifications were made to make it clearer and more understandable to the full-scale survey respondents.

During the full-scale survey, the questionnaire is administered to the target population though personal contact by the researchers and collaborators, who helped in data collection. Respondents are kindly requested to fill the questionnaire based on their experience.

3.7 Pilot Testing

Reliability tested using Cronbach ‘s alpha values for the items in each construct. According to Sekaran and Bougie (2016) reliabilities less than 0.60 are considered poor, those in the 0.70 range, acceptable, and those over 0.80 good.

The below table indicates a pilot test to check the reliability and validity of the study variables. As indicated below, the coeffects shows a positive relationship and valid to conduct the research reliably.

Table 3.2 Reliability Analysis of Variables

	Cronbach’s alpha coefficient	**Number of items**
Information Technology	**0.801**	**5**
Research & Development	**0.841**	**3**
Automated Process	**0.842**	**3**
3D printing	**0.851**	**3**
Productivity	**0.845**	**3**

Source: own Survey Data (2021)

3.8 Data analysis

Given the quantitative nature and the purpose of the study, the application of statistical techniques is a necessary requirement. Hence, the study data would be analyzed using Statistical Package for the Social Science (SPSS). Prior to hypothesis testing preliminary data analysis was conducted. Prior to undertaking the regression analysis, model specification based on the hypotheses was

performed. To test the hypotheses multiple linear regression analysis was conducted. Furthermore in order to test the direction among the variables correlational analysis also conducted using SPSS.

3.8.1 Descriptive Analysis

Descriptive analysis has been used to describe the demographic profile of target respondents in frequency and percentage of the sample characteristics in the form of tables, graphs, and written explanations as well as central tendencies measurement of constructs that include mean and standard deviation. These demographic profiles consist of gender, age, education, monthly income, industry experience and marital status.

3.8.2 Scale Measurement

3.8.2.1 Normality Test

Saunders (2009) said that normality test is used to determine whether the data sets are normally distributed. In this study, normality test has been tested by using Skewness and kurtosis. A distribution is positively skewed when there is positive value of Skewness and kurtosis while a distribution is negatively skewed when there is negative value of Skewness and kurtosis. It is recommended that the result for Skewness test should not exceed +/-3 while the result of kurtosis should not exceed +/-10.0 (Kline, 2005).

3.8.2.2 Reliability Test

Reliability refers to the degree that provides consistent results. Reliability test is conducted to examine the consistency of observed scores by carry out on the same test. In this study, reliability indicates which is Cronbach's Alpha was used to estimate the consistency. Nunnally (1978) recommended that the Cronbach's alpha level that exceeds 0.70 will be considered reliable. If the values of Cronbach's Alpha are less than 0.70, the survey questionnaires are considered not

reliable and have to be reconstructed. A low Cronbach's Alpha level occurs when there are inappropriate questions included in the questionnaire.

3.8.3 Inferential Analysis

All statistical procedures were conducted using Statistical Package for Social Science (SPSS).

3.8.3.1 Pearson Correlation Analysis

Pearson Correlation analysis is used to examine the association between two variables which are X and Y (Goodwin & Leech, 2006). Besides, Pearson Correlation is used to determine the relationship of strength and direction between two variables. According to Goodwin (2006), there is no linear relationship between two variables when the value is 0. When the value is -1.00 or +1.00, it shows that a strong correlation between two variables. However, it should not exceed +/- 0.90 to avoid multi-Collinearity problem (Hair, Bush, & Ortinau, 2006). Multi-collinearity occurs when there are two highly correlated independent variables; it can be detected through testing the correlation matrix among all independent variables in the research. When multi-Collinearity problem occurs, one of the relevant independent variables should be removed.

3.8.3.2 Multiple Linear Regressions

Multiple Linear Regressions is used to assess the relationship between more than one independent variable and a single dependent variable (Zikmund, Babin, Carr, & Griffin, 2010).

According to Saunders (2009), the regression coefficient indicates the relative significance of the independent variables in the forecast of the dependent variable while the coefficient of multiple determinations (R square) provides the measurement of how well a predictor of the equation of multiple linear regressions is likely to be. Moreover, if the p-value of multiple linear regressions is less than 0.05, then the relationship between the selected **TECHNOLOGICAL FACTORS AFFECTING PRODUCTIVITY** taking **THE CASE OF TECHNOSTYLE PLC.** independent

variables and dependent variable will be significant. Thus, the alternative hypothesis should not be rejected. If not, vice versa. In this research, the relationship between a dependent variable (Productivity) and the four independent variables (information technology, research & development, Automated Process & 3d Printing) will be determined using a multiple linear regression.

Model specification

To assess the extent of effect of the above variables on productivity, Multiple Linear Regression model consisting of four independent variables are used to test the effect on dependent variable and are modeled as shown below.

Technological Factors = f (Information Technology, Research & Development, Automated Process, 3D printing)

Equation for Multiple Linear Regressions

$$\hat{Y} = B0 + b1X1 + b2X2 + b3X3 + \ldots + bnXn + e$$

Where: $\hat{Y}$ = Dependent variable

B0= Constant value (also known as **Y-intercept**)

b= The slope, for any corresponding change in one unit of X

X= Independent variable

e = Error term (normally distributed about a mean of zero)

$$PD = B0 + b1I + b2R + b3A + b4F + e$$

3.9 Ethical Issues

The study considered ethical issues that may arise while undertaking the research by precisely communicating respondents about the objective of the study to get their free consent to respond to

the questionnaire. They were promised that all data to be collected will be used solely for the academic study purpose and will be kept confidential. Finding and results obtained from the study are presented without any biases. The works of scholar cited in the study are properly acknowledged.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the data analysis and discussion of the research findings. The data analysis was made with the help of Statistical Package for Social Science (SPSS v. 21). The data obtained from the main data collection were subjected to descriptive statistics analysis, comparing mean analysis (i.e., independent t-test and ANOVA) and other analyses (i.e., correlation analysis and multiple linear regressions).

4.1 Response Rate

To make the collected data suitable for the analysis, all questionnaires were screened for completeness. All returned incomplete questionnaires were considered as errors and removed from the survey data. Out of the 385 distributed questionnaires, 379 were collected. During data editing, the collected questionnaires were checked for errors and 6 incomplete questionnaires were identified and discarded. Therefore 96.88% of questionnaires were found to be valid and used for the final analysis i.e., 373. To analyze the data, statistical package for social science (SPSS) version 21.0 was used.

Table 4.1 Respondents' response rate

Questionnaires Distributed	Questionnaires Returned	Percentage
385	379	96.88%

4.2 Demographic Profile of the Respondents

The first part of the questionnaire consists of five items about the demographic information of the respondents. It covers the general information gender, age, education level, monthly income, industry experience and marital status. The next table pottery's the demographic characteristic of the respondents.

4.2.1 Demographic Profile of Respondents Gender Wise

As Table 4.2 shows the demographic profile of 373 respondents. In terms of gender, male respondents have outnumbered female respondents (Female 32.98%, Male 67.02%).

Table 4.2 Demographic Profile of Respondents Gender Wise

Variables		Total Respondents	
		Frequency	Percentage
Gender	Male	250	67.02
	Female	123	32.98
	Total	373	100.0

Source: Own Survey Data (2021)

4.2.2 Demographic Profile of Respondents Age Wise

Regarding Table 4.3 the age of respondents, the sample population is largely dominated by the age group of 18-30 (29.49%) followed by the group within the age group of 31-40 (27.07%). The rest of the respondents consist of adults in the age group 41-50 (24.93%) and those above the age of 50 (18.51%). This implies that most of the sample respondents are the younger generation below the age of 40. Moreover, old adults avoid technological advanced companies as compared to the young generation.

Table 4.3 Demographic Profile of Respondents Age Wise

Variables		Total Respondents	
		Frequency	Percentage
Age in Years	18-30	110	29.49
	31-40	101	27.07
	41-50	93	24.93
	Above 50	69	18.51
	Total	373	100.0

Source: Own Survey Data (2021)

4.2.3 Demographic Profile of Respondents by Monthly Average Net income Wise

As Table 4.4 the largest group of population account for those that earns a monthly net income of up to ETB5, 000 (43.16%) followed by those that earn between ETB 5,001 and ETB 10,000 (28.96%). The third group that account for 15.28% earning a monthly net income between ETB 10,001 and less than ETB 15,000 and 12.60% account for those that earns more than ETB 15, 000.

Table 4.4 Demographic Profile of Respondents by Monthly Average Net income Wise

Variables		Total Respondents	
		Frequency	Percentage
Monthly Average Net income (in ETB)	Up to Birr 5000	161	43.16
	5001-10,000	108	28.96
	10,001-15,000	57	15.28
	More than Birr 15,000	47	12.60
	Total	373	100.0

Source: Own Survey Data (2021)

4.2.4 Demographic Profile of Respondents by Education Background Wise

In terms of education, the largest of the population comprises below diploma holders, which accounts for 46.38% of the total respondents, followed by those that hold college diploma which comprise of 25.74%.

