Knowledge Management Support for Quality Management to Achieve Higher Customer Satisfaction

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Abstract—As a Quality Management society transforms into a more knowledge and learned based society, it requires enhancement and improvement of strategies, systems and techniques towards meeting new expectations and demands. The importance of knowledge continues to grow to the spread of global networks, accelerated product cycles and changing market conditions. In this era; a progressive enterprise should strive to adapt itself successfully to new management skills, principles, abilities and higher levels of competency. Also customer demands and their levels of satisfaction are determined by new factors. In this paper, we surveyed related aspects of Knowledge Management in order to be integrated in Quality Management. Finally we have proposed a model of Knowledge Management approaches for supporting Quality Management to achieve higher customer satisfaction. It has been revealed that Knowledge Management brings and sustains advantages to fulfill customer demands by creating and supporting beneficial features through launching of appropriate Knowledge Management processes.

Index Terms—Knowledge Management, Quality Management, Process, Enterprise, Customer.

I. INTRODUCTION

From long centuries ago, as far as human beings started life in the earth, they had tried to ensure quality of houses, foods, vehicles and guns. Basically they established some standards dealing with simple criteria. The background of standardization refers to necessities of people to have more comfortable life. Standards are not only applied for using tools, products, services or goods, but also; from another point of view; people established standards to insure their individual and public safety, security and health. Today enterprises without consideration of quality will quickly face to extraordinary costs. Quality is important for financial issues and customers satisfaction. Also it indirectly affects on customers by supplying extreme reliability and usability for products or services.

W. Edwards Deming believed management creates the right conditions for scientific method to work effectively [1]. In fact to conduct and manage different issues regarding quality of products or services, methods of scientific thinking like Quality Management (QM) can aid enterprises. Particularly, enterprises have to consider QM as a basis to achieve target-quality and customer satisfaction.

Quality Management is all activities that determine the quality policy, objectives, responsibilities, plans, actions, inspections, evaluations, and verifications across enterprises to fulfill customer satisfaction. In addition, Quality Management is set of methods to design, develop, improve, ensure and declare quality of a product or service. QM is to certify that all activities in enterprises are effective, appropriate and efficient for the whole system and its performance. It is an everlasting and continual process because customers expect to purchase a product or service with higher and insured quality within fewer limits.

Deming’s philosophy had a great role to establish new systematical approaches willing to use all possibilities to make integrative methods. Especially it was resulted to introduce a new management philosophy, paradigm, or non-traditional approach named as Total Quality Management (TQM).

Éthier explained TQM as an organizational policy which encourages continuing mobilization of all employees to improve: (a) The quality of products and services, (b) The quality of the organization's operations and (c) The quality of its goals, in relation to the evolution of its environment [2].

Also Morgan and Murgatroyd defined Total Quality Management as a user-driven methodology concerned chiefly with changing attitudes and skills and a philosophy and culture of never ending improvement leading to customer satisfaction and then to customer delight [3].
On the other hand, modern and recent technologies such as Knowledge Technology can be used to assist and enable QM processes across enterprises to attain higher customer satisfaction and to level up.

II. ORGANIZATION OF ENTERPRISE-KNOWLEDGE

A. Knowledge and Knowledge Management

The history of knowledge is long enough to be referred to many centuries ago. By considering modernization, the industrial revolution and especially the cybernetic revolution, the role of knowledge and its value has been significantly changed. According to Ackoff, knowledge is an interopulative, probabilistic, analytical and cognitive process. It is the process by which somebody can take knowledge and synthesize new knowledge from the previously held one. Knowledge is not truly the appropriate collection of information, because it is learning rather than memorizing [4].

Primarily, knowledge has different types. Knowledge rooted in action, experience, and involvement in specific context named as tacit knowledge. It consists of two types. Firstly, cognitive-tacit based on mental models e.g. individual’s belief on cause-effect relationships, and secondly, technical-tacit that is to “know-how” is an applicability of a specific work like production. On the other hand, explicit knowledge is articulated or generalized knowledge e.g. knowledge of major customers in a region.

Since decades, there is a rapid transition from an industrial society into a knowledge society. The knowledge intensity in work processes increases compared to manual works. Enterprises need to know what they know and be able to leverage on its knowledge base to gain competitive advantages. At this point, they can create and sustain advantages through launching of appropriate Knowledge Management processes. It leads to advantages in the forms of identifying trends, unusual patterns, and hidden relationships. For example in 1960s, experiences of an old retired employee were not valuable. But today some enterprises have been encouraged to collect his/her tacit knowledge even by investing and defining new projects based on Knowledge Management techniques.

