DEPENDENCE OF QUANTITATIVE MODELS OF MANAGEMENT ON IOT AND DIGITAL TRANSFORMATION

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Abstract: *The current research investigated technological support to managers in adopting quantitative models of management due to the latest inventions of the Internet of Things in the digital age. The research evaluated the potential influence of IoT-based digital transformation on the internal business processes and external business processes in competitive workplace environment. It examined how successfully artificial intelligence based IoT and IoT-based Robotics supported the management of growing businesses in the manufacturing industry to improve productivity, employee performance, competitiveness and sustainability in their business operations due to latest technological developments and their implementation for the quantitative models of management. The research also explored the potential influence of IoT-based digital transformation on reducing operational costs, improving business operations and ensuring safety and security of business data through IoT-based databases. Overall, the research examined how successfully the applications of IoT-based digital transformation changed business operations and manufacturing processes by empowering the management with latest technologies and quantitative models of management to succeed in achieving their desired goals.*

Key words: *Internet of Things, IoT-based digital transformation, quantitative models of management, business data, artificial intelligence, IoT-based Robotics*

Chapter 1: Introduction

Introduction

The current research investigates the dependence of quantitative models and methods of management on the Internet of Things and digital transformation. Before identifying potential influence of IoT and digital transformation on quantitative models and methods of management, it is essential to describe quantitative models of management and their importance in competitive business environment. The quantitative models and methods of management are considered to be highly important for businesses because they are based on scientific methods and effectively used by the management to manage and analyze their business performance in more appropriate manner. The quantitative models are scientifically used for managerial decision making to interpret the data, manipulate or process the business-related information and make valuable business decision making to protect people and business resources (Balic & Ebrahimi, 2017). The quantitative models or methods in management are used to formulate the problem, define decision-making variables, develop a suitable model,

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acquire input data, solve the model, validate the model and implement the results to achieve desired results for the management. There are different models and methods of quantitative data for management including regression analysis, linear programming, factor analysis and data mining. In the areas of quantitative models and methods of management, regression analysis is a popular technique by which economists and statisticians adopt regression analysis to solve complex statistical equations in the context of managerial decision making (Pacis et al., 2017).

The current research critically investigates the influence of Internet of Things (IoT) and digital transformation on established business models and methods of manufacturing companies. The research is aimed at observing and analyzing the potential influence of the IoT and digital transformation on the business models based on business level perspectives. In particular, the research is focused on determining the interrelationship or dependence of quantitative models and methods of management on IoT and digital transformation. In the areas of Internet of Things (IoT), the research indicates that IoT is based on network of worldwide objects that are interconnected, unique addressed and based on standardized communication protocols. IoT and digital transformation is incorporated with latest technologies and different types of devices such as RFID tags to censors, complex wireless network sensors, and wearable connected cars (Garetti & Taisch, 2012). Along with Internet of Things (IoT), digital transformation plays a very crucial role to influence the quantitative models and methods of management. The digital transformation facilitates the management of asset-intensive businesses by focusing more on operational technology (OT) and information technology (IT) by offering best solutions to the businesses by integrating them. The integration of operational technology and information technology unlocks opportunities for businesses to make business processes more efficient and productive and making their products and services more valuable. The Internet of Things (IoT) has become the most important concept that enhances the connectivity of the business by enabling the integration of various business resources including human resource, assets and processes into one agenda or point of view and paving ways to obtain valuable business insights for industrial players (Milojevic, 2017).