Table 4.5 Demographic Profile of Respondents by Education Background Wise

Variables		Total Respondents	
		Frequency	Percentage
Education Background	Below Diploma	173	46.38
	College Diploma	96	25.74
	BA/BSc Degree	61	16.35
	Above BA/BSc Degree	43	11.53
	Total	373	100.0

Source: Own Survey Data (2021)

4.2.5 Demographic Profile of Respondents Company Experience in Technostyle

In terms of Company Experience in Technostyle, the largest of the population comprises employees with less than 5-year experience, which accounts for 52.54% of the total respondents, followed by those that between 5 to 10 years of firm experience which comprise of 35.12%.

Table 4.6 Demographic Profile of Respondents Company Experience in Technostyle

Variables		Total Respondents	
		Frequency	Percentage
Company Experience in Techno-style (in Years)	Less than 5Years	196	52.54
	5-10Years	131	35.12
	Above 10Years	46	12.34
	Total	373	100.0

Source: Own Survey Data (2021)

4.2.6 Demographic Profile of Respondents by there Marital status

As Table 4.7 shows marital status most of the respondents, 44.77% are single followed by 40.48% of married customers. 14.75% account for divorced respondents

Table 4.7 Demographic Profile of Respondents Company Experience in Technostyle

Marital status	**Single**	**167**	**44.77**
	Married	**151**	**40.48**
	Divorced	**55**	**14.75**
	Total	**373**	**100.0**

Source: Own Survey Data (2021)

4.3 Analysis of Collected Data

4.3.1 Descriptive Analysis

This part of analysis of the study is done using descriptive statistics by computing the mean scores and standard deviations. The purpose of using these parameters is to interpret the average responses of respondents for each question that was stated under each item. The study used five-point Likert –scales to measure each item where 1 is used for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree.

Mean and standard deviation is used to interpret the questions. The mean will tell us which direction the average answer is, and the standard deviation gives us average distance from the mean. High standard deviation shows that there is a lot of variation in the answer and low standard deviation shows that most observations are clustered around the mean.

4.3.1.1 Descriptive Statistics of Study Variables

One statistical approach for determining equivalence between groups is to use simple analyses of means and standard deviations for the variables of interest for each group in the study (Marczyk, Dematteo and Festinger, 2005). The mean indicates to what extent the sample group on average agrees or does not agree with the different statement. The lower the mean, the more the respondents disagree with the statement. The higher the mean, the more the respondents agree with the statement. Although there is no clearly standardized measures to evaluate the mean value results, Pihie (2009) was applied the following mean score measurement to describe the mean score of the participants.

- If The Mean Score <3.39 Considered as Low.
- If The Mean Score Of 3.4-3.79 as Moderate And,
- If The Mean Score 3.8 Conceded as High.

4.3.1.1.1 Analysis of Information Technology in Productivity

This part of the paper describes the finding of the respondent's perception towards if Information Technology affects productivity in Technostyle Plc. Descriptive statistics was done in the form of mean and standard deviation for five dimensions and it is presented in the following table.

Table 4.8 Analysis of Information Technology in Productivity

S/N	Statements	Rating Scale							
		1(SD)		2(D)	3(N)	4(A)	5(SA)	Mean	St deviation
1	Productivity is increasing in techno-style plc, because of its high investment on technologies.	Count	6	22	8	186	151	4.21	1.79
		%	1.6%	5.89%	2.14	49.86%	40.48%		
2	Productivity is increasing in techno-style plc, because of its unique IT based strategic marketing.	Count	5	21	3	211	133	4.19	1.65
		%	1.34%	5.63%	0.80%	56.56%	35.65%		
3	Productivity is increasing in techno-style plc, because of its exhaustive use the social media promotion technologies.	Count	30	6	15	153	169	4.13	1.58
		%	8.04%	1.60%	4.02%	41.01%	45.30%		
4	Productivity is increasing in techno-style plc, because of its high investment on the supply chain technologies as well.	Count	9	25	12	182	146	4.16	1.62
		%	2.41%	6.70%	3.21%	48.79%	39.94%		
5	Productivity is increasing in techno-style plc, because of its continuous improvement in using the latest IT technologies in the industry.	Count	5	10	1	223	134	4.22	1.81
		%	1.34%	2.68%	0.26%	59.78%	35.92%		
Average (aggregate) mean								**4.19**	

1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5=Strongly Agree

Source: Own Survey Data (2021)

As depicted in the above Table 4:8, out of the total ,1.6% believed that they were strongly disagreed or disagreed Productivity is increasing because of high investment in technologies, while 5.89% disagreed and 2.14% said they were neutral, 49.86% said they agreed and the rest, 40.48% responded they were strongly agreed. Excluding the neutral respondents, on aggregate 9.63% has shown their disagreements and 90.34% of the respondents were in agreement position towards Productivity is increasing because of high investment in technologies.

Technostyle unique It based strategic marketing increased productivity, 1.34 % said they strongly disagreed, 5.63% said disagreed, 0.80% said they were neutral, 56.56% they were said agreed and 35.65% of the respondents were said strongly agreed. Excluding the neutral respondents, on aggregate 7.77% expressed their disagreement while 92.23% of the respondents in the position of agreement Productivity is increasing at a reason of unique It based strategic marketing.

Similarly, when employees were asked if Productivity is increasing in Technostyle plc, because of its exhaustive use the social media promotion technologies., 8.04% said strongly disagreed, 1.60% said disagreed, 4.02% said neutral and 41.01% of the respondents said that were agreed and the rest of 45.30% of the respondents were strongly agreed. Excluding the neutral respondents, on aggregate 9.64% of them revealed their disagreement and whereas 86.31% of the respondents were expressed their agreements towards exhaustive use the social media promotion technologies is increasing Productivity in Technostyle.

Regarding the response on the question of Productivity is increasing in techno-style plc, because of its high investment on the supply chain technologies as well, 2.41% of the respondents were said that they strongly disagreed, 6.70% of the respondents were said, disagreed, 3.21% of the respondents were said, neutral, 48.79% said that, they were agreed and the rest 39.94% of the

respondents were strongly agreed. Excluding the neutral respondents, on aggregate 9.11% shown their disagreement while 88.73% of the respondents were in agreement position.

The response obtained from the question, Productivity is increasing in techno-style plc, because of its continuous improvement in using the latest IT technologies in the industry, 1.34% of the respondents were strongly disagreed, 2.68% of the employees, disagreed, 0.26% of the employees neutral, 59.78% of the respondents were agreed and 35.92% of the respondents were strongly agreed. Excluding the neutral respondents, on aggregate 4.02% of the respondents was in disagreed while 95.7% of the respondents were in agreement.

The total perception of employees towards the effect of Information Technology had shown a mean of 4.19. Therefore, the respondents highly believe that Information Technology affect Productivity in Technostyle Plc.

4.3.1.1.2 Analysis of Research and Development in Productivity

The table below describes the finding of the respondent's perception towards the effect of Research and Development in firms Productivity.

Table 4.9 Analysis of Research and Development in Productivity

S/N	Statements	Rating Scale						Mean	St deviation
		1(SD)		2(D)	3(N)	4(A)	5(SA)		
1	Productivity is increasing in Techno-style plc., because of its strong research and development section.	Count	4	7	6	203	153	4.32	1.23
		%	1.07%	1.87%	1.6%	54.42%	41.01%		
2	Productivity is increasing in Techno-style plc, because of its new proactive ideas through the research and development propositions.	Count	7	1	4	199	162	4.34	1.16
		%	1.87%	0.26%	1.07%	53.35%	43.43%		
3	Productivity is increasing in Techno-style plc, because of its high investment on research, innovations, and technologies.	Count	9	30	13	177	144	4.11	2.79
		%	2.41%	8.04%	3.48%	47.45%	38.60%		
Average (aggregate) mean								4.26	

1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5=Strongly Agree

Source: Own Survey Data (2021)

As depicted in the above Table 4:9, out of the total ,1.07% believed that they were strongly disagreed Productivity is increasing in Techno-style plc., because of its strong research and development section, while 1.87% disagreed and 1.6% said they were neutral, 54.42% said they wear agreed and the rest, 41.01% responded they were strongly agreed. Excluding the neutral respondents, on aggregate 2.94% has shown their disagreements and 95.43% of the respondents were in agreement position towards Productivity is increasing in Techno-style plc., because of its strong research and development section.

Technostyle new proactive ideas through the research and development propositions is increasing productivity, 1.87 % said they strongly disagreed, 0.26% said disagreed, 1.07% said they were neutral, 53.35% they were said agreed and 43.43% of the respondents were said strongly agreed. Excluding the neutral respondents, on aggregate 2.13% expressed their disagreement while 96.78% of the respondents in the position of agreement Productivity is increasing at a reason new proactive ideas through the research and development propositions.

