The Method to Evaluate Relationship between Knowledge Automation and Employee Creativity

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Abstract

The central focus of the research is based on the demand of knowledge management framework by State Bank of Pakistan (SBP). The literature is reviewed on dimensions of knowledge, knowledge management, measuring knowledge, creativity and measuring employee creativity. Knowledge automation is one of the contemporary critical success factors of knowledge management. In this context, the study focuses on the connectivity between knowledge automation and employee creativity. The particular interest in this research includes developing Knowledge Automation and Employee Creativity (KAEC) mechanism for policy makers so that this mechanism can be included in knowledge management framework for strengthening organizational efficiency and effectiveness.

Keywords: Knowledge management, knowledge automation, measuring knowledge automation, creativity, measuring employee creativity

INTRODUCTION

The knowledge management area as a discipline has grown in academia and in research. Evidence from empirical research prove the connection of knowledge management with constructs like innovation, organizational performance, organizational culture, financial performance, leadership, competitive advantage, and creativity (Giampaoli et al. 2017). The continuous technological advances and the increase of global competition do not only bring opportunities but also challenges for organizations, to cope up with such transformations as need for more data-driven processes has increased (Semertzaki 2017). The data itself is an organizational asset, when data is appropriately managed and analyzed it supports in decision making process (Chang et al. 2019). In this continues changing world where the only constant is change, the need to turn data into information and information into knowledge is highly critical success factor for all sectors (Tian 2017).

The knowledge automation has become the part of intellectual business world now. Knowledge automation is a critical aspect of knowledge management, where focus is on the use of machines and software to automate knowledge. Organizations where knowledge is the driving force are using software and machine as a helping tool that help them achieving the tasks and processes automatically. To know how much machine is involved to achieve the task and complete the process, knowledge automation should be measured. Literature highlights the relationship between knowledge automation and creativity, so there is a demand of mechanism to evaluate knowledge automation and employee creativity in organizations. The mechanism will be beneficial for policy makers to deduce policy related to knowledge management framework, to rate the level of

knowledge automation, to measure employee creativity, and to evaluate the connection between knowledge automation and employee creativity.

The strategic plan of State Bank of Pakistan (SBP 2015), covers the five-year period starting from 2016 to 2020, is the 3rd plan of SBP. The title of this plan is 'Plan SBP Vision 2020' which is to help strategists focus on delivery of the important strategic priorities. The strategic goal six of the plan directs strengthening SBP's organizational efficiency and effectiveness. The tactical objective six focuses implementing a modern framework for retention and sharing of information and knowledge. The 3rd key activity of strategic plan is to develop a knowledge management framework. This research focuses on one of the key elements of knowledge management which is knowledge automation.

Knowledge workers deal with the right information to the right people at the right time for better decision-making process and embrace new challenges and opportunities in unpredictable contemporary organizations (Semertzaki 2017). Efficiently managing data is the key success of organizations. For quality management systems standards International Organization for Standardization (ISO) 9001:2015 has included the clause 7.1.6 on organizational knowledge (International Organization for Standardization 2015). The new standard organizational knowledge directs to the information that is used and shared to achieve organizational goals (Chang et al. 2019).

LITERATURE REVIEW

A literature review is collection of selected topics that must carry information to express point of views of the nature of topics. A critical literature review sparks understanding on the research topic; it allows researcher to work in an expert manner, to make informed decisions and to get benefited from available knowledge (Sekaran and Bougie 2016).

This chapter reviews literature of selected and related topics that gives an overview of topics required to understand knowledge, knowledge management process, measuring knowledge, automated knowledge, process mapping, creativity and measuring creativity. Moving from board to narrowing down, this literature focuses on measuring knowledge automation and measuring employee creativity. Different points of views are given from the approaches of many researchers. It discusses the essence of knowledge automation and employee creativity.

The literature review is structured on conceptual foundations. Starting from the concepts of data, information, knowledge, wisdom, automation, process, and creativity, moving towards knowledge management process, measuring knowledge, and focusing on creativity. The selected literature review is based on knowledge pyramid (Ackoff 1989), revised knowledge pyramid (Jennex and Bartczak 2013), SECI (socialization, externalization, combination, and internalization) framework (Nonaka and Takeuchi 1995), measuring knowledge, process in organizations and creativity tests. The literature review concludes by highlighting Automated Knowledge Management Model (AKMM), Bohn's eight-scale stages (Bohn 1994), process mapping, and employee creativity. The

Knowledge Automation and Employee Creativity (KAEC) mechanism is developed which helps to evaluate the level of automation in processes of organizations and measures employee creativity.