Background of the Research

The current research is conducted to observe and analyze the dependence of quantitative models and methods of management on Internet of Things (IoT) and digital transformation in asset-intensive industries such as manufacturing. It identifies that these industries are adopting emerging technologies to streamline and improve their decade-old business operations and processes to ensure considerable improvements in their existing products and services by designing and developing new products, creating new channels of communication, advertising and marketing to their customers through the development of new business models and methods (Rong, Vanan & Phillips, 2016). The research indicates that this transformation enable industrial companies to be able to enhance their business values by becoming well-organized, technologically managed, more agile and lean to address their customer needs and tailor their products and services accordingly. The management of best performing manufacturing companies can implement IoT-based digital solutions at different levels of their enterprise ranging from floor to back office to reduce costs and improve the overall productivity and performance to enhance revenues. The research indicates that large numbers of companies have adopted and incorporated IoT and digital transformations in their models and methods and management quantitatively to incorporate a digital mindset by adopting IoT solutions and boosting the quality and cost-effectiveness of their manufacturing process to produce innovative and creative products and services by cutting down their operational costs (Crump & Brown, 2013).

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Experience
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The research indicates that IoT-based digital transformation provides best solutions to the top performing enterprises by making considerable improvements in quantitative models and methods of management. These IoT-based solutions could be offered in various sizes and shapes and applied across different levels of an enterprise and help companies to reach out at their digital momentum. The management of the manufacturing concerns can adopt these IoT-based solutions at their quantitative models and methods of management to improve internal business performance such as on the shop floors, empowering and improving their workplace performance and transforming back-office business operations along with IoT-enabled mobility solutions for these enterprises (Rong, Vanan & Phillips, 2016). Immense numbers of devices have populated the Internet of Things (IoT) that supported them to adopt heterogeneous technologies and standards in the areas of processing, communication and energy availability. The integration of Internet of Things (IoT) and digital transformation could make substantial influence on the quantitative models and methods used by the management of fast growing businesses. The technological development ensures continuous monitoring and control of the physical environment of the manufacturing firms by which their human resource and other resources are used and managed through quantitative models of management. The heterogeneity and critical nature of the IoT and digital transformation makes this combination a very complex environment for businesses because it is associated in rich with opportunities and threats. The research indicates that it is essential for the management of best performing organizations to practice IoT and digital transformations to survive and operate effectively in complex business environment. They need to practice technologically developed platforms, tools and techniques that could be very useful to control the work process and operations in the real-life workplace environment (Shrouf & Miragliotta, 2015).

The current research indicates that quantitative models and methods of management are largely dependent on the IoT and digital transformation because the combination of IoT and digital technologies could be used as a tool for organizations to reduce their operational costs and improve their operational efficiency. In the process of operating costly industrial machines, IoT and digital transformation techniques supports their management with quantitative models of management to guide their employees to adopt integrated systems in complex production processes and production lines (Crump & Brown, 2013). The management adaptation of quantitative models and methods supported with IoT is considered to be very useful to improve external capabilities of the organization by improving the quality of the products by enabling the organizations to develop new products and services and business models to achieve their business goals successfully. The IoT and digitally transformed applications are regarded as very useful for the manufacturing business organizations to specialize in different areas of business

operations by adopting quantitative models of management to fulfill their customer needs (Weber, 2016).

The research indicates that large numbers of business corporations adopt quantitative methods of management associated with IoT and digital technologies to ensure data security and privacy of their customer database. IoT and digital transformation facilitates managers and the IT departments of the organizations to adopt latest scientific models and approaches to overcome growing numbers of cyber-attacks and data stolen from the database of the business corporations. With IoT, every connected machine or complex management system becomes an endpoint that could potentially be breached and damaged if not secured properly. When the quantity of cyber-attacks is increasing and businesses are facing huge challenges of protecting their database, mounting compliance and regulatory burdens are increasing on firms to raise concerns and slowdown the pace of adoption. When business organizations adopt IoT and digital transformation techniques for their quantitative management models, Internet of Things or IoT improves internal capabilities and certain level of confidence of companies when it comes of IoT initiatives and strategy development (Crump & Brown, 2013).

Research Aims and Objectives

The main aim and objective of the research is to examine how quantitative models and methods of management are largely dependent on IoT and digital transformation. The research is also focused to add following points as the research aims and objectives:

- To investigate the potential influence of IoT and digital transformation on internal and external business performance of quantitative models of management,
- To examine the artificial intelligence of IoT and their managerial support to the management to adopt technologically developed quantitative models of management,
- To evaluate the IoT-based Robotic Things and their support to management to adopt quantitative models of management for better results in business solutions,
- To evaluate how IoT and digital transformation improved operational costs by improving the operational performance of the manufacturing organizations,
- To explore how successfully the quantitative models of management are dependent on IoT and digital transformation which facilitates the management to overcome cyber-attacks from growing numbers of cyber-attacks worldwide.

