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DIGITAL QUALITY MANAGEMENT SYSTEMS: BENEFITS AND CHALLENGES

Abstract: *Quality management is a maintenance and control process in which product and service quality are scrutinized for conformity with stated requirements. Digital quality management systems (QMS) is designed for agile, consistent and customer-centric enterprises. Digital QMS has been widely used by world-class business enterprises to attain competitive advantage in terms of performance, innovation and quality product and service delivery. Unfortunately, the extant literature is devoid of a definitive conclusion highlighting the benefits and challenges digital QMS. To fill this void, this paper reviewed the benefits and challenges digital QMS to provide a comprehensive framework. This paper concludes that digital QMS is an essential component for modern business enterprises, as it guarantees homogeneous and cost-efficient products / services at maximum returns and minimum complaints. Implications are discussed..*

Keywords: *Digitalization, quality management systems, technology*

1. Overview

Digitization represents the use of digital technologies to connect firms, operations, products and services as well as people (Coreynen et al., 2017). The theme digitalization is a trend that offers several opportunities for both manufacturing and service firms. It also has the capability to radically improve productivity and performance of firms by opening new market and business opportunities, all this happen because of automation function of digitalized systems. According to Coreynen et al. (2017), the use of emerging technologies in a firm's back-end operations has the propensity to facilitate operational performance through automation. Further, increased usage of automation result in greater levels of transparency that ensures informed decision-making (i.e., allocation of

resources) and identification of fault-lines (Ness et al., 2015). Henceforth, manufacturing and services firms can leverage on knowledge generated by digitalized systems not only for internal processes but also for external processes (i.e., customers' process, supplier process and other stakeholders).

Scholars (i.e., Ulaga and Reinartz, 2011) suggested that firms should co-opt automation and digitalized systems into the customer's process such as product / service design and production activities. It is on this premises that we linked the ideation of digitalization to quality management system (QMS). QMS is depicts "a management system designed to direct and control an organization with regard to quality" (International Organization for Standardization, 2005). QMS is "a set of interrelated or interacting elements of an organization to establish policies and

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objectives, and processes to achieve these objectives with regard to quality” (Kumar, Maiti & Gunasekaran, 2018, pg.3). Rönnbäck, Witell and Enquist (2009) further clarify that QMS “as a tool to control and improve the quality of the company’s products, which includes everything from methods and routines to organization and responsibility distribution”. The system entails processes by which organization identifies organization objectives, determines the essential activities and resources to achieve stated goals.

Kumar et al. (2018) added that in the past few decades, QMS has become an integral part of business enterprises to achieve not only world-class product and service quality, but also market success. The fundamental reason is because QMS has the capability to transform the structures and processes of business practices, and in doing so, it set a system that prevents inferior quality. This led some scholars to argue that QMS can empower business enterprises to improve service quality without increasing costs (Zarei, Karimi, Mahfoozpour & Marzban, 2019). To accomplish these goals and objectives, firms, world-wide tends to adopt QMS. Advances in technology gave birth to digital quality management systems (QMS) which is designed for agile, consistent and customer-centric enterprises. The digitization of QMS is designed to reduce cost (Busch, Henriksen & Sæbø, 2018), easy and fast access (Jansson & Erlingsson, 2014), and enforcement of certain procedures and interpretations of rules for quality enhancement (Henriksen, 2018). Cordella and Tempini (2015) added that digitalized QMS can help firms to acquire relevant and timely information, which may facilitate decision-making, information flow and communication capability (Busch et al., 2018).

Many scholars and practitioners are hesitant on adoption and implementation of QMS. This primary reason is because [they] do not consider QMS to be the best path for

improved quality, moreover, there are questions about its financial benefits. Subsequently, existing scholarly work failed to corroborate the importance of QMS especially in the digitalized age. This calls for more research on the benefits and potential challenges of digital QMS.

2. Benefits

Digital quality management systems (QMS) is a contemporary management system that adds business value to contemporary organizations. Digital QMS adds business value through greater speed, agility, and analytical capability of historical, present and future commercial and business activities that happened and/or will happen in the firm during its lifetime (Hallberg, Hasche, Kask & Öberg, 2018). Digital QMS subsumes systems such as ISO certifications, which dictate the way organizations follows to secure internal work routines, eliminate unnecessary traditional approach to enhance business performance and earn competitive advantage. Although, Digital QMSs are mainly designed for internal processes, the system indirectly instructs organizations to follow several business standards in choosing business partners such as suppliers, collaborators and other stakeholders (Hallberg et al., 2018). The presence of various actors could create challenges for traditional QMS. However, Rönnbäck, Witell and Enquist (2009) claimed that joint digital QMS can create business value in three sections namely:

- Value creation in business-2-business domain - this denotes the creation of business value for associates such as suppliers.
- Value creation in business-2-others domain - this denotes the creation of business value for cooperating partners, alliance partners, off-shore collaborators etc.