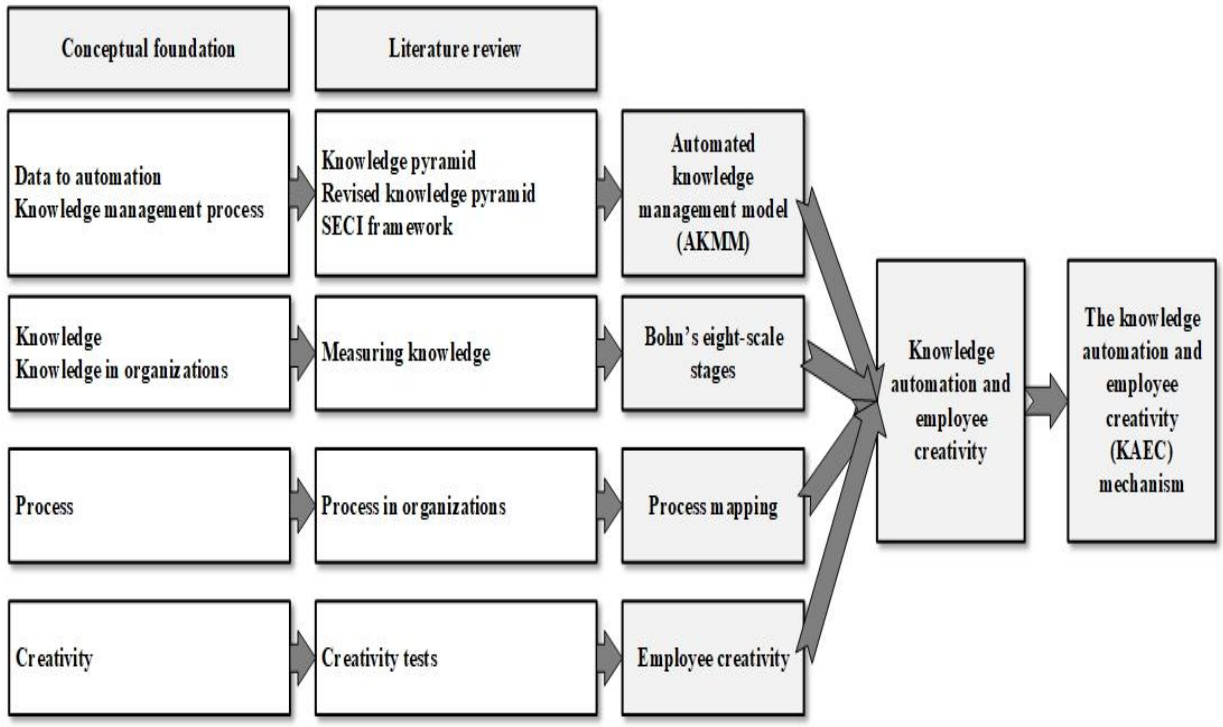


Figure: Structure of Research Paper

FROM DATA TO KNOWLEDGE AUTOMATION

Literature has discussed much about linking data, information, knowledge, and wisdom. Data, information, and knowledge are involved in any process of a system. The word 'data' in the literature is mostly used in an objective manner (Bosancic 2020).

Data, information, knowledge, and wisdom are the essential intellectual assets for the functioning of organizations. The process of knowledge creation goes through a range where data converts into information and information converts into knowledge (Semertzaki 2017).

One of the early thoughts discusses knowledge pyramid (Ackoff 1989) which states how data converts into wisdom. The knowledge pyramid (Figure) is also called the wisdom hierarchy (Rowley 2007) expresses the hierarchical relationships between data, information, knowledge, and wisdom. Ackoff (1989) defines data as the symbols of objects that convert into information after it gets processed, and information converts into knowledge after it gets scanned or filtered out, and the wisdom is the right use of knowledge which deals with the development and values.

Tian (2017) mentions knowledge pyramid works as a pyramid, data as a foundation reflects facts and figures, which can be organized for a purpose to convert into information and turning knowledge where it is referred into context.

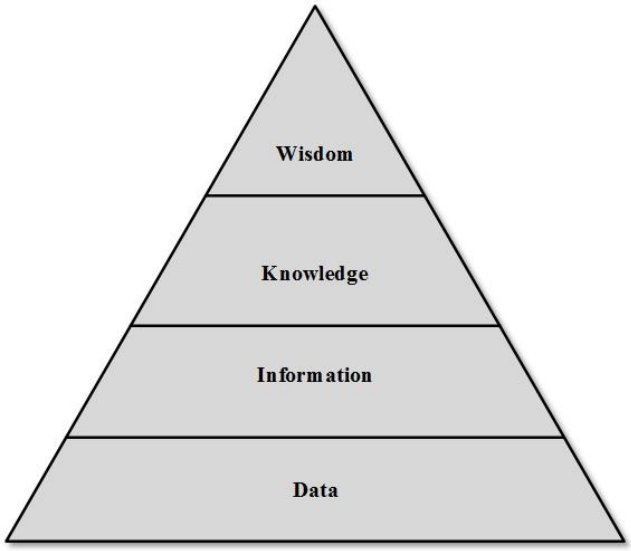


Figure: Knowledge Pyramid (Ackoff, 1989)