As stated by Groff and Jones; Knowledge Management (KM) is taken as the tools, techniques and strategies to retain, analyze, organize, improve and share organizational expertise [5]. As well as; KM is the dynamic cyclical sets of practices like create, extract, refine, store, manage, disseminate and/or transfer of knowledge within enterprises. Some of these practices are illustrated in Figure 1. The outcomes of these practices are selectively applied for current and future activities e.g. Quality Assurance (QA).

In consequence, the purpose of using Knowledge Management is to improve and enhance effectiveness and efficiency of organizational procedures.

B. Knowledge Management via Enterprises, People and Technology

As explained earlier, Knowledge Management covers all systematic activities involved in the creation and sharing of knowledge across enterprises and in relations to customers, partners and knowledge stakeholders. Thus it contributes to achievement of goals and creation of value added by enterprises. Relatively, as Figure 2 shows, Knowledge Management involves people, technology, processes, and organizational cultures in overlapping parts.

According to Grover and Davenport, organizations can be viewed to have two categories of knowledge-buyers. Firstly, the local buyers are people who are searching for knowledge assets to address an issue that they need to resolve. They require expertise, experience, insight, and judgment rather than information to bring to bear on the issue. They could pay for knowledge in hard currency via e.g. a consultant from outside the firm, or buy the knowledge from internal suppliers. Secondly, the global knowledge buyers are the firm, which have a vested interest in realizing knowledge assets into valuable products and services. The global knowledge buyers, represented by organizational stakeholders whose benefits are tied to organizational level outcomes, have a strong interest in transferring local knowledge to global knowledge [6].

On the other hand, Grover and Davenport also pointed out knowledge-sellers are who have usually tacit knowledge to sell. The quality of this knowledge might be high or low depending on the credibility of the source [6].

Information Technology (IT) can play an important role in successful Knowledge Management initiatives. As IT and Information Systems (IS) started to facilitate data and information overflow, the corporate attention became a scarce resource, and the concept of knowledge emerged as a particularly high-value form of information [6]. However as remarked by Nahapiet and Ghoshal, the concept of coding and transmitting knowledge in organizations is not new. Training and employee development programs, organizational policies, routines, procedures, reports, and manuals have served this function for many years. What is new and exciting in the Knowledge Management area is the potential for using modern Information Technology. The examples are the Internet, intranets, extranets, browsers, data warehouses, data filters, software agents, Knowledge Based Systems (KBS) and expert systems. These system are used to support knowledge.

![Figure 1. Set of practices in Knowledge Management](image-url)
creation, sharing and exchange in an organization and between organizations. Modern Information Technology can collect, systematize, structure, store, combine, distribute and present information of value to knowledge workers [7].

C. **Knowledge Management Systems**

Maier described a Knowledge Management System (KMS) as an Information Communication Technology (ICT) System in the sense of an application system or an ICT platform that combines and integrates functions for the contextualized handling of both, explicit and tacit knowledge, throughout the organization or that part of the organization that is targeted by a KM initiative. A KMS supports networks of knowledge workers in the creation, construction, identification, capturing, acquisition, selection, valuation, organization, linking, structuring, formalization, visualization, distribution, retention, maintenance, refinement, evolution, accessing, searching and, last but not least; the application of knowledge. The aim of which is to support the dynamics or organizational learning and organizational effectiveness [8].

In addition, Alavi and Leidner explained a KMS as a class of IS applied to manage organizational knowledge. It applies to support and enhance the organizational processes of knowledge creation, storage, transfer and application [9].

Based on Artificial Intelligence (AI) and relatively to intelligent systems, Knowledge Based Systems were introduced to focus on systems that use knowledge-based techniques to support human decision-making, learning and action. Such systems are capable of cooperating with human users. So the quality of support given and the manner of its presentation are important issues. Stelzer stated that KBS are hardware and software systems which aim at supporting a clearly defined task by using a specific form of knowledge representation; particularly rules, frames or neural networks, where knowledge is usually highly formalized excluding groupware and knowledge sharing mechanisms [10].