- Value creation in business-2-customers domain - this denotes the creation of business value for customers.

Therein, it could be argued that it can have several implications for organizations. These selection standards are mostly relevant in high-tech and sensitive industries (e.g., automotive, aerospace, car, food and medical industry). Research highlighted the paramount economic value of QMS for a nation, industry and/or organization at micro-level:

- Exports competitive advantage.
- National trade deficits.
- Economic growth.
- Productivity and customer satisfaction.
- Standardization (Sampaio, Saraiva & Rodrigues, 2011).

According to Sampaio et al. (2011), both traditional and digital QMS could result to improvement in business and financial performance. For example, research found that digital QMS permits organizational decision-makers to compare their performance with and without the system, this provides evidence of digital QMS function in attaining genuine management goals beyond bunches of certificates. QMS can generate business for business by enhancing value for customers in products and services, which could result in greater market share and revenues. Further, QMS eliminates redundant process and procedures, in doing so it lowers the costs of production and service delivery, technically increasing organizational margins and asset usage. These sets of outcomes facilitate organizations to voluntarily implement, manage and fully take advantage of the digital QMS (Sedevich Fons, 2011).

Digital QMS has more benefits in terms of decision-making compare to traditional QMS. Sedevich Fons (2011) noted that QMS allows organizations to become aware of important quality activities that were previously ignored. For instance, managers tend to figure out hat stakeholders such customers, employees, suppliers and

distributor value more through QMS, henceforth enhancing the quality of decisions. On similar grounds digital QMS has the capacity to ensure that organizations have adequate, updated, reliable and useful information for decision making. With digital QMS, organizations tend to discover that they can increase profits through certain quality management practices compare to what they would have earn without the implementation of digital QMS. Digital QMS has simulation and forecasting technologies which allows managers to test a blueprint or prototype of business plan before actual implementation (Abubakar, Behraves, Rezapouraghdam & Yildiz, 2019). These capability grants managers the ability to enhance and restructure activities and cost management, also these capability serves a decisive facet during decision making, as managers can see and anticipate what the future has for them and how they can achieve or evade threats (Sedevich Fons, 2011).

Digital QMS ensures and allows organizations to identify various problems or failures in their activities, in addition it ensures and provide them with insights to investigate and identify the cause. In the past, the advantage of traditional QMS is that it helps organizations to detect the causes of non-conforming products and/or services, remarks and the underlying ways to improve the problems. However, digital QMS has the tendency to act as a locator for cause-effect, assign monetary value for the causes and effects e.g., errors, and concludes with various sets of useful recommendations. Although, sets of recommendations are generated each is tested with simulations based on the availability of resources, and managers can establish or prioritized quality related challenges using economic consequence criterion (Sedevich Fons, 2011).

Digital QMS is essential in regard to cost-benefit relationship analysis. In particular, it operates efficiently by providing vital data

on prevention and appraisal actions on organizational activities. On the other hand, traditional QMS generates data about the effects caused by prevention and appraisal actions through non-financial indicators (Sedevich Fons, 2011). However, digital QMS can translate the data from non-financial indicators into valued in monetary units, which then could be used for enhanced cost-benefit analysis e.g., how convenient it is to perform a quality control to the output of a process or not and by how much, how much resources e.g., machineries, manpower are required etc.

Digital QMS has been shown to have indirect benefits on organizations. The virtue of digital QMS is to obtain “collateral operational performance advantages because they would be forced to reach certain work patterns”. These benefits will be discussed in the succeeding paragraphs:

- Operational performance – in terms of operation organization are forced to follow certain standards and work pattern. This demands that organizational must consider several activities e.g., accounting practices as part of the QMS and management must follow the same principles for all processes. Consequently, making accounting areas more effective and efficient. Variation is one of the major problems in organizations, digital QMS enforces sets of measurement standards which demands communication and coordination between departments, thus, reducing disparity between departments in organizations. In addition, measurement approach enforced by digital QMS has the capacity to identify the link between financial and non-financial indicators.
- Financial performance – digital QMS can reduce financial cost such as overhead cost and on the positive fronts boost sales volume, revenue and yearly returns.