Rowley (2007) names knowledge pyramid as wisdom hierarchy and defines the relationship between data, information, knowledge, and wisdom. Rowley (2007) defines data as objective facts, figures, and observations, which is disorganized, unrefined, and unprocessed, and do not convey any specific meaning. Data turns into information when it has been organized so that it gives meaning and value to the recipient. The blend of data and information is called knowledge which includes expert opinion, skills, and experience, for the purpose of decision making. Wisdom is the stage after the creation of knowledge. It is the utilization of accumulated knowledge to create a higher level of understanding of the data (Semertzaki 2017). The accumulated knowledge is wisdom which allows to understand the application of ideas from one area to another situations or problems. The data, information, knowledge, and wisdom connect to each other, one definition connects and defines another definition.

The revised version of knowledge pyramid (Jennex and Bartczak 2013) expresses the connectivity between data, information, knowledge, and intelligence. The revised knowledge pyramid (Figure) replaces wisdom to intelligence and highlights that the gathering of data, information, knowledge, and intelligence as never-ending learning process whether in daily life or in organizations.

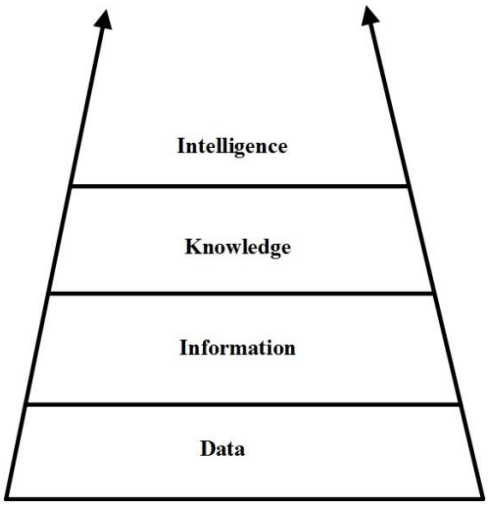


Figure: Revised Knowledge Pyramid (Jennex and Bartczak 2013)

Intelligence which is considered as the highest level of revised knowledge pyramid is extended with the knowledge automation. Intelligence can be automated and augmented (Rouse and Spohrer 2018). Intelligence is the ability to constantly apply the right decisions to acquire knowledge for action. Tang et al. (2016) expresses intelligence as skill of knowing what, when and why actions are valuable or unproductive. In another words, intelligence is recognizing when a decision is bad or good.

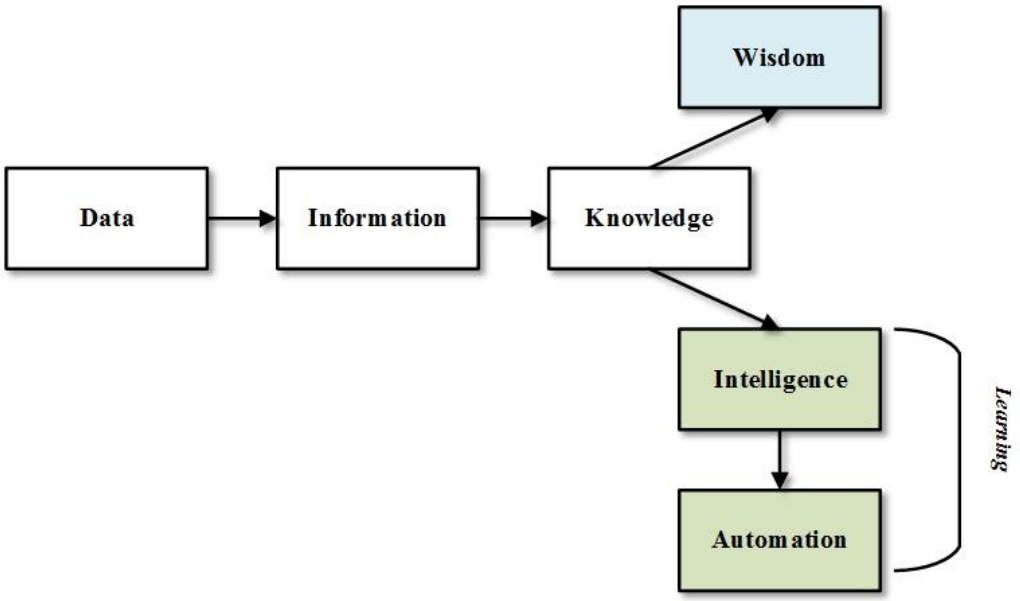


Figure: From Data to Automation (Source: Author)

The intelligence which is a continuous learning phase (Jennex and Bartczak 2013) turns into automation when machines and get involved. Thus, now the data turns into automation (Figure) as business analytics world is now using intellectual knowledge assets with the help of machines, software, and human intellectuals as well.