Similarly, when employees were asked if Productivity is increasing in Techno-style plc, because of its high investment on research, innovations, and technologies, 2.41% said strongly disagreed, 8.04% said disagreed, 3.48% said neutral and 47.45% of the respondents said that were agreed and the rest of 38.60% of the respondents were strongly agreed. Excluding the neutral respondents, on aggregate 9.64% of them revealed their disagreement and whereas 10.45% of the respondents were expressed their agreements towards high investment on research, innovations, and technologies increased Productivity in the firm.

The total perception of employees towards the effect of Research and Development had shown a mean of 4.26. Therefore, the respondents highly believe that Research and Development affect Productivity in Technostyle Plc.

4.3.1.1.3 Analysis of 3D Printing in Productivity

The table below describes the finding of the respondent's perception towards the effect of 3D Printing in firms Productivity.

Table 4.10 Analysis of 3D Printing in Productivity

S/N	Statements	Rating Scale							
		1(SD)		2(D)	3(N)	4(A)	5(SA)	Mean	St deviation
1	Productivity is increasing in Techno-style, because of the use of 3d printing technology.	Count	6	7	0	212	148	4.32	1.23
		%	1.6%	1.87%	0%	56.83%	39.67%		
2	Productivity is increasing in Techno-style, because of the use of latest technologies for product designing	Count	1	9	4	201	158	4.35	1.15
		%	0.26%	2.41%	1.04%	53.88%	42.35%		
3	Productivity is increasing in Techno-style, because of the ease of production using 3d printing.	Count	5	7	6	203	152	4.31	1.23
		%	1.34%	1.87%	1.6%	54.42%	40.75%		
Average (aggregate) mean								4.33	

1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5=Strongly Agree

Source: Own Survey Data (2021)

As depicted in the above Table 4:10, out of the total ,1.6% believed that they were strongly disagreed Productivity is increasing in Techno-style plc, because of the use of 3d printing technology while 1.87% disagreed and 0% said they were neutral, 56.83% said they wear agreed and the rest, 39.67% responded they were strongly agreed. Excluding the neutral respondents, on aggregate 3.47% has shown their disagreements and 96.53% of the respondents were in agreement position towards Productivity is increasing in Techno-style, because of the use of 3d printing Technology.

The use of latest technologies for product designing is increasing productivity of the firm, 0.26 % said they strongly disagreed, 2.41% said disagreed, 1.04% said they were neutral, 53.88% they were said agreed and 42.35% of the respondents were said strongly agreed. Excluding the neutral respondents, on aggregate 2.67% expressed their disagreement while 96.23% of the respondents in the position of agreement Productivity is increasing in Techno-style, because of the use of latest technologies for product designing.

Similarly, when employees were asked if Productivity is increasing in Techno-style, because of the ease of production using 3d printing, 1.34% said strongly disagreed, 1.87% said disagreed, 1.6% said neutral and 54.42% of the respondents said that were agreed and the rest of 40.75% of the respondents were strongly agreed. Excluding the neutral respondents, on aggregate 2.94% of them revealed their disagreement and whereas 95.17% of the respondents were expressed their agreements towards the ease of production using 3D Printing has increased Productivity.

The total perception of employees towards the effect of Research and Development had shown a mean of 4.33. Therefore, the respondents highly believe that 3D Printing affect Productivity in Technostyle Plc.

4.3.1.1.4 Analysis of Automated Process in Productivity

The table below describes the finding of the respondent's perception towards the effect of Automated Process in firms Productivity.

Table 4.11 Analysis of Automated Process in Productivity

S/N	Statements	Rating Scale						Mean	St deviation
		1(SD)		2(D)	3(N)	4(A)	5(SA)		
1	Productivity increases in Techno-style plc, because of its processes are automated.	Count	5	10	0	224	135	4.27	1.34
		%	1.34%	2.68%	0%	60.05%	36.19		
2	Productivity increases in Techno-style plc, because of the automated processes throughout the supply chain network.	Count	7	1	1	214	150	4.33	1.56
		%	1.87%	0.26%	0.26%	57.37%	40.21%		
3	Productivity increases in techno-style, because of the ease of processes along the value chain of each process.	Count	17	37	15	218	86	3.85	2.79
		%	4.55%	9.91%	4.02%	58.44%	23.05%		
Average (aggregate) mean								**4.15**	

1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5=Strongly Agree

Source:Own Survey Data (2021)

As depicted in the above Table 4:11, out of the total ,1.34% believed that they were strongly disagreed Productivity increases in Techno-style plc, because of its processes are automated. while 2.68% disagreed and 0% said they were neutral, 60.05% said they wear agreed and the rest, 36.19% responded they were strongly agreed. Excluding the neutral respondents, on aggregate 4.02% has shown their disagreements and 96.24% of the respondents were in agreement position towards Productivity increases in Techno-style plc, because of its processes are automated.

The presence of automated processes throughout the supply chain network increase firms productivity, 1.87 % said they strongly disagreed, 0.26% said disagreed, 0.26% said they were neutral, 57.37% they were said agreed and 40.21% of the respondents were said strongly agreed. Excluding the neutral respondents, on aggregate 2.13% expressed their disagreement while

97.58% of the respondents in the position of agreement Productivity is increasing in Techno-style, because of the automated processes throughout the supply chain network.

Similarly, when employees were asked if Productivity increases in techno-style, because of the ease of processes along the value chain of each process, 4.55% said strongly disagreed, 9.91% said disagreed, 4.02% said neutral and 58.44% of the respondents said that were agreed and the rest of 23.05% of the respondents were strongly agreed. Excluding the neutral respondents, on aggregate 14.46% of them revealed their disagreement and whereas 81.49% of the respondents were expressed their agreements towards the the ease of processes along the value chain of each process has increased Productivity.

The total perception of employees towards the effect of Automated Process had shown a mean of 4.15. Therefore, the respondents highly believe that Automated Process affect Productivity in Technostyle Plc.

4.3.1.1.5 Analysis of Productivity

The table below describes the finding of the respondent's perception towards firms Productivity.

Table 4.12 Analysis of Productivity

S/N	Statements	Rating Scale							
		1(SD)		2(D)	3(N)	4(A)	5(SA)	Mean	St deviation
1	The Techno-style PLC's productivity is an extremely high and they manufacture quality and standardized items, so I prefer buying from them.	Count	9	30	13	176	145	4.11	1.98
		%	2.41%	8.04%	3.5%	47.18%	38.87%		
2	I choose Techno-style firm over the other competitors because of its advanced technological features of its products.	Count	5	10	1	223	134	4.26	1.34
		%	1.34%	2.68%	0.26%	59.78%	35.92%		
3	Techno-style is my choice for its high quality and industry best practice technology-based company.	Count	5	21	13	211	138	4.19	1.12
		%	1.34%	5.63%	3.48%	56.56%	36.99%		
Average (aggregate) mean								4.18	

1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5=Strongly Agree

Source: Own Survey Data (2021)

As depicted in the above Table 4.12, out of the total ,2.41% they were strongly disagreed Technostyle plc manufacture quality and standardize items so prefers to buy from them, because of its extreme Productivity. while 8.04% disagreed and 3.5% said they were neutral, 47.18% said they wear agreed and the rest, 38.87% responded they were strongly agreed. Excluding the neutral respondents, on aggregate 10.45% has shown their disagreements and 86.05% of the respondents were in agreement position Techno-style PLC's productivity is an extremely high and they manufacture quality and standardized items, so I prefer buying from them.

Respondents choose Techno-style firm over the other competitors because of its advanced technological features of its products., 1.34 % said they strongly disagreed, 2.68% said disagreed, 0.26% said they were neutral, 59.78% they were said agreed and 35.92% of the respondents were said strongly agreed. Excluding the neutral respondents, on aggregate 4.02% expressed their disagreement while 95.7% of the respondents in the position of agreement where Technostyle uses advanced technological features in its products.

Similarly, when employees were asked if Techno-style is there choice for its high quality and industry best practice technology-based company, 1.34% said strongly disagreed, 5.63% said disagreed, 3.48% said neutral and 56.56% of the respondents said that were agreed and the rest of 36.99% of the respondents were strongly agreed. Excluding the neutral respondents, on aggregate 6.97% of them revealed their disagreement and whereas 93.55% of the respondents were expressed their agreements towards Techno-style is their choice for its high quality and industry best practice technology-based company.

The total perception of employees towards productivity shown a mean of 4.18. Therefore, the respondents highly believe that Technostyle Plc is productive using the advanced technologies and manufacturing quality products with technological features.

4.3.2 Correlation Analysis

This study employs the correlation analysis, which investigates the strength of relationships between the studied variables. Pearson correlation coefficients reveal magnitude and direction of relationships (either positive or negative) and the intensity of the relationship (–1.0 to +1.0).