- Human resources performance – with digital QMS organizations can design high-performance work systems which empowerments and enhances employee learning, development and involvement. This is achieved through the guidelines of the system, for instance employees are aware of procedures to follow while undertaking daily tasks. This alone significantly boost productivity, efficiency and morale of the employees
- In doing so, it also fosters team work and communication between team members and departments. Properly implemented digital QMS can monitor and manage environment and occupational health-related performance through enhanced consideration for safety, which is known to be a string determinant for employee satisfaction and individual performance.
- Quality and customer performance - digital QMS is known to identify and/or detect cause and effects. Therefore, organizations with this ability are less likely to make mistakes which could boost operating profit, reduce customer complaints, defects, and retention rate. Because there will be no need for service recovery activities as applicable to traditional QMS. In this regard, digital QMS can forecast potential problems before they go out of hand. Thus, this could be translated into greater market-related performance
- Market-related performance – greater market share, inimitable market competitiveness, greater levels of brand image and performance against competitors.

Digital QMS is now seen as a ticket for firms in the competitive markets, because there is a need for greater agility to detect, forecast and respond in real time with accurate and consistent actions. This makes digital QMS important in today’s world and it is characterized by the following developments namely:

- Automation – one of the major advancements with digital QMS is automation, which overtook the paper-based approach within the last decade. Digital QMS has brought substantial value to adopting organizations in that automated quality solution permits firms to drive lean production capabilities over time. Moreover, firms could learn from their present mistakes and failures and make continuous improvement decisions. This is primarily due to increased interaction between the system and employees, during these interactions employees have accessed to timely and update information. Employees have access to records, log information and have greater control compare to paper-based QMS especially for processes like corrective action, audit management, and document or record control. As such, digital QMS is consider as a helper for managing, using, updating and analyzing information submitted by employees from different departments. Hence, this allows organizations to make better decisions, take faster corrective actions and manage risk more efficiently. In sum, in paper-based QMS, decisions are made based on intuition and experience. However, digital QMS ensures that organization uses automation to make informed decision following laid down procedures. It saves cost ranging from million to billion of dollars yearly, as paper-based QMS requires additional manpower to manage and control all the quality processes. Additionally, training waste time and resources which could have been channeled into useful productive activities. Digital QMS reduces training cost and time for new employees, as they can find all information online embedded in the system.
- Risk management - in today's business environment that is characterized by turbulent technological changes and breakthrough, risk management and quality are inseparable. Recent announcement by ISO 9001:2016 shows that organizational risk awareness is a vital component of quality management (i) risk is a compliance benchmark – even though there are variations in individual process risk assessment, also this variation increases or decreases based on industry and business environment, the central idea of measuring and evading risk remains the same (Takeda et al., 2003). Thus, this implies that risk is the common theme linking all organizational processes; (ii) prioritization approach of risk and decision tool – traditional QMS often categorize risks using chronological order, which is the reason important risk are mostly ignored or omitted, with digital QMS organizations can categorize risks and events with their corresponding corrective actions and tracking policies to avoid potential adverse effects.
- Big data and knowledge management – are the most important and recent innovations that is closely linked with quality management for informed decision making (Abubakar, Elrehail, Alatailat & Elçi, 2017). Contemporary organizations are now leveraging on business analytics tools and knowledge management systems to build competitive advantage. They often achieve this by collecting, storing and analyzing massive unstructured datasets that alters how organizations make decisions. The continuous collection, storage and analysis of huge dataset allows firms to continuously identify new trends and correlations that's supports improvements in production, processing and marketing areas. Additionally, the conception and/or inception of Industry 4.0 is simple attempt to extend Big data and

knowledge management system usage to arrive at top-notch operational excellence. This implies that digital QMS uses Big data, knowledge management and Industry 4.0 concepts to enhance quality management. Some the technologies include machine learning, artificial intelligence, smart devices, cloud computing, social media and blockchain. These technologies ensure that firms make decisions basked by data, which helps them to bypass quality challenges.