Knowledge

The definitions of knowledge emphasize from the perspective of functionality of knowledge in literature which highlight its value in problem solving and decision-making situations for achieving goals (Giampaoli et al. 2017).

Semertzaki (2017) defines knowledge as a combination of thinking processes mixed with the experiences, education, and the cultural and socioeconomic background of the holder. In organizations, knowledge is organized in different categories such as task related knowledge, organizational knowledge, and customer related knowledge (Rothberg and Erickson 2017). Starting from the early definitions of knowledge; Ackoff (1989) expresses knowledge is conveyed by instructions and answers to how-to question. Rowley (2007) defines knowledge as a data and information that is processes and organized to deliver understanding, experience, learning, and expertise as it applies to a problem or activity. In an essence, knowledge is built on information that is obtained from data.

When the only constant is change and uncertainty, knowledge surely leads the path of competitive advantage (Nonaka 1991). When knowledge is more critical to organization then it becomes more important to renew the knowledge dimensions (Hendriks and Vriens 1999). Thus, knowledge in organizations is all about managing the different categories of knowledge.

Categories and Types of Knowledge

According to Bornemann et al. (2003) knowledge is organized into three categories (Figure); knowledge psychology, knowledge holder and knowledge articulability.

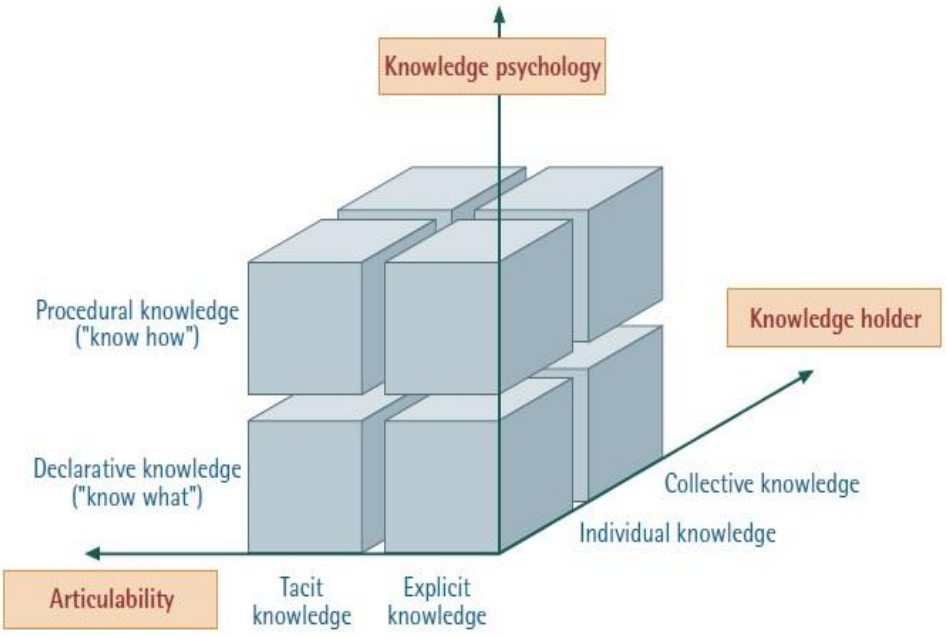


Figure: Types of Knowledge (Bornemann et al. 2003)

Knowledge Psychology: Procedural Versus Declarative Knowledge

Knowledge psychology distinguishes between procedural and declarative knowledge. Procedural knowledge is described as process knowledge, knowledge of 'know-how', knowledge about how to do something in a better way and knowledge about how things are done (Bornemann, et al. 2003; Dixon 2000).

Procedural knowledge comprises of actions, concerns the way actions are performed and is used to solve problems by moving problem from one state to another. When procedural knowledge is compiled into functional units, it gets converted into declarative knowledge (Alexander and Judy 1988).

Declarative knowledge comprises of information related to processes and objects which is also referred to knowledge of something, knowing something or 'know what'. (Bornemann et al. 2003; Alexander and Judy, 1988).

Knowledge Holder: Collective Versus Individual Knowledge

Another category of knowledge is 'knowledge holder' which differentiates between individual and collective knowledge. When a person possesses a knowledge that is what it is called individual knowledge which is not dependent on any context. Whereas collective knowledge is a knowledge shared by all individuals related to specific environment which includes knowledge of all individuals connected to that specific environment (Bornemann et al. 2003).