Correlations are perhaps the most basic and most useful measure of association between two or more variables (Marczyk, et al., 2005). As per Marczyk, et al., (2005) general guidelines correlations of .01 to .30 are considered small, correlations of .30 to .70 are considered moderate,

correlations of .70 to .90 are considered large, and correlations of .90 to 1.00 are considered very large.

As can be seen from the table below there was a significant positive correlation between the four independent variables (Information technology, Research and Development,3D Printing and Automated Process) and dependent variable (Productivity). And the result was found to be statistically significant at (P<0.01) for each variables. The table 4.13 shows that, there is positive and significance between Information Technology and Productivity at (r=.389, p<0.01) 99% level of significance, there is On other hand there is also positive and significance between Research and Development and Productivity at (r=.151, p<0.01) 99% level of significance, there is a positive and significance between Automated Process and Productivity at (r=.372, p<0.01) 99% level of significance, and also there is positive and significance between 3D Printing and Productivity at (r=.453, p<0.01) 99% level of significance.

The finding on Table 14.16 above further indicates that the highest relationship is found between 3D Printing & Productivity (r = 0. 453, p < 0.01).

Table 4.13 Pearson Correlation Analysis for Independent and Dependent Variables

		Information Technology	Research & Development	Automated Process	3DPrinting	Productivity
Information Technology	Pearson Correlation	1	.472**	.523**	.251**	.389**
	Sig. (2-tailed)		.000	.000	.000	.000
	N		373	373	373	373
Research & Development	Pearson Correlation		1	.125**	.123*	.151*
	Sig. (2-tailed)			.000	.024	.011
	N			373	373	373
Automated Process	Pearson Correlation			1	.640**	.372**
	Sig. (2-tailed)				.000	.000
	N				373	373
3DPrinting	Pearson Correlation				1	.453**
	Sig. (2-tailed)					.000
	N					373
Productivity	Pearson Correlation					1
	Sig. (2-tailed)					
	N					

**. Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Source: Own Survey Data (2021)

4.3.3 Assumptions Testing in Multiple Regression

The basic assumptions should be satisfied in order to maintain data validity and robustness of the regressed result of the research under the multiple regression models. Hence, this study has conducted the assumption tests such as, multi-Collinearity, auto correlation, linearity, and normality.

4.3.3.1 Multi-Collinearity Test

According to Myers (1990) Multi-collinearity refers to very high‘ inter-correlation among predicator variables. A perfect linear relationship among the independent variables implies difficulty of computing unique estimates for a regression model. As the degree of multi-collinearity increases, the estimates from the regression model become unstable and hence it would be difficult to discrete the separate effect of predictor variables.

In addition, the standard errors for the coefficients would be highly inflated. Variance inflation factor (VIF) was used to check the seriousness of multi-collinearity among explanatory variables. As a rule of thumb, multi-collinearity is a potential problem when VIF is greater than 4; and a serious problem when it is greater than 10. According to Myers (1990) a variable having VIF greater than ten indicates high multi-collinearity which requires further investigation. VIFs were calculated for all independent variables all found to be less than ten and the tolerance level is less than two implying that multi-collinearity was not a concern in this study.

Table 4.14 Multi-Collinearity Test

Model	Collinearity statistic	
	Tolerance	VIF
Information Technology	.096	9.370
Research & Development	.397	2.518
Automated Process	.132	7.576
3D Printing	.150	6.663

Source: Own Survey Data (2021)

4.3.3.2 Testing for autocorrelation

According to Will Kenton (2019), Durbin Watson (DW) statistic is a test for autocorrelation in the residuals from a statistical regression analysis. According to Kenton, the Durbin-Watson statistic will always have a value between 0 and 4. A value of 2.0 means that there is no autocorrelation detected in the sample. Values from 0 to less than 2 indicate positive autocorrelation and values from 2 to 4 indicate negative autocorrelation. In order to test whether autocorrelation of residuals from the linear regression models were exist or not in this study, Durbin-Watson test statistic was used. The Durbin-Watson test statistic ranges from a value close to zero, which denotes positive autocorrelation, to a value near to four which suggests negative autocorrelation. The commonly used benchmark is that values of Durbin-Watson (d) which fall in the range between 1.5 to 2.5 indicates non-existence of residual autocorrelation. As it is shown in Table 4.15, the calculated Durbin-Watson test statistic (d=1.528) is within the range of 1.5 and 2.5 indicating that the is no autocorrelation.

Table 4.15 Autocorrelation Test

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.813[a]	.629	.651	.29351	1.528

a. Predictors:(Constant), information Technology, Research &Development, Automated Process, 3DPrinting

b. Dependent Variable Productivity

Source: Own Survey Data (2021)

4.3.3.3 Normality and Linearity Test

According to Saunders (2009), normality test is used to determine whether the data sets are normally distributed or not. In this study, normality test has been tested by using Skewness and kurtosis. Skewness is a measure on the asymmetry of a distribution. Whereas kurtosis measures the extent to which observations cluster around a central point. The acceptable range for normality for both statistics is between (-1.0 and +1.0). As depicted in Table 4.16, all variables are within the acceptable range for normality (-1.0 to + 1.0). The kurtosis measures how the data is flatter or picked our distribution is, which is all within the suggested range of normality (-1.0 to + 1.0).

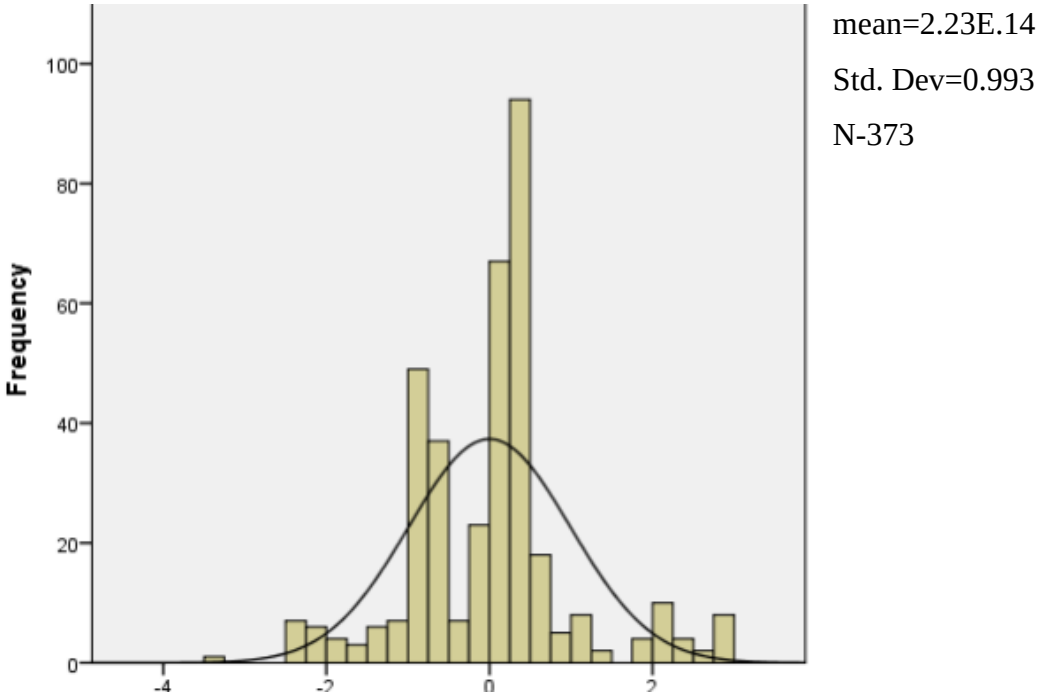
Linearity refers to the degree to which the change in the dependent variable is related to the change in the independent variables. To determine whether the relationship between the dependent variable and the independent variables is linear; P-P plots (probability–probability 53 plot) of the regression residuals through SPSS software has been used and it is presented as Figure 4.1.

Table 4.16 Skewness and Kurtosis

Variables	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Information Technology	373	-1.317	.127	7.210	.261
Research & Development	373	-1.050	.127	4.596	.261
Automated Process	373	-.771	.127	9.664	.261
3DPrinting	373	-.169	.127	4.598	.261
Valid N (listwise)	373				

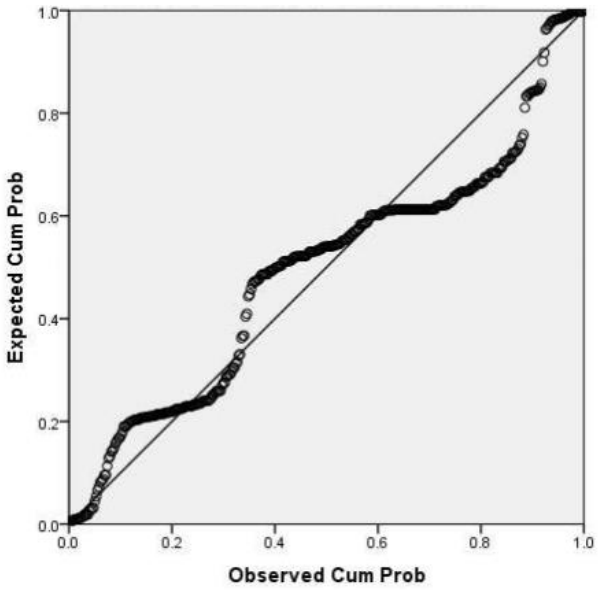
Source: Own Survey Data (2021)

Figure 4.1 Regression Standardized Residual



As Garson (2012) and Field (2009) noted, normal distribution takes the form of a symmetric bell-shaped curve. Accordingly, as we observed from the above figure, the histogram look like a normal distribution (bell-shaped curve) and the distribution is roughly normal. Moreover, the curve is perfectly skewed (symmetrical). Therefore, it can be concluded that, the model good for the data.