Importance of the Research

The current research is regarded as highly important because it describes how successfully the management of an organization can adopt quantitative models and methods of management to succeed in achieving their desired business goals. It indicates that different quantitative or scientific models of management are popular among successful managers such as linear programming, solution methods, integer programming, network models, project management models and multi-objective models. It identifies how successfully quantitative models of management are dependent on Internet of Things (IoT) and digital transformation. It identifies how the Internet of Things (IoT) has revolutionized the businesses by improving the level of security and privacy of the private database (Kranz, 2017).

In reality, the most of the current implementation of the Internet of Things (IoT) are related to business-to-business scenarios where management is focused to improve the efficiency and productivity around existing process. IoT and digital transformation has gained incremental growth and popularity among business managers because it has facilitated them to adopt

quantitative models and techniques to succeed in improving productivity, business performance and success over their competitors in continuously changing business environment. The IoT and digital transformation can be effectively used to automate the existing processes by delivering fast paybacks, revolutionary applications, new business models and incremental revenue streams. Such a business growth was never possible before the introduction of IoT and digital transformation in the business world (Marjani et al., 2016). It has provided great opportunities to the business managers to improve their production processes, safety and security of the workplace environment by employing new business models, streamlining product design and supply chain management processes and enhancing the competitiveness of advertising, marketing and promotional campaigns. The application of IoT and digital transformation has provided new business opportunities to various business organizations through increased flexibility and quick adaptation to market changes whether they need to introduce a new product or they are planning to do necessary changeover at the production lines (Balic & Ebrahimi, 2017).

Chapter 2: Literature Review

Review of the Literature

The internet of things and digital transformation has changed management practices and facilitated them in adopted highly innovative quantitative models and methods. The IoT has revolutionized the industry and enabled their management to adopt advanced digital technology to conduct their daily business operations. IoT and digital transformation has also changed the workplace environment to enable people to interact with each other using latest digital technologies. Workplace disruptions reduced and the performance of employees increased in a technology-driven world where managers adopted new and innovative quantitative models and methods to succeed in achieving their business goals (Marjani et al., 2016). The conceptualization of IoT was based on different qualities, vision and multidisciplinary activities with a variety of things such as wireless and wired connections and unique quantitative techniques by which people can interact and cooperate with other things and succeed in creating new applications/services to reach at common organizational goals. IoT and digital transformation has also enabled the management of the fast growing and competitive businesses to develop new communication protocols and devices to reach at the multidisciplinary domains where services, internet technology and people were covered through data and semantics to create a complete ecosystem for business innovation, interoperability and reusability to solve security, privacy and trust implications (Pundir, Sharma & Singh, 2016).

The research work conducted by Balic & Ebrahimi (2017) indicated that IoT and digital transformation provided new technological developments and opportunities to the managerial decision making to communicated and interact with their employees through technologically developed devices. The management of top performing organizations could adopt efficient wireless protocols, improved sensors, cheaper processors, bevy startup and establish their business environment by developing necessary managerial and application software and other techniques through IoT mainstreams. The IoT and digital transformation facilitates the management to converge with their consumers, businesses and industrial internet consumers to achieve desired business goals and objectives by adopting quantitative models and methods of management. The convergence through IoT and digital transformation facilitates the management to create open and global networks of connecting and communicating with people, data, and other organizational things. The convergence of also important because it leverages the cloud to ensure the connectivity with intelligent things that could be used to transmit a broad

array of data and help the management to create services that would not be obvious without the level of connectivity and analytical intelligence (Chen et al., 2014).