Knowledge Articulability: Tacit Versus Explicit Knowledge

The third category of knowledge is 'knowledge articulability' which refers how knowledge is expressed and explained. Knowledge articulability differentiates between tacit and explicit knowledge. Tacit knowledge is a knowledge that is not open to being verbalized, hard formularize, personal in nature, involving factors like values and belief, and difficult to communicate (Hendriks and Vriens 1999; Nonaka, 1991). Tacit knowledge is knowledge of knowing how to perform practical tasks which are usually not expressed and stated, and it is developed through informal learning, individual's own experiences or others' experiences and through lessons learned workshops. Explicit knowledge is a knowledge that can be articulated, expressed, and transferred to other individuals by the individual who holds the knowledge through formal language (Bornemann et al. 2003; Hendriks and Vriens 1999). In other words, explicit knowledge is a knowledge which can be captured, codified, and disseminated in a systematic way or in product specification or a scientific formula (Nonaka 1991). Rowley (2007) mentions explicit knowledge can be recorded in systems, whereas tacit knowledge cannot be recorded as tacit knowledge is in the minds of humans.

Automated Knowledge

The constant changes and advancements in information and communication technologies including the automation in processes have directed towards the generation and creation of huge data sets which requires contemporary methods for analyzing and managing data (Chang et al. 2019). Viewing firms as knowledge system help researchers and practitioners refine their understandings of what organizations are. The magic to achieve coordinated action does not only depend on gathering knowledge but also depends on searching and highlighting ways of staying connected and interdepending knowledge each one has (Nonaka 2005).

There is a high demand of use of automated technologies in society (Arthanat et al. 2020). Koh et

al. (2019) highlights the third paradigm of industry 4.0 is the augmented operator which emphasizes the technological support for humans and workers in system with higher flexibility that augmented operator addresses the knowledge automation in the system.

Automated knowledge is the converted procedural knowledge of processes which carries steps of completing processes. Automated knowledge extracts knowledge from information and recommends specific knowledge to specific client. The level of automation affects the entire process of work, starting with the given information and building the task representation (Liang et al. 2016). The knowledge of people is represented through symbols and then embodied in systems, when system encodes, decodes, and uses that knowledge it refers to automation (Gruber 1989). In other words when system represents people's knowledge it is called automated knowledge.

2.4 KNOWLEDGE MANAGEMENT

The term knowledge management is defined from many different perspectives in literature. Giampaoli et al. (2017) defines knowledge management as a strategy of attaining the related knowledge to the related people at the specific time and assisting people share information into actions for the purpose of enhancing organizational performance. According to Semertzaki (2017) knowledge management is concerned with the ability to collect, process, and use data to enhance tasks and processes which are held on daily basis in organizations and support long-term strategic planning processes. Knowledge management refers to the practices of generating, capturing, collecting, disseminating, and reusing know-how people create in organizations. Many organizations have realized that knowledge and its management are their competitive advantage. Knowledge management enhances the organization's performance and leads to the creation of new products bringing them profit.

Knowledge is widely recognized as essential competitive factor which can significantly support an organization's adaptation, existence, and performance (Sigala and Chalkiti 2015; Bohn 1994).

The value of knowledge management is recognized in the 1990s. Knowledge is considered as the base of creating innovation and competitive advantage as it can focus on challenges and opportunities which organizations face in global economy. For building and maintaining core competencies in organizations, knowledge management is focused for creating, validating, formatting, distributing, and applying knowledge in organizations to learn, reflect and relearn (Tian 2017).

Many organizations involve in handling and managing knowledge for leveraging knowledge both within the organization and outside to their shareholders. Nonaka (1991) highlights the secret of success of organizations as the unique approach to managing the creating of new knowledge. Successful firms use predefined ways to manage knowledge in technology driven contemporary organizations where focus is on globalization, technology, and industrial convergence (Santoro et al. 2018). The statistics show extensive research has been done on organizational knowledge, focusing the issue of managing knowledge to increase organizational benefit (Santoro et al. 2018).

Knowledge management identifies knowledge assets and then uses it for growing organization through a mechanism of capturing, identifying, creating, codifying, organizing and transferring intellectual assets that are crucial to the organization's performance related to knowledge intensive tasks (Rothberg and Erickson 2017). To create competitive advantage, knowledge assets are coordinated through knowledge management which obtains and uses resources through which

individuals obtain, access, and share the information to increase the level of individual knowledge (Uden and He 2017).

Different Concepts of Knowledge Management

According to Semertzaki (2017) knowledge management is the learning process through education and life-long training, the human knowledge is the basic component of knowledge management, and the information technology is a supportive factor of knowledge management.