Figure 4.2 Normal P-P plot of regression Standardized Residual



Source: Own Survey Data (2021)

4.3.4 Regression Analysis

To see contribution of technological factors that are affecting productivity, a multiple linear regression analysis was employed. Productivity was used as the dependent variable while technological factors which affect productivity were used as the independent variables. Tables 4.4 provide the results of the multiple regression analysis.

The regression model (see Appendix 2) presents how much of the variance in the measure of productivity is explained by the underlying technological factors which affect productivity (the model). The model or the predictor variables have accounted for 65.1% adjusted R square with estimated standard deviation 0.29351 of the variance in the criterion variable (productivity). The remaining 34.9% are explained by other variables out of this model.

Similarly, the ANOVA table (see Appendix 2) shows the overall significance/acceptability of the model from a statistical perspective. As the significance value of F statistics shows a value of 87.838 and p- value (.000), which is less than $p<0.05$, the model is significant. This indicates that the variation explained by the model is not due to chance. As it is stated earlier in this chapter, this study aims to identify the most contributing independent variables in the prediction of the dependent variable. Thus, the strength of each predictor (independent) variable influence on the criterion (dependent) variable can be investigated via standardized Beta coefficient. The regression coefficient explains the average amount of change in dependent variable that is caused by a unit of change in the independent variable. The larger value of Beta coefficient that an independent variable has, the more support to the independent variable as the more important determinant in predicting the dependent variable.

Compared to coefficient of determination or R, Adjusted R-square is more reliable in measuring a regression model's goodness of fit. The main disadvantage of using coefficient of determination or R-square is more to do with bias of number of independent variables included into the model, which implies that the more independent variable added into the model, the more R-square increasing. Worst of all, this condition does not take into consideration whether independent variable included is significant or insignificant influencing dependent variable. Meanwhile, that situation will not apply in the case of using adjusted R-square ((Marczyk, Dematteo, & Festinger, 2005).

When we see the extent to which each independent variables influences the dependent variable; information technology, research, and development and 3d printing were found to be the determinant technological factors which are perceived to be affecting productivity in the techno-style plc.

Table 4.17 Regressions for Productivity

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.248	.210		1.769	.078		
	Information Technology	.215	.019	.216	3.497	.001	.096	9.370
	Research & Development	.122	.043	.212	4.172	.000	.397	2.518
	Automated Process	.018	.083	.126	.314	.753	.132	7.576
	3DPrinting	.345	.024	.069	4.473	.000	.150	6.663

a. Dependent Variable: Productivity

Table 4.18 Regressions for Productivity

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.248	.210		1.769	.078
	Information Technology	.215	.019	.216	3.497	.001
	Research & Development	.122	.053	.212	4.172	.000
	Automated Process	.018	.083	.126	.314	.753
	3DPrinting	.345	.024	.069	4.473	.000

a. Dependent Variable: Productivity

Source: Survey Data (2021)

According to Table 4.19, the hypotheses raised at the beginning of the study were also addressed in the analysis, so the null hypothesis was rejected, and the alternate hypothesis was failed to be rejected for three factors information technology, research & development, and 3D printing.

Table 4.19 Summary of the Overall Outcome of the Research Hypotheses

Hypothesis	Result	Reason
H0: Information Technology has no significant effect on productivity.	**Ho: Rejected** **H1: Fail to Reject**	**β = 0.216, p<0.05**
H0: Research and Development has no significant effect on productivity.	**Ho: Rejected** **H1: Fail to Reject**	**β = 0.212, p<0.05**
H0: Automated Process has no significant effect on productivity.	**Ho: Fail to Reject** **H1: Rejected**	**β = 0.126, p<0.05**
H0: 3D Printing has no significant effect on productivity.	**Ho: Rejected** **H1: Fail to Reject**	**β = 0.069, p<0.05**

Source: Own Survey Data (2021)

In general, as table 4.18 clearly shows, among the four factors, multiple linear regressions (Beta coefficients) analysis revealed that, information technology, research, and development and 3d printing are the first most significant technological factors that are perceived to be important in the productivity of techno-style plc.

In addition to the above-mentioned factors, which have been confirmed significant through regressions analysis, there are other factors that productivity is perceived to be affected. So many other factors are found to influence a firm's productivity. Of these, the demographic profiles of employees were mentioned as complimentary factors.

4.3.4.1 Underlying Technological Factors Affecting Productivity Based on Respondents' Profile

With the aim to achieve the third objective that aims to examine if there is a difference between the demographic profile of employees and the technological factors affecting productivity in Technostyle firm, two inferential statistics techniques were employed. These are independent t-test and one-way ANOVA which help to compare demographic characteristics and investigate how they are related with the other four independent variables or factors.

T-test is used to test mean differences between two groups. In general, t-test requires a single dichotomous independent variable and a single continuous dependent variable (Marczyk, Dematteo and Festinger, 2005). Thus, t- test were used to compare mean difference between gender and underlying factors perceived to be important in affecting productivity. Similarly, ANOVA is a test of mean comparisons. In fact, one of the only differences between a t-test and an ANOVA is that the ANOVA can compare means across more than two groups or conditions (Marczyk, Dematteo and Festinger, 2005). Hence, One-Way ANOVA analysis between the factors perceived to be important in affecting productivity and four age groups, three marital statuses, four

monthly average net income, four educational levels and three company experience groups were executed.

4.3.4.2 Underlying Technological Factors Affecting Productivity Based on Gender

As it is shown in table 4.7, the mean differences between male and female subjects regarding all variables.

Table 4.20 Independent sample t-test between gender and underlying technological factors of Productivity.

Group Statistics

	Gender of the respondents	N	Mean	Std. Deviation	Std. Error Mean
Information Technology	Male	250	4.1735	.38880	.02332
	Female	123	4.1351	.42888	.04471
Research & Development	Male	250	4.1647	.34567	.02073
	Female	123	3.9511	.61414	.06403
Automated Process	Male	250	4.2124	.28787	.01727
	Female	123	4.4317	.29966	.03124
3DPrinting	Male	250	4.1614	.27568	.01653
	Female	123	4.3325	.36726	.03829

Source: Own Survey Data (2021)

Gender has statistically significant effect on Productivity.

4.3.4.3 Underlying Factors of Productivity Based on Age

The result of the analysis shows that there is significance difference between age group of respondents regarding all factors except Automated Processes. Different age group of employees will have different assumption on productivity of the firm. The firm can do significant customization to enhance productivity based on the results and further research.

Table 4.21 One Way ANOVA between Age and underlying factors of Productivity

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Information Technology	Between Groups	2.376	7	.792	5.115	.002
	Within Groups	56.675	366	.155		
	Total	59.051	373			
Research & Development	Between Groups	1.028	7	.343	2.714	.045
	Within Groups	46.197	366	.126		
	Total	47.225	373			
Automated Process	Between Groups	.792	7	.264	2.795	.340
	Within Groups	34.577	366	.094		
	Total	35.369	373			
3DPrinting	Between Groups	3.817	7	1.272	15.092	.000
	Within Groups	30.854	366	.084		
	Total	34.670	373			
Productivity	Between Groups	4.791	7	1.597	7.934	.000
	Within Groups	73.666	366	.201		
	Total	78.457	373			

Source: Own Survey Data (2021)

4.3.4.4 Underlying Factors of Productivity Based on Income

The results of the analysis as presented in Table 4.9 shows that there is a significance difference between income levels. The difference is observed regarding all factors. Those who are at different level of income will assume productivity differently.

Table 4.22 One Way ANOVA between income and underlying factors of Productivity

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Information Technology	Between Groups	8.685	7	2.895	21.036	.000
	Within Groups	50.367	366	.138		
	Total	59.051	373			
Research & Development	Between Groups	4.640	7	1.547	8.460	.000
	Within Groups	66.909	366	.183		
	Total	71.549	373			
Automated Process	Between Groups	3.722	3	1.241	14.350	.000
	Within Groups	31.647	366	.086		
	Total	35.369	373			
3DPrinting	Between Groups	2.217	7	.739	8.336	.000
	Within Groups	32.453	366	.089		
	Total	34.670	373			
Productivity	Between Groups	5.527	3	1.842	9.246	.000
	Within Groups	72.930	366	.199		
	Total	78.457	373			

Source: Own Survey Data (2021)

4.3.4.5 Underlying Factors of Productivity Based on Industry experience

The result of the ANOVA test shows that there is a significance difference among the respondents with different years of experience with Techno-style firm. All factors are perceived to influence productivity are statistically significant. This is because the more the employees have an

experience, the more they have a chance to easily compare productivity efficiency, effectiveness, and product excellence.