The dynamics that are associated with the development of IoT and digital applications are regarded as highly complex and enable the management to ensure network connectivity, systems integration, value-addition services and other managerial functions that are used to address the requirements of the end-users to connect intelligent edge devices into complex IoT applications. The management of highly competitive organizations is also dependent on the IoT and the digital transformations to create IoT-enabled ecosystems that offer greater solutions to their customers comprising of large heterogeneous systems to solve important technical issues in different industrial verticals. The disruptive nature of the IoT also needs strong commitment and dedication from the management to assess the requirements of each project separately to ensure future deployment across the digital value chains in various industrial and application areas to ensure better exchange of data, the use of standardized interfaces, interoperability, security, privacy, safety and trust could generate transparency and integration of consumer, business and industrial operations in competitive workplace environments (Pundir, Sharma & Singh, 2016).

In the areas of digital transformation, Internet of Things or IoT is one of the major technologies that could be used to improve quantitative models and methods of management to enhance the productivity and performance of the organization. Over the years, management has realized the importance of developing new business applications and technologies to enable, drive and accelerate digital transformation of their business operations to establish strong working relationship with their customers and business suppliers. Internet of Things or IoT enables the management to develop quantitative methods to create/change new business opportunities by improving the ways people work, live, entertain and connect with other groups within the organization. It has enabled the management of fast growing businesses to create a number of devices and connections through the Internet of Things by correlating it with other technologies to address the transformational needs of their business growth (Manika et al., 2015).

The research article indicated that IoT as a part of digital transformation has become a big task for every successful organization. The role of management is very important to adopt quantitative models of management through IoT to survive in highly competitive market by adopting emerging technologies and adapting changes rapidly. The changing process in large business organizations are not easier but through IoT digital transformation, it is possible for the management to make necessary decisions to carry out change through the value proposition assumptions of digital transformation and Internet of Things. It would be helpful for the management to improve their business operations and competitiveness while entering into new markets and competing with local and foreign companies. Furthermore, the management of the fast growing businesses is also responsible to adopt effective business strategies associated with quantitative models of management to lead their companies and succeed through IoT digital transformations. The management of these organizations can adopt automation models to make processes easier by employing necessary management skills and technological solutions. The research indicated that most of the studies were focused on transforming the digital workflows into technological solutions that could employ to digitalize the information. The research was also focused on observing and identifying the concepts of digital transformation and IoT and the ways of automation solutions to support the digital transformation of the business to achieve greater efficiency in their business operations by reducing mistakes about decision making and proposing value for digital transformation assumptions.

The research work conducted by Microsoft (2015) identified that millions of people, products and other resources are interconnected with each other produce terabytes of data in everyday business operations. Internet of Things (IoT) in digital transformations has revolutionized many industries including agricultural, manufacturing and services. The management of various businesses has adopted quantitative models and methods in the context of Internet of Things (IoT) to improve their business operations, processes and procedures in different areas of the business including operations, administration, finance, marketing and sales. IoT in digital transformation has facilitated the management to find out new ways to engage with their customers and to optimize their business operations by enhancing the motivation and commitment of their employees through technologically developed business operations and processes. IoT in the context of digital transformation has brought together operational technology and information technology to manage their business operations successfully by creating new business opportunities for digital manufacturers to transform their business offerings. Managers and leaders in manufacturing organizations who has an access to the desired information and capable to extract deep insights are quite capable to optimize their business operations and manufacturing processes better than before (Rossi, 2018). The managers can adopt quantitative models of management through Internet of Things of digital transformation to streamline their business operations, make well-informed decisions, and predict customer preferences and preferences to achieve desired business goals and objectives. More importantly, when managers have an insight into the large amounts of data which is secured through Internet of Things, they are quite able identify new revenue streams by developing high-value service offerings that are focused on how products and customers interact in the real world. The digital transformation through the Internet of Things (IoT) has changed the landscape for the manufacturers that has enabled them to differentiate themselves by offering unique and differently designed products by achieving operational excellence and disrupting the markets (Gubbi et al., 2013).