Some of the early concepts of knowledge management states that it is the continuous process to accumulate the knowledge to satisfy the needs and to identify the existing capital and asset of knowledge. Knowledge management pursues assisting knowledge logistics to improve the efficiency of organizations and individuals (Guns and Välikangas 1997). The management of knowledge is further divided to create and develop novel knowledge, to maintain knowledge and to transfer knowledge from it. Knowledge management discusses the organized planning, monitoring, scheduling, environment and technology with suitable aims and feedback processes, to enable the sharing, retention, creation, identification and information measurement. Knowledge Management focuses on the activities of management related to knowledge such as organizing, sharing, creating, and expending knowledge for value creation in an organization (Wong and Aspinwall 2004). Knowledge management is a contemporary area of study that encourages maximizing innovation to organizations (Dayan and Evans 2006). Knowledge management indicates a sequence of processes and directives which allows creation, dissemination and institutionalization of knowledge to achieve the goals of organizations.

KNOWLEDGE MANAGEMENT PROCESS

The process of knowledge management is from concept to capture, to organize, to share, to transfer, to reuse, and to create new knowledge that facilitate knowledge management in an organization, such as knowledge acquisition, creation, utilization, application, storing, and sharing (Semertzaki 2017). Knowledge storage is where explicit and tacit knowledge is stored in different forms, attained by knowledge workers and individual networks (Ling et al. 2009). The arranged and structured knowledge makes accessing and distributing knowledge within the organization easier (Heisig 2009). The movement of knowledge is referred as knowledge transfer and organizations must use reliable channels to transfer tacit knowledge to explicit knowledge to have complete tacit knowledge (Gold et al. 2001). Another element of knowledge management process is knowledge application which focuses on actualization of knowledge and which can be used to adjust strategic direction and solve new problems (Newell et al. 2003).

Nonaka and Takeuchi (1995) explored knowledge management from the perspective of tacit and explicit knowledge concepts into the business world. The essence is that successful knowledge management process happens from the conversion of tacit knowledge to explicit knowledge and again from explicit knowledge to tacit knowledge through four modes of knowledge conversion; socialization, externalization, combination and internalization which is also called SECI framework.

SECI Framework

SECI (socialization, externalization, combination and internalization) framework (Figure) looks at

knowledge management from the type of knowledge and how it is created through exchange process and sets out the theory of making a tacit-to-tacit exchange (socialization), tacit-to-explicit (externalization), explicit-to-explicit (combination) and explicit-to-tacit (internalization), and is based on taking present knowledge.

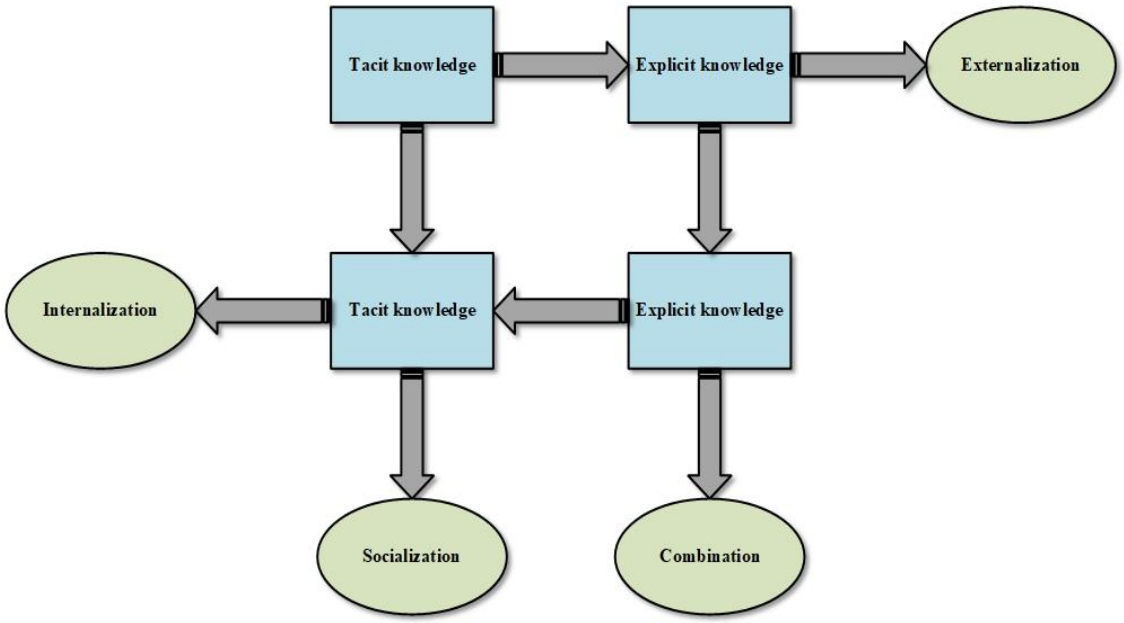


Figure: SECI Framework (Nonaka and Takeuchi, 1995)

Knowledge creation involves development of new knowledge or updating current knowledge with the organization's tacit and explicit knowledge through socialization and combination elements of SECI (socialization, externalization, combination, and internalization) framework in which new knowledge is created, shared, updated in the process.