Table 4.23 One Way ANOVA between Industry experience and underlying factors of Productivity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Information Technology	Between Groups	10.249	6	5.124	38.535	.000
	Within Groups	48.803	367	.133		
	Total	59.051	373			
Research & Development	Between Groups	11.303	6	5.652	34.428	.000
	Within Groups	60.246	367	.164		
	Total	71.549	373			
Automated Process	Between Groups	14.155	6	7.077	46.708	.000
	Within Groups	55.610	367	.152		
	Total	69.765	373			
3DPrinting	Between Groups	9.179	6	4.589	35.672	.000
	Within Groups	47.217	367	.129		
	Total	56.395	373			
Productivity	Between Groups	12.760	6	6.380	35.641	.000
	Within Groups	65.697	367	.179		
	Total	78.457	373			

Source: Own Survey Data (2021)

4.3.4.6 Underlying Factors of Productivity Based on Educational background

ANOVA result in table 4.11 shows that there is significant difference between the respondent's educational level and all factors which were important in influencing productivity is statistically significant as the p value is <0.05.

Table 4.24 One Way ANOVA between Educational background and underlying factors of Productivity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Information Technology	Between Groups	3.793	7	1.264	8.375	.000
	Within Groups	55.258	366	.151		
	Total	59.051	373			
Research & Development	Between Groups	1.943	7	.648	5.233	.002
	Within Groups	45.283	366	.124		
	Total	47.225	373			
Automated Process	Between Groups	1.558	7	.519	5.623	.001
	Within Groups	33.810	366	.092		
	Total	35.369	373			
3DPrinting	Between Groups	2.170	7	.723	8.145	.000
	Within Groups	32.500	366	.089		
	Total	34.670	373			
Productivity	Between Groups	4.073	3	1.358	6.681	.000
	Within Groups	74.384	366	.203		
	Total	78.457	373			

Source: Own Survey Data (2021)

4.3.4.7 Underlying factors of purchase decision Based on Marital Status

The result of the analysis showed that there is a significant difference among respondents in the different marital status categories. All factors affect productivity in techno-style firm.

Table 4.25 One Way ANOVA between Marital Status and underlying factors of Productivity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Information Technology	Between Groups	7.279	2	3.639	25.798	.000
	Within Groups	51.773	371	.141		
	Total	59.051	373			
Research & Development	Between Groups	6.780	2	3.390	30.760	.000
	Within Groups	40.445	371	.110		
	Total	47.225	373			
Automated Process	Between Groups	2.836	2	1.418	15.999	.000
	Within Groups	32.533	371	.089		
	Total	35.369	373			
3DPrinting	Between Groups	1.991	2	.996	11.181	.000
	Within Groups	32.679	371	.089		
	Total	34.670	373			
Productivity	Between Groups	6.854	2	3.427	17.564	.000
	Within Groups	71.603	371	.195		
	Total	78.457	373			

Source: Survey Data (2021)

Table 4.26 Model Summery

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.813[a]	.629	.651	.29351

a. Predictors: (Constant), information Technology, Research& Development, Automated Process, 3DPrinting

b. Dependent variable Productivity

The study was designed and carried out to find out the significance of technological factors that affect productivity in Techno-style firm. This paper has particularly tried to see four factors that affect productivity in techno-style firm.

As per the findings of the research, three factors were found to be significantly affect the productivity of the firm that is information technology, research & development, and 3D printing. The study also resulted that the other factor automated process has no significant influence on the productivity of the firm.

The regression analysis of the current study also showed that there are other factors other than the ones found to be significant by this study. This is because the adjusted R-square comes out to be 65.1% implying that the rest 34.9% of productivity of the firm (techno-style) is to be determined by other factors (i.e., other than the ones that come significant in the current study). This is true in that other research on the area have come up with many other factors that affect productivity of the firm.

The hypotheses raised at the beginning of the study were also addressed in the analysis, so the null hypothesis was rejected, and the alternate hypothesis was failed to be rejected for three factors information technology, research & development, and 3D printing.

The findings of the T-test and ANOVA results also showed that the independent factors affecting productivity have differences among the different demographic profiles of the employees. The T-Test revealed that male and female respondents differ in the influencing factors in productivity. The ANOVA results revealed that employees in different age group are affected differently by the four significant factors. Employees in different marital status and those who have different experience in Techno-style firm have also showed different reaction to the productivity of a firm.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter aims to review the problem of the research and conclude the findings regarding the objectives of the study. Conclusion, recommendations, limitations, and direction for further related research are also included in this chapter.

5.1 Summary of Major Findings

The objective of this study was to identify technological factors which affect productivity in Tecchnostyle PLC by taking four factors by considering the previous studies (i.e, Information technology, research and development,3D printing and Automated Process).

From the Specific objective were to identify which technological factors (Information-Technology, Automated system, Research & Development, or 3D printing) affecting productivity in Techno-style PLC, to describe the magnitude and relationship of technological factors affecting productivity in Techno-style PLC and to find out if there is any variation in the determinant technological factors of productivity in the demographic profile of the respondents. The main findings of the study are summarized as follows; -

- From the correlation analysis, the factors (independent variables) all variables i.e. Information Technology, research & development, automated process and 3D printing are positively related to the dependent variable (productivity).
- From the regression analysis, it is observed that three factors (i.e., Information Technology, research & development, and 3D printing) out of the four studied independent variables come out to significantly affect productivity in techno-style firm.

- From the T-test it is observed that, female employees are more influenced by automated process and 3d printing as compared to male. But in case of information technology and research and development variables, male employees are more influenced as compared to female employees.

- From the ANOVA analysis it is observed that, all the moderate variables have statistically significant effect on the productivity.

5.2 Conclusion

The data collected and analyzed indicated that there is a positive relation between technological factors like information technology, research and development,3D printing and automated process with firm's productivity.

The study tried to meet its objectives addressing the raised research questions by employing different analysis techniques. To address its first objective the research through analyzing different prior studies and theories come up with four factors that are believed to affect productivity in techno-style firm. From the adopted four factors, through regression analysis; information technology, research & development and 3d printing prevail to be significant in affecting Techno-style firm productivity.

The second objective was met through an analysis of regression. Before doing so a correlation analysis was made to check whether the studied independent variables have association with the dependent variable. The result showed that there is significant relation between them, and all the independent factors have a positive correlation with the dependent variable. The correlation table also prevailed that there is a high correlation among the independent variables, showing that it is possible to undergo further analysis. Regression analysis was then made, and it came to show that the most significant technological factors in affecting productivity are information technology,

research & development, and 3d printing. But automated process is dropped because it is statistically insignificant to affect the dependent variable. So, one can conclude that, information technology, research & development and 3d printing are the foremost factor that determines the productivity in techno-style firm.

The third objective was met by employing one-way independent T-test and ANOVA. Both results showed a significant variation between employees of different gender, age, marital status, income level, current position, educational background, and company experience are affected by the different factors differently. From this one can conclude that the productivity in techno-style determinant factors studied are highly vary across different demographic profiles of employees.

5.3 Recommendations

Depending on the findings of the study and conclusions made, the researcher came up with some important recommendations that can be used to affect productivity in Technostyle firm. To increase productivity in a firm technological factor, play a big role. Productivity can be enhanced by having advanced technologies incorporated in the company system. Therefore, based on the study findings, the following are the researcher's recommendations:

- The firm shall focus on the demographic differences of its employees to enhance productivity in the firm.

- This research showed that how a process being automated have a positive relationship to its productivity. The world is Automating internal process is important as it will reduce cost, enhance efficiency and thereby productivity of the company which works the same for Technostyle PLC.

- According to this study 3D printing has been found to significantly affect firm's productivity so Technostyle should use 3D printing not only for the design of products and

production, but also for catalogues as customers may see the catalogues and select products and/or order products accordingly which affect productivity of the firm.

- This study found a research and development affect productivity significantly. It is recommended that Technostyle should understand the use of structured and independent research & development section shall be in the structure of the organization to better cope up with the fierce global and local competitions and thereby understand the changing needs, wants, and preferences of its customers which significantly affect firm's productivity.
- As this study shows that Information based systems and process remarkably influence firm's productivity. The world is enhancing in technology Continuous improvement shall be done in product excellence, operational excellence, cost leadership, process efficiency and integrated marketing communications to enhance productivity. So, firms should give a considerate attention on investing new information technologies.