Chapter 3: Research Methodology

Introduction to Research Methodology

The research methodology section is regarded as highly important in the context of current research to examine the dependency of quantitative models and methods that management adopts through Internet of Things (IoT) of digital transformation to ensure the safety, security and reliability of business data. The research methodology is defined as the process by which a theory is observed through the processes of data collection to make desired results. In the research methodology, current research adopts exploratory methods of data collection, analysis and observation to examine the dependence of quantitative models and methods of management on the Internet of Things (IoT) digital transformation. The exploratory method is preferred in the current research because it is useful for both the qualitative and quantitative methods of data collection and observation. The current research adopts qualitative methods of data collection through secondary sources of data collection by evaluating the dependency of qualitative models and methods on IoT digital transformation through already published materials such as books, journals and online sources. Once the necessary literature is reviewed, the research critically evaluates the interpret the results by indicating the importance of managerial practices in the 21st century and their dependence on the Internet of Things (IoT) digital transformations by selecting specific quantitative models and methods to resolve existing organizational issues and complications to improve their business operations, process and procedures to improve their organizational performance and competence (Gubbi et al., 2013).

Explanation and Justification of the Research Methodology

The research methodology in the context of social science research is used to collect necessary information relevant to the research topic to help the management of industrial organizations to make better organizational decisions. The research indicates that a company which is planning to gather necessary information on important models and methods of management that are dependent on the Interne of Things (IoT) digital transformation, they need to review theoretical observation and data associated with theories on managerial models and methods. The current research is conducted to observe three major objectives including descriptive, exploratory and explanatory research process to gather necessary information and analyze it considering the importance of the research topic. The current research is related to management related issues in the context of technological developments like Internet of Things and digital transformation and adopts exploratory methods of data collection, analysis and observation.

Exploratory Research

In the current research, exploratory method is chosen because it presents the situation or process to examine a theoretical idea and then observe it through statistical reasoning. It investigates how successfully managerial models and methods are dependent on the Internet of Things (IoT) of digital transformation. The exploratory research is useful because it provides the groundwork in the social science research to examine its relevance to the current research. It examines existing theoretical approach on quantitative models and methods of management that are dependent on IoT and digital transformation. It is used to collect necessary information by illustrating the relevance of the collected data to the current research and its implications to the future research.

Research Design

The research design is regarded as highly important in the context of current research because it provides a structure to the research to gather necessary information about the research topic to reach on the research conclusions. It describes detailed research process and procedures that could be adopted to gather data relevant to quantitative models of management, IoT and digital transformation and their relationship in the industrial or manufacturing context. The research design for the current research topic is selected with a framework to examine already published sources as the data sources and evaluate their relevance to the current research and what else is needed to be observed for the future research implications. In the current research, qualitative sources of data collection are used to observe and analyze the data collected through www.googlescholar.com to examine the relevance of already published literature in books, journals and online sources.

Chapter 4: Analysis and Discussion

Potential influence of IoT and digital transformation on internal and external business performance

The current research is regarded as highly important to observe the dependence of quantitative models and methods of management on the IoT of digital transformation because technology has constantly developed and provided new opportunities to the management to improve their business processes and operations. The research examine the importance of Internet of Things (IoT) of digital transformation that has revolutionized the world and created new challenges

and opportunities for competitive business organizations operating in the manufacturing industry. The researched investigated how successfully IoT and digital transformation in the past decade influenced internal and external business processes and operations at the international levels. It also examined the contribution of IoT digital transformation on the safety, security and protection of the given set of data in the collaborative business environment. The research also investigated the dependence of quantitative model and methods that the management of industrial organizations could adopt to improve their operational costs and operational performance in highly competitive and changing market environment. In order to investigate the influence of managerial models of IoT and digital transformation, the study evaluated the management approach to specifically adopt unique models of management to address their operational costs, administration, finance and other business-related issues. The research also observed and analyzed the dependency of managerial models on latest technological solutions to improve their business performance by overcoming cyber-attacks and ensuring the safety, security and complete protection of the given set of data (Coleman et al., 2017).