The study of knowledge management represented by SECI is an important pivot in the study of knowledge dynamics and one of the most used and cited and currently is been combining with technological issues. In this sense, but considering a modification from the classic SECI model, Li et al. (2018) proposes adding the grey knowledge into the process of knowledge conversion tacit-to-explicit, including the modes of knowledge internalization through reflection and through systematization of knowledge. Following a process of validity and the adoption of Likert five-grade scale for questionnaires, the results exposing that the knowledge internalization by reflection and practice are the most important for individual innovation performance for the industries in China. In another study Natek and Zwilling (2016) proposes the use of technologies for supporting the knowledge conversion, as for example, in socialization, it can be used video-conferencing; for externalization, chat groups; in combination, repositories of information; for internalization, it can be used the computer simulations (Torres et al. 2020).

Rothberg and Erickson (2017) discusses SECI framework in terms of exchange situations, knowledge that gets exchanged and transferred within system, and emphasized none of these patterns generate new knowledge, but focuses on existing knowledge, the best ways to process it and the best ways to apply it. The knowledge transfer element of knowledge management process focuses on same perspective such as movement of tacit and explicit knowledge.

AUTOMATED KNOWLEDGE MANAGEMENT MODEL (AKMM)

Tian (2017) merged the concepts of creating knowledge, first using SECI model and second applying knowledge pyramid. Tian (2017) expresses in knowledge management practices knowledge creating is always considered major task through SECI model given by Nonaka and Takeuchi (1995) where knowledge is created by four-stage sequence linking tacit and explicit knowledge and knowledge is also created through the concepts of data, information and knowledge, often acts as knowledge pyramid.

Automated Knowledge Management Model (AKMM) (Figure) is developed by exploring the knowledge management process through SECI framework and linking the connection of automation through knowledge pyramid.