Besides, Avram remarked that using knowledge engineering techniques have been enabled KBS to develop. These techniques are similar to software engineering techniques by emphasizing on knowledge rather than data or information. The central theme in knowledge engineering techniques is the conceptual modeling of the system in the analysis and design stages of the development process. Furthermore, KBS have been embedded in search engines that remember previous searches, legal software, and social software–networking, automated pilots, medical diagnose, call centers, Computer Aided (CA) applications, and debugging tools [11].

Particularly Knowledge Based Systems are capable of being applied in Quality Control (QC) as the means of Quality Management. Hildebrand and Fathi proposed a knowledge based-quality control system by using resistance spot welding with fuzzy color processing [12]. Also Ansari Ch. and Fathi extended the idea to apply this system in Bio-Composite material [13].

III. **Knowledge Management Support in Quality Management**

To attain higher target-quality, it is necessary to have sufficient knowledge of processes, procedures and subsystems in each enterprise. In Quality Management most of available systems are not completely knowledge based. Therefore required practices such as analysis, detection, evaluation, modification, and improvement confront to problems in order to achieve higher customer satisfaction and demand.

In Figure 3 the role of KM in Quality Management especially for continual improvement is illustrated. Besides, Knowledge Management conducts and manages knowledge within a dynamic procedure which leads to continual and/or permanent improvement and insuring enterprises against risks.
Also Knowledge Management causes to consider all effective parameters in a right manner and right time simultaneously. KM determines procedural requirements and interaction between people, technology, especially information based systems, and enterprises. It analyzes procedures and evaluates current circumstances. This analyses and evaluations provide capabilities to make continual improvement for Quality Management. Additionally, integration of Knowledge Management in Quality Management leads to unification of strategy and action plans for each unit of enterprises. The sample of such integration is respectively presented and described in Intelligent Quality Management Process (IQMP) and explained later in section IV.

Furthermore, Housel and Bell stated that the multidisciplinary character of Knowledge Management combines several disciplines including business and management, computer science, cybernetics, and philosophy. Each of these fields may lay claim to the study of Knowledge Management. The field is frequently defined so broadly that anything can be incorporated. Finally, it is difficult to make sense of the many tools available. It is not difficult to perform a search to produce a list of more than one hundred software providers. Each of the software packages employs unique visions and aims to capture its share of the market [14].

Moffett and McAdam described the variety of Knowledge Management or Knowledge Technology tools by distinguishing between three kinds of them as collaborative, content management and business intelligence tools. Firstly, collaborative tools include groupware technology, meeting support systems, knowledge directories, and intranets/extranets. Secondly, content management tools include the Internet, agents and filters, electronic publishing systems, document management systems, and office automation systems. Finally, business intelligence tools include data warehousing, Decision Support Systems (DSS), Knowledge Based Systems (KBS) and workflow systems [15].

In summary integration of Knowledge Management supports processes of Quality Management. It leads to improve quality of products and services continually. The continual improvement supplies customer demand respectively. Therefore integration of Knowledge Management facilitates achieving higher customer satisfaction as the main purpose of Quality Management.

IV. INTELLIGENT QUALITY MANAGEMENT PROCESS

Fundamentally iteration can be assumed as the principle of Quality Management processes. For instance, the model of Intelligent Quality Management Process (IQMP) based on Knowledge Management is schematically illustrated in Figure 4. This model is composed of basic components of Quality Management processes which are colored in blue. These processes can be applied in activities like industrial Quality Control, health Quality Assurance or any means of Quality Management.

IQMP consists of a new component rather than traditional iterative processes named as Knowledge Management (KM)-component which is colored in yellow. It enables the entire procedure to improve continually based on its subsystems.

IQMP is described in iterative continual steps. Once a scope of Quality Management is determined and required knowledge, including high level of risk and uncertainties, and assessments of operation acquired, the strategy of operation will be established. It follows by executing of operation, and verification of outputs as shown in Figure 4.

A. Steps of Intelligent Quality Management Process

Each step of Intelligent Quality Management Process is meaningful. The first step is to prepare and initiate the Quality Management process. It consists of three phases such as scope, knowledge and assessments of operation. Stakeholders, customers or departments are the main parties involving in scope phase. They present their required specification and expectations from a product or service.

The second step is to determine and establish the strategy of operation. External preferences like financial issues are considered in this step. Here the process is switched back or returned to the first step based on any sorts of incompatibility between outputs of preparation and initiation step and strategy of operation.