The research indicated that the dependence of quantitative models and methods of management on IoT digital transformation has increased over the years and businesses adopting latest technological solutions are succeeded in achieving business competitiveness and increased business performance in comparison to their industrial competitors. The current study was specifically focused on the quantitative models and methods of management associated with the manufacturing industry that depended on the IoT digital transformation in the recent years. For example, the research indicated that in the models of management, customer relationship management or CRM was effectively used by the management through the Internet of Things (IoT) to enhance the relationship of the management with their potential customers. Operational CRM was involved in providing customer services in the sales and marketing processes along with technical support to succeed in cross-selling and up-selling of further products and services to the existing business customers. The management of manufacturing organizations has adopted a large numbers of trends in the evolution process of CRM to predict and adopt self-learning adaptive models to increase the mining of big data to leverage marketing and sales. It helps the company representatives to learn from the market and customer behaviors when during specific customer interaction processes to develop next best strategy for the organization to take necessary actions for a specific customer by taking into considerations the individual background of transaction and interaction history of the customers.

Artificial Intelligence of the Internet of Things and Managerial Support

The review of literature from different sources indicates that the Internet of Things has provided considerable support to the managers to develop quantitative models to collect data from different industrial sectors to facilitate in their business operations. The data generated through IoT provides an insight from the applications that generated it. Therefore, managers can adopt artificial intelligence techniques that could be useful to monitor and automate the data to facilitate in smarter decision-making approach. The IoT applications that are enabled with artificial intelligence provides additional features of managerial methods to create the next generation smart homes, vehicles, smart manufacturing and smart buildings through intelligent automation, proactive intervention and predictive analytics. In the context of smart models and methods for management, IoT-enabled artificial intelligence provides a complete support to the managers to find out the smart business data and analyze it for better decision-making trends and patterns based on well-defined rules and regulations. The research indicated that artificial intelligence techniques would be helpful for the top level management of manufacturing

organizations to adopt cognitive systems to integrate their business with the IoT applications to get optimized solutions for various business problems. Cognitive IoT technologies are regarded as highly effective and useful to embed intelligence into systems and processes by allowing the management of these businesses to enhance the efficiency of business processes to find out new business opportunities. It helps the management to identify risks and threats that could disrupt business processes and deteriorate their business growth and productivity. The Internet of Things (IoT) applications through latest technologies would be highly effective and useful for the management to integrate and collect necessary data through different types of sensors, sources and reasons and learn how to interact the data with business processes by creating communities of devices that share information. The information collected through IoT-based applications will be interpreted and managed by the business managers by using cognitive systems to ensure the generation of new and better services for their customers that enable them to expand their business beyond their national borders. When companies expand their business operations internationally, they depend largely on latest technological solutions like the Internet of Things to make better business decisions by addressing and fulfilling their customer needs and preferences (Marsh, 2017).

IoT-based Robotic Things and Managerial Support in Quantitative Models of Management

Internet of Things (IoT) based robotics could also be used by the managers of various businesses as the programmed machines to involve in labor intensive and repetitive work. IoT-based robotics provides an excellent source of quantitative models to empower machines in labor intensive and repetitive tasks to achieve desired workplace objectives without any need for additional human resources. The robotics and machine learning has become essential in the recent years for business managers but they need extensive robotic and machine learning to perform autonomous tasks through advanced state of intelligence in using statistical patterns, parametric algorithms, neural networks and recommended systems. The technological development of the IoT-based robotics has improved the business operations and workplace environments through great technological innovation by creating new business opportunities. In the recent years, large numbers of business initiatives are focused on using connected devices to ensure the successful management, monitoring and optimization of systems and their processes. The research indicated that intelligent devices that monitor events and business processes are associated with advanced and transformation aspects of connectivity and communication to fuse sensor data from the variety of sources and to determine the best sources of action in the industrial workplace environment. The development of internet of robotic things has revolutionized the industrial manufacturing and workplace environment b contributing greatly through advanced robotic capabilities, along with novel applications of these technologies and tension in creating and developing new business and investment opportunities (Shea, 2017).