3. Challenges

From financial view, quality can have significant impact on business performance through two major routes: manufacturing and market (Sousa & Voss, 2002). From the manufacturing fronts, enhancing the quality of the internal procedures and process can result in greater levels of operational performance which latter heightens the financial performance of any firm. From the marketing fronts, enhancing the quality of the products and/or services will significant influence firm's ability to market their products and/or services against competitors. Henceforth, quality management practices deem to exert substantial effects on quality and operational performance. Sampaio, Saraiva and Guimarães (2011) argued that the contributions of quality management practices on financial performance is weak and not always significant. This is because digital QMS practices has the tendency to delimit the selection of qualified business partners such as distributors, suppliers and other stakeholders. Thus, represent an upstream pressure for such digital QMS, in that selecting and/or deselecting of business partners could have positive or negative effect on the business network structure as well as operational capability (Hallberg, Hasche, Kask & Öberg, 2018). Other challenges for digital QMS includes:

- Digital QMS controllable cost – these are accrued cost that entails overhead costs in terms of operationalizing and implementation of digital QMS. For instance, setting up a digital QMS requires series of meetings and negotiation among stakeholders and with vendor firms. Next, after successful negotiation, time frame is important regarding costs for organization as time equates to money. Third, training the employees on how to use digital QMS is necessary and time consuming e.g., implementation and training time could be spent on other productive activities. Fourth, additional costs are accrued from error prevention and appraisal costs for the use of the system (Sedevich Fons, 2011).
- Digital QMS non-controllable cost – these are accrued costs generated from digital QMS system failures and wrong implementations. This does not necessary mean that digital QMS is not functional rather the scope of implementation, context, industry, availability of infrastructure and even organizational culture may have contributed to the failure. In practice, these are costs (internal and external) that originated by direct failures (Sedevich Fons, 2011).
- Digital QMS inflexibility – digital QMS tends to create inflexible structures and organization, moreover, it increases administrative task for employees e.g., scorecards, monthly reports, even though digital QMS is better than the tradition QMS which is characterized by bunch of manuals, the digital version is also time consuming and complicated. For instance, some scholars suggested that the status and functionality of digital QMS should be monitored on regular basis to identify areas that require improvement as well as weaknesses (Zarei et al., 2019). Subsequently, doing this would add

- administrative workload to the employees and management.
- Digital QMS system failure – network and system failure can hamper the ability of organizations to provide prompt and timely response to issues. For instance, system failure in terms of missing files, records and reports can have adverse effect of quality control. Similarly, attack on network that jeopardize organizational activities and intelligence.
 - Digital QMS and collaboration challenges – Digital QMS requires high degree of co-ordination and shared goals among stakeholders (e.g., out-sourcing firm, suppliers, collaborators etc.) actors. The need for shared vision arises when part of the production process and/or service provision process is outsourced. This is because the absence of shared and common goals can jeopardize customer satisfaction and affects value creation. This challenge calls for Digital QMS that can direct and also control the activities of partners, which is almost impossible in most cases. Rönnbäck, Witell and Enquist (2009) argued that value could be created for inter-organizational collaboration through joint digital QMS to perform, direct and dictate the processes, routines, measurement and also highlights the areas that need improvement.

4. Conclusion

Digital QMS supports the flow of data across departments in an organization automatically, this limits the need for manual transfer that are prone to man-made error and time-consuming e.g., data entry. Digital QMS systems overtake the paper-based QMS because it leverages on real-time measuring and feedback mechanism, thereby enabling timely response to failures and errors (Yeung, Chan & Lee, 2003). With

digital QMS organisations can manage and benefit from updated vital quality management documents such as orders, guidelines and drawings. This eliminates the need for physical copies and thus save stationary costs for firms. In addition, data and business-related information is available for everyone, anywhere and anytime. Furthermore, transparency is enhanced through greater collaboration and information sharing among business units which helps build a shared vision to achieve common organizational goals, homogeneous, cost-efficient products / services at maximum returns and minimum complaints. Digital QMS “can easily be analyzed when the organization requires any change; it can also be used to keep a history of commercial and business activities that happened in the firm during its lifetime. The Electronic quality management system is a dynamic management system that adds long-term value to the firm. It provides speed, adds agility, and it is even capable of analyzing the change in the company” (Cabrerizo et al., 2015). Traditional QMS has been characterized with redundancy, however, digital QMS operates in the opposite direction as it aims to reduce redundancy. This article suggest that business enterprises should invest in digital QMS as it is very easy to maintain, it also makes information available for both internal and external audits and new changes can be implemented quickly by all employees across the organization. Despite this benefits future digital QMS implementations could enhance the system by incorporating the following features:

- Risk management – A matrix that offers information related to the probability and severity of risks.
- QMS oversight reporting – Dashboards that run in the background and grant user access for automated reports, and also permit users to monitor goals, trends, and issues.

- Audit features – Full control over the auditing management process, including content auditing, scheduling, and results.
- Corrective action preventive action (CAPA) – Formal documentation of how a non-conformance was resolved with automated workflows to approve and document resolution.
- Key performance indicators (KPIs) – The ability to set key performance indicators that allow organizations to measure the steps necessary to stay on task to complete performance goals.

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