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After confirming the compatibility; the second step proceeds to the third step named as action. At this point; the operation is starting to process e.g. production line. Generally any kind of operation outputs such as products or services are essentially required to be verified and validated by examination e.g. Quality Assurance. Hence, the fourth step is to verify and validate operation outputs. The products or services are accepted or rejected based on standards or predefined criteria.
Before starting the next loop, the entire process is surveyed and analyzed in Knowledge Management (KM)-component as illustrated in Figure 4. It receives outcomes of verification step to provide suitable decisions for scoping or strategy levels of operation, to store automatically all data or documents as records, and to enable IQMP to collect and manage data and documents. The subsystems of KM-component are shown in Figure 5.

While the process is returned and switched back based on any sorts of incompatibility for outputs of initiation step and strategy of operation, rejected outcomes are verified in KM-component to remove problems too.

KM-component receives documents or data via its agenda system. The agenda system receives acquired inputs and delivers required outputs from/to steps of the Intelligent Quality Management Process. It facilitates interaction between KM-component and other parts of IQMP.

Also Automatic Learning System (ALS) is dedicated to power KM-component in order to store received inputs in any forms of data or documents and transmitted outputs as records of IQMP.

As illustrated in Figure 5, agenda system transmits data to Data Warehouse (DW) to be used by DSS. Besides, it transfers documents to Document Management System (DMS). Documents are either used by DSS or used by text search engine e.g. by means of text mining.

The main subsystem of Knowledge Management-component is Decision Support System (DSS). DSS is combined models and data in an attempt to solve semi-structured and some unstructured problems. Hence it is used as the subsystem in KM-component to analyze outcomes of IQMP and to provide required or suitable solutions to improve the Quality Management issues continually within steps of IQMP. Independently from structure of DSS, it has an access to DW and DMS of KM-component to accomplish its tasks.

DSS is supported by the Rule-Based System (RBS). Because to analyze and examine inputs of IQMP we need to establish some rules based on applications of IQMP in each enterprise.

RBS is using a set of rules that specify how to act on the assertion set. These rules can be defined by simple if-then statements to examine the whole process of Quality Management. In addition, RBS is supported by inference machine to examine rules. If the information supplied by the process satisfies the conditions in the rules, actions are executed.

After finalizing the analyses in KM-component, results are sent to the target-steps of the IQMP in order to become improved or modified e.g. strategy of operation. Then the next loop will be started from the first step again. However its systematic behavior is changed in compare to the last loop.

So KM-component leads to continual improvement of Quality Management process. In other words, because Intelligent Quality Management Process is based on dynamic approach, the outcomes are improved according to modification of the whole process in the last step of each cycle. However the original first and second steps may continue depend on the evaluation step results. Desired results in evaluation step lead to save original status unless new scope or strategy of operation will be made.

In consequence, Intelligent Quality Management Process (IQMP) is based on the assumption that knowledge and learning skills are improved dynamically during repetition of Quality Management process by assisting Knowledge Management (KM)-component.

V. CONCLUSION/OUTLOOK

In knowledge era, enterprises need to acquire knowledge for achieving higher customer satisfaction. Most of the available systems are not capable to get learned during the Quality Management process to compensate the problems by using feedbacks from the previous stages.

Therefore the Quality Management process is not able to use explicit or implicit sources of knowledge. In such conditions; Quality Management has missed potentials to become knowledge based, and to consider dynamically all parameters within processes. Thus enterprises that are using Quality Management techniques are not able to fulfill higher levels of customer satisfaction.

As a result, enterprises require using Knowledge Management approaches, in both strategic and operational levels, to attain and sustain customer satisfaction.

The proposed sample of Intelligent Quality Management Process (IQMP) brings Knowledge Management into service for applying a dynamic procedure of analyses and modifications of an iterative Quality Management process. In this process, Knowledge Management-component plays the role as a controller. It receives, analyzes and uses data or information to be used in its subsystems. Then it transmits acquired knowledge for scoping and strategic levels of process to adapt with new conditions, decrease uncertainties / errors / risk factors, and improve the outcomes of the entire process.
Future research activities will focus on realization of the proposed idea of Intelligent Quality Management Process (IQMP), because dependent studies should be done to achieve an optimum model to integrate Knowledge Management in Quality Management.

REFERENCES