The research indicated that the development of advanced technologies through IoT digital transformation has greatly supported the managers and business leaders to adopt latest quantitative models of management through advanced sensing, communication, local and distributed processes with net classes of opportunities for IoT robotics solution providers. The characteristics of robotic technologies are regarded as highly distinguished from other technologies because they are based on separate, unique and distinguished class of IoT objects that the management of an organization could prefer to improve their business operations based on robotic machine environment. The salient features of this technology make it distinguished and unique from other technologies because it is featured with movement, mobility,

manipulation, intelligence and autonomy and enhanced IoT-based paradigm with edging devices. The combination of IoT digital transformation and the robotic technologies has provided new classes of applications to deliver value in the business manufacturing processes through Ambient Sensing, intelligent and localization environment (Unhelkar & Murugesan, 2016).

IoT Digital Transformation and Improved Operational Performance

The current research indicated that IoT-based digital age has brought about new ways of thinking about the manufacturing and business operations. It created incredible change in the labor rate in the emerging economies and influenced global production associated with distribution decisions. Digital transformation has brought about significant in the latest technologies such as big data and analytics, the IoT, robotics and the additive manufacturing that enhance the capabilities of the manufacturing enterprises by improving their competitiveness at the global level. In response, the manufacturing and operations needed digital overhaul at their production processes and needed training of their employees with challenges of redesigning of their manufacturing and retaining of highly skilled employees. In the detailed literature review, the research indicated that new and technologically developed devices and automatic machines were introduced at the industrial manufacturing processes due to the IoT digital transformation. It helped the managers to adopt new and advanced quantitative models of management to perform various functions of their business enterprises. Latest devices were used for the purpose of increased communication among managers and their employees that benefited the manufacturing industry, improved decision-making, enhanced productivity, ensure more efficient energy management, improved investment management systems and reduced production costs per unit. The intelligent IoT systems made incredible impact on the manufacturing of new and technologically improved products by giving dynamic response to the market conditions and changing business environments. It provided a real-time optimization to the manufacturing production processes and operations through supply chain network of interconnected machines, sensors and control systems.

Chapter 5: Conclusion

Conclusion

The current research critically investigated the dependence of quantitative models of management on technological developments of IoT and digital transformation in the digital age. The research indicated that before the digital age, managers were unable to adopt quantitative models because most of the business processes were based on old-fashions methods of management. It evaluated that development of latest technologies has changed the production processes of manufacturing industry and provided an opportunity to the management to adopt latest ways of management to improve productivity and employee performance at competitive workplace environment. The research indicated that quantitative models of management were scientific methods that needed complete understanding of the managers to instruct and guide their employees to work on latest and technologically developed industrial machines and communication networks. The quantitative models of management are specifically adopted by the management to formulate the problems, define decision-making variables, develop a suitable model, acquire input data, validate the model and implement results to achieve desired results.

The research was conducted on evaluating the dependence of quantitative or numeric models of management on IoT digital transformation and examined how it influenced the internal and external processes and performance of the businesses. It also observed the artificial intelligence of IoT digital transformation and support it provided to the managers to adopt technologically developed quantitative models of management. In the research objectives it examined the IoT-based Robotic things that improved the manufacturing processes and provided added support to technologically developed organizations to adopt quantitative models of management and to succeed in achieving their desired business objectives. The research indicated that by adopting IoT digital transformation, companies have succeeded in achieving operational efficiency by improving their business operations based on Internet of Things digital transformations and latest technological developments. The research also explored the impact of IoT digital transformation through in-depth literature review by indicating that it has supported the management to safe, secure and protects their confidential business data by overcome cyber-attacks from the growing cybercrimes worldwide. Overall, the research showed that latest technological inventions in the form of IoT have provided incredible technological support to the management of best performing businesses to adopt latest technologies in quantitative models of management to improve their business operations including production processes, finance, operations, managers to employee level communication, enhanced productivity, performance and competitiveness of the businesses.

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