5.4 Directions for Further Studies

The research has more rooms for improvements. Further research could be conducted by comparing productivity among the different furniture companies considering different affecting factors.

Expanding the current study to a larger sample size or geographical area may also turn the result to reflect the actual Technological factors that affect productivity of a firm.

Gathering the data by using different qualitative methods such as in- depth interview or focus group discussion and string questionnaires might have also help to uncover other variables that might have an impact on the productivity of the firm.

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APPENDICES

APPENDIX ONE- QUESTIONNAIRE

St. MARY UNIVERSITY COLLEGE OF BUSINESS ADMINISTRATION

POST GRADUATE PROGRAM

Questionnaire on Technological factors affecting productivity: The case of Techno-style PLC. This questionnaire will be filled by employees only.

Greetings!!

I am Betelhem Legesse, and I am a graduate student at St. Mary University college of business administration. Currently, I am undertaking my thesis under the title "**Technological factors affecting productivity: The case of Techno-style Plc**".

The purpose of this questionnaire is to assess your thoughts and feelings about which technological factors affect the productivity of Techno-style Plc. The result of this study is believed to benefit the firm to identify the technological factors which are indispensable in the industry and better compete with the fierce competitors. Your exact reaction is vital for the realization of the study and it is only used for an academic research purpose only. Therefore, you are kindly requested to reply the maximum number of questions with sincerely and honesty and your answers are highly confidential and no personal identification information is required.

Instruction

- There is no need to write your name.
- For all questions that are provided with alternative answer, make tick mark on the space provided.
- Many thanks and compliments for your cooperation.

PART I: General Information

DEMOGRAPHIC VARIABLES	PLEASE MARK(✔) IN THE RIGHT PLACE	DEMOGRAPHIC VARIABLE	PLEASE MARK (✔) IN THE RIGHT PLACE
GENDER	Male ☐ Female ☐	AGE	18-30 ☐ 31-40 ☐ 41-50 ☐ More than 50 ☐
EDUCATION	Below Diploma ☐ College diploma ☐ BA/BSc Degree ☐ Above BA/BSc degree ☐	MONTHLY AVERAGE NET INCOME	Up to birr 5000 ☐ Birr 5001-10,000 ☐ Birr 10,001-15,000 ☐ More than Birr 15,000 ☐
INDUSTRY EXPERIENCE	Less than 5 years ☐ 5-10 years ☐ Above 10 years ☐	Marital status	Single ☐ Married ☐ Divorced ☐

PART II

→ **Please Mark (✔) In the Right Place after Closely Seeing the Note Below**

Note: - **SA= Strongly Agree A= Agree N=Neutral D= Disagree SD= Strongly Disagree**

		SD(1)	D(2)	N(3)	A(4)	SA(5)
IT						
1	Productivity is increasing in techno-style plc, because of its high investment on technologies.					
2	Productivity is increasing in techno-style plc, because of its unique IT based strategic marketing.					
3	Productivity is increasing in techno-style plc, because of its exhaustive use the social media promotion technologies.					
4	Productivity is increasing in techno-style plc, because of its high investment on the supply chain technologies as well.					
5	Productivity is increasing in techno-style plc, because of its continuous improvement in using the latest IT technologies in the industry.					
RD						
6	Productivity is increasing in Techno-style plc., because of its very strong research and development section.					
7	Productivity is increasing in Techno-style plc, because of its new proactive ideas through the research and development propositions.					
8	Productivity is increasing in Techno-style plc, because of its high investment on researches, innovations and technologies.					
3D						
9	Productivity is increasing in Techno-style, because of the use of 3d printing technology.					
10	Productivity is increasing in Techno-style, because of the use of latest technologies for product designing.					
11	Productivity is increasing in Techno-style, because of the ease of production using 3d printing.					
AP						
12	Productivity increases in Techno-style plc, because of its processes are automated.					

13	Productivity increases in Techno-style plc, because of the automated processes throughout the supply chain network.					
14	Productivity increases in techno-style, because of the ease of processes along the value chain of each process.					
PD						
15	The Techno-style PLC's productivity is a very high and they manufacture quality and standardized items so I prefer buying from them.					
16	I choose Techno-style firm over the other competitors because of its advanced technological features of its products.					
17	Techno-style is my choice for its high quality and industry best practice technology-based company.					

Please kindly write your email, if you need the soft copy of the final result of this thesis:

_____

Thank you very much for your contribution.

አባሪ አንድ- ቃለ መጠይቅ

ቅድስተ ማርያም ዩኒቨርስቲ ኮሌጅ ቢዝነስ አድሚኒስትሬሽን ድህረ ምረቃ መርሃ ግብር

ምርታማነት ላይ ጫና የሚያሳድሩ የቴክኖሎጂ ምክንያቶች፡- የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ላይ ያተኮረ

ይህ ቃለ መጠየቅ በሠራተኛ ብቻ የሚሞላ ነው፡፡

ሰላምታ

እኔ ቤተልሔም ለገሰ እባላለሁ፣ የቅድስተ ማርያም ዩኒቨርስቲ ኮሌጅ ቢዝነስ አድሚኒስትሬሽን ተመራቂ ተማሪ ነኝ፡፡ በአሁኑ ጊዜ ምርታማነት ላይ ጫና የሚያሳድሩ የቴክኖሎጂ ምክንያቶች የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ላይ የምረቃ ጥናታዊ ጽሁፍ እየሰራሁ ነው፡፡

የዚህ ቃለ መጠይቅ አላማ በቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ላይ ጫና ሊያሳድሩ ይችላሉ ብለው በሚያስቡት እና በሚገመቱት የቴክኖሎጂ ምክንያቶች ላይ ዳሰሳ ለማድረግ ነው፤ የዚህ ጥናት ውጤት ድርጅቱ በኢንዱስትሪ የሚገጥሙትን የቴክኖሎጂ ችግሮች ለመለየት እና ከተፎካካሪዎቹ ጋር ብቁ ተወዳዳሪ እንዲሆን ያስችለዋል፡፡ የእርስዎ ትክክለኛ ምላሽ በዚህ ጥናት አዎንታዊነት የሚጠቅም እና ለትምህርታዊ ጥናት ዓላማ ብቻ ይውላል፡፡ ስለዚህ ጥያቄዎቹን በትህትና እና በታማኝነት እንዲመልሱ እየጠየቅን ምላሽዎ በሚስጥራዊነት የሚያዝ እና የእርስዎ የግል ማንነት መረጃ አይጠቀስም፡፡

<u>መመሪያ</u>

- ስምዎን መፃፍ አያስፈልግም
- አማራጭ መልስ ያላቸው ሁሉም ጥያቄዎች ባለው ክፍት ቦታ ላይ ምልክት ያድርጉ
- ለትብብርዎ የላቀ ምስጋና አለን

ክፍል አንድ፡- ጠቅላላ መረጃ

የግል መረጃ	**እባክዎን በቀኝ በኩል ባለው ክፍት ቦታ (X) ምልክት ያድርጉ**	**የግል መረጃ**	**እባክዎን በቀኝ በኩል ባለው ክፍት ቦታ (X) ምልክት ያድርጉ**
ጾታ	ወንድ ☐ ሴት ☐	እድሜ	ከ18-30☐ ከ31-40☐ ከ41-50☐ ከ50 በላይ ☐
ትምህርት	ከዲፕሎማ በታች ኮሌጅ ዲፕሎማ ቢኤ/ቢኤስሲ ዲግሪ ☐ ከቢኤ/ቢኤስሲ ዲግሪ በላይ ☐	ወርሃዊ አማካይ የተጣራ ገቢ	እስከ ብር 5000☐ ከብር 5001-10000☐ ከብር 10001-15000☐ ከ15000 ብር በላይ ☐
የኢንዱስትሪ ልምድ	ከ5 ዓመት በታች ☐ ከ5-10 ዓመት ☐ ከ10 ዓመት በላይ ☐	የትዳር ሁኔታ	ላጤ ☐ ያገባ/ች ☐ የፈታ/ች☐

ክፍል ሁለት፡-

እባክዎን ከታች የተቀመጠውን ማስታወሻ በትኩረት ከተመለከቱ በኋላ በቀኝ በኩል ባለው ባዶ ቦታ ላይ (X) ምልክት ያድርጉ፡፡

ማስታወሻ፡- 5 = እጅግ እስማማለሁ፣ 4 = እስማማለሁ፣ 3 = ገለልተኛ

2 = አልስማማም 1 = ፈጽሞ አልስማማም

		ፈአ (1)	**አ(2)**	**ገ(3)**	**እ(4)**	**እእ(5)**

ተ/ቁ.						
1	በቴክኖሎጂዎች ላይ ከፍተኛ ኢንቨስትመንት በማውጣቱ የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
2	የግብይት ስልቱ በልዩ አይቲ ላይ የተመሰረተ በመሆኑ የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
3	የማህበራዊ ድህረ ገጽ የማስታወቂያ ቴክኖሎጂዎችን በመጠቀም ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
4	በአቅርቦት ሰንሰለት ቴክኖሎጂዎች ላይ ከፍተኛ ኢንቨስትመንት በማውጣቱ ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
5	በኢንዱስትሪው የዘመኑትን የአይቲ ቴክኖሎጂዎች በቀጣይነት በመጠቀሙ ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
አርዲ						
6	ጠንካራ የጥናት እና ምርምር ክፍል ስላለው የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					

7	በጥናትና ምርምር ዘርፎች አዳዲስ ሀሳቦችን በማፍለቁ ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
8	በጥናትና ምርምር፣ አዲስ ግኝት እና ቴክኖሎጂዎች ላይ ከፍተኛ ኢንቨስትመንት በማውጣቱ ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
9	የ3ዲ ህትመት ቴክኖሎጂ በመታገዙ ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
10	ለምርት ዲዛይን የዘመኑ ቴክኖሎጂዎችን በመጠቀሙ ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
11	3ዲ ህትመት በመጠቀም በማምረቱ ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
ኤፒ						
12	ሂደቶቹ አውቶሞትድ በመሆናቸው ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
13	በመላው የአቅርቦት ሰንሰለት አውታር ሂደቶቹ አውቶሞትድ በመሆናቸው ምክንያት የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					

14	የቫሉይ ቼይን እያንዳንዱ ሂደቶች ቀላል ሂደቶች በመሆናቸው የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ጨምሯል					
ፒዲ						
15	የቴክኖ ስታይል ኃ/የተ/የግ/ማህበር ምርታማነት ከፍተኛ እና ደረጃውን የጠበቀ ምርት በማቅረቡ ምክንያት ክነሱ መግዛትን እመርጣለሁ					
16	የረቀቀ የቴክኖሎጂ ግብአቶችን በምርቶቹ ስለሚጠቀም ከሌሎቹ ተወዳዳሪዎች በበለጠ የቴክኖ ስታይል ድርጅትን እመርጣለሁ					
17	ከፍተኛ ጥራት እና በቴክኖሎጂ ትግበራ ላይ የተመሰረተ ድርጅት በመሆኑ ምክንያት ቴክኖ ስታይልን እመርጣለሁ					

እባክዎ የዚህ የምረቃ ጥናታዊ ጽሁፍ የመጨረሻ ውጤት ሶፍት ኮፒ የሚፈልጉ ከሆነ ኢሜይልዎን እንዲጽፉልን በትህትና እጠይቃለሁ፡፡

ላደረጉልኝ ትብብር የላቀ ምስጋና አለኝ፡፡

APPENDIX TWO: REGRESSION

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.813[a]	.629	.651	.29351

a. Predictors: (Constant), InfromationTechnology, Research&Development, AutomatedProcess, 3DPrinting

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59.383	8	7.055	87.838	.000[b]
	Residual	39.172	367	.080		
	Total	98.555	373			

a. Dependent Variable: Productivity

c. Predictors: (Constant), information Technology, Research and Development, Automated Process, 3DPrinting

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.248	.210		1.769	.078
	Information Technology	.215	.019	.216	3.497	.001
	Research & Development	.122	.053	.212	4.172	.000
	Automated Process	.018	.083	.126	.314	.753
	3DPrinting	.345	.024	.069	4.473	.000

a. Dependent Variable: Productivity

APPENDIX THREE: INDEPENDENT SAMPLE T-TEST AND ANOVA

Apendix-3A: Independent sample t-test between gender and underlying factors of productivity

Group Statistics

	Gender of the respondents	N	Mean	Std. Deviation	Std. Error Mean
InformationTechnology	Male	250	4.1735	.38880	.02332
	Female	123	4.1351	.42888	.04471
Research&Development	Male	250	4.1647	.34567	.02073
	Female	123	3.9511	.61414	.06403
AutomatedProcess	Male	250	4.2124	.28787	.01727
	Female	123	4.4317	.29966	.03124
3DPrinting	Male	250	4.1614	.27568	.01653
	Female	123	4.3325	.36726	.03829

Apendix-3B: Independent sample t-test between age and underlying factors of productivity

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Information Technology	Between Groups	2.376	7	.792	5.115	.002
	Within Groups	56.675	366	.155		
	Total	59.051	373			
Research & Development	Between Groups	1.028	7	.343	2.714	.045
	Within Groups	46.197	366	.126		
	Total	47.225	373			
Automated Process	Between Groups	.792	7	.264	2.795	.340
	Within Groups	34.577	366	.094		
	Total	35.369	373			
3DPrinting	Between Groups	3.817	7	1.272	15.092	.000
	Within Groups	30.854	366	.084		
	Total	34.670	373			
Productivity	Between Groups	4.791	7	1.597	7.934	.000
	Within Groups	73.666	366	.201		
	Total	78.457	373			

Appendix-3C. One Way ANOVA between income and underlying factors of Productivity

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Information Technology	Between Groups	8.685	7	2.895	21.036	.000
	Within Groups	50.367	366	.138		
	Total	59.051	373			
Research & Development	Between Groups	4.640	7	1.547	8.460	.000
	Within Groups	66.909	366	.183		
	Total	71.549	373			
Automated Process	Between Groups	3.722	3	1.241	14.350	.000
	Within Groups	31.647	366	.086		
	Total	35.369	373			
3DPrinting	Between Groups	2.217	7	.739	8.336	.000
	Within Groups	32.453	366	.089		
	Total	34.670	373			
Productivity	Between Groups	5.527	3	1.842	9.246	.000
	Within Groups	72.930	366	.199		
	Total	78.457	373			

Appendix-3D One Way ANOVA between Industry experience and underlying factors of Productivity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Information Technology	Between Groups	10.249	6	5.124	38.535	.000
	Within Groups	48.803	367	.133		
	Total	59.051	373			
Research & Development	Between Groups	11.303	6	5.652	34.428	.000
	Within Groups	60.246	367	.164		
	Total	71.549	373			
Automated Process	Between Groups	14.155	6	7.077	46.708	.000
	Within Groups	55.610	367	.152		
	Total	69.765	373			
3DPrinting	Between Groups	9.179	6	4.589	35.672	.000
	Within Groups	47.217	367	.129		
	Total	56.395	373			
Productivity	Between Groups	12.760	6	6.380	35.641	.000
	Within Groups	65.697	367	.179		
	Total	78.457	373			

Appendix-3E One Way ANOVA between Educational background and underlying factors of Productivity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Information Technology	Between Groups	3.793	7	1.264	8.375	.000
	Within Groups	55.258	366	.151		
	Total	59.051	373			
Research & Development	Between Groups	1.943	7	.648	5.233	.002
	Within Groups	45.283	366	.124		
	Total	47.225	373			
Automated Process	Between Groups	1.558	7	.519	5.623	.001
	Within Groups	33.810	366	.092		
	Total	35.369	373			
3DPrinting	Between Groups	2.170	7	.723	8.145	.000
	Within Groups	32.500	366	.089		
	Total	34.670	373			
Productivity	Between Groups	4.073	3	1.358	6.681	.000
	Within Groups	74.384	366	.203		
	Total	78.457	373			

Appendix-3F One Way ANOVA between Marital Status and underlying factors of Productivity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Information Technology	Between Groups	7.279	2	3.639	25.798	.000
	Within Groups	51.773	371	.141		
	Total	59.051	373			
Research & Development	Between Groups	6.780	2	3.390	30.760	.000
	Within Groups	40.445	371	.110		
	Total	47.225	373			
Automated Process	Between Groups	2.836	2	1.418	15.999	.000
	Within Groups	32.533	371	.089		
	Total	35.369	373			
3DPrinting	Between Groups	1.991	2	.996	11.181	.000
	Within Groups	32.679	371	.089		
	Total	34.670	373			
Productivity	Between Groups	6.854	2	3.427	17.564	.000
	Within Groups	71.603	371	.195		
	Total	78.457	373			

APPENDIX-4 RELIABILITY TEST

Case Processing Summary

		N	%
Cases	Valid	373	100.0
	Excluded	0	.0
	Total	373	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.795	5

Reliability Statistics

Cronbach's Alpha	N of Items
.687	3

Reliability Statistics

Cronbach's Alpha	N of Items
.756	3

Reliability Statistics

Cronbach's Alpha	N of Items
.672	4

Reliability Statistics

Cronbach's Alpha	N of Items
.765	6

Reliability Statistics

Cronbach's Alpha	N of Items
.814	3

APPENDIX-5 NORMALITY TEST

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Information Technology	373	1.00	5.00	4.0939	.41403	-1.317	.127	7.210	.261
Research & Development	373	2.33	5.00	4.4595	.36772	-1.050	.127	4.596	.261
Automated Process	373	1.75	5.00	4.2541	.31869	-.771	.127	9.664	.261
3DPrinting	373	2.17	5.00	4.1977	.31879	-.169	.127	4.598	.261
Valid N (listwise)	373								