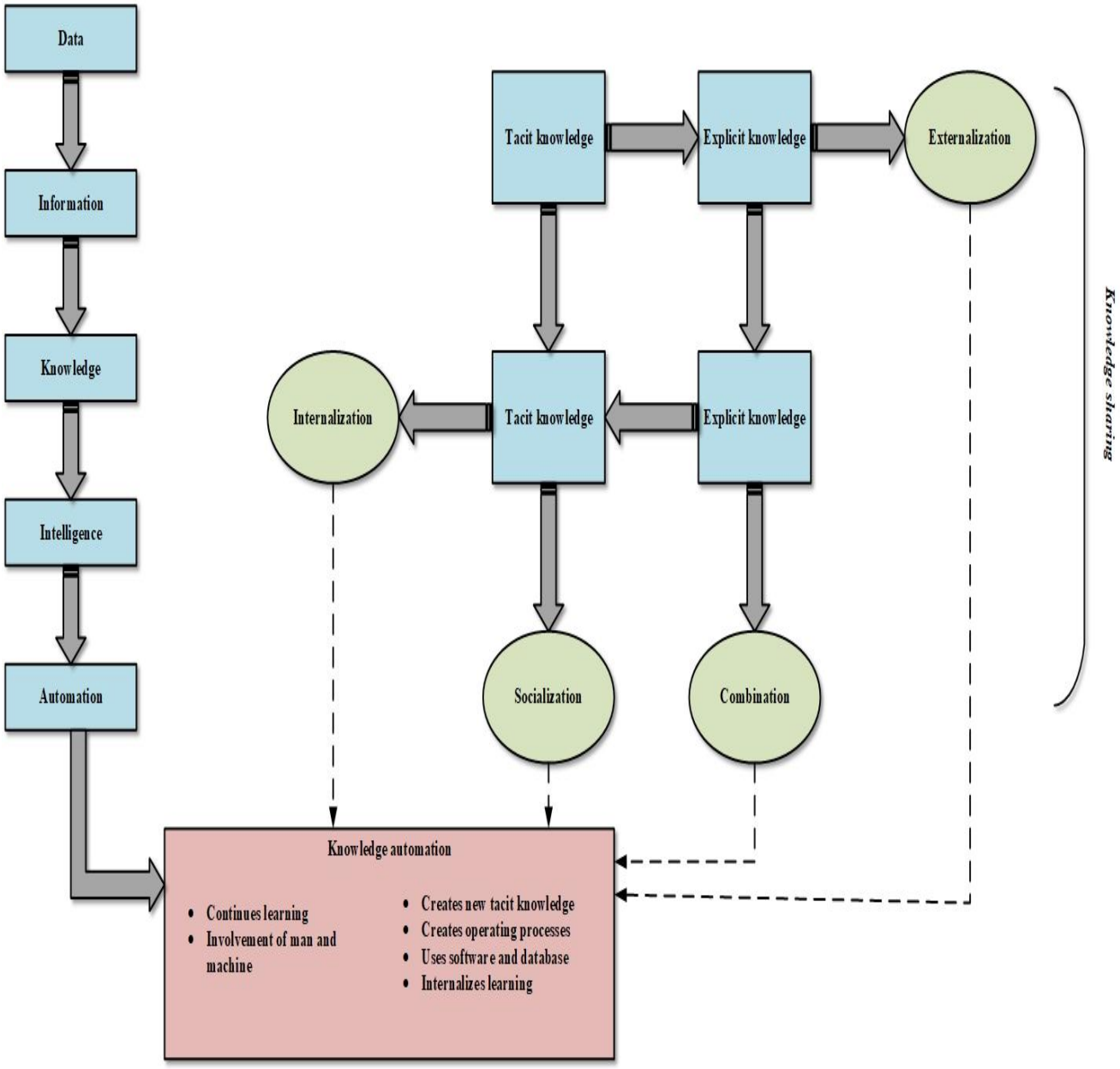


Figure: Automated Knowledge Management Model (Source: Author)

Discussing further about socialization, externalization, combination, and internalization (SECI) framework which is originally named the spiral of knowledge (Nonaka et al. 2000), the spiral of knowledge is named spiral because it is never ending process of generating knowledge. This circular conversation is known as the socialization, externalization, combination, and internalization (SECI) process (Takeuchi and Nonaka 2004).

Socialization phase includes physical interaction between knowledge workers with the help of lessons learned in the environment for creating new tacit knowledge. Externalization phase transforms tacit knowledge to formalized operating procedures and processes. Combination phases uses software and databases to facilitate the process. Internalization phase internalizes operating procedures into learning (Campanella, Derhy and Gangi, 2019).

Moving further into the concept of automation, Shekhar (2019) links automation with software along with machine that works on process automatically efficiently and effectively without any form of human interventions. When we look at automation from knowledge perspective, we usually see how much automated process possesses or carries knowledge to complete the task efficiently and effectively.

KNOWLEDGE MANAGEMENT AND KNOWLEDGE AUTOMATION

The essence of knowledge management allows to visualize the big picture and connect the dots of information for solving problem. Organizations that implement knowledge management enhance the ability to capture and incorporate information from many sources with the help of tools and techniques of data analytics or data science (Chang et al. 2019).

Knowledge management can lead organizations to "know what they know and what they don't know" (AlShihi and Zualkernan 2012). Moving from the information age to experience age, knowledge automation is becoming more significant area of study for future success.

Automation means having a software or hardware which automatically performs tasks or processes without any form of human intervention (Evans 1991). Industries where tasks and processes are repetitive, automation is used with the help of computers, control systems and operating equipment (Shekhar 2019). When repetitive tasks are performed automatically, it allows individuals to focus more on other intellectual tasks which require judgment and thought (David 2015). Employees get benefited from automation if the processes or tasks are complemented by automation (David 2015).

Knowledge Management has always discussed beyond doing with knowledge assets, identifying, using, and growing knowledge within organization. Interest has increased in several ways such as marketing intelligence, business intelligence, which have become more modern and contemporary version of wisdom. (Rothberg and Erickson 2017). Vallor (2017) has discussed the connection between wisdom and knowledge automation. Knowledge automation system plays an important role in building operation nowadays (Fan et al. 2015). For this study knowledge automation can be defined as knowledge about how much human and how much machine is involved in a process.

Regardless of increased discussion in research, still there is a lack of instrument measuring knowledge automation. To measure and quantify knowledge automation, the scale Knowledge Automation Measuring Scale (KAMS) is developed. The scale can be used to map, evaluate, and compare stages of automated knowledge in a process.

KNOWLEDGE MANAGEMENT IN BANKING SECTOR

The continuous and repetitive tasks are the part of banking activities. That is why it is important to have synchronization between technology and social process in banks. With the help of information technology and automated knowledge management processes, banking sector can boost their performances.

During the last years banks emphasized actively on manual processes. This was resulted creation of information systems within banks. These information systems helped banks to organize their

processes and resources. A failure of last information system is creation of massive amount of data and information, which resulted overload of information. This incident occurs when banks have quantity of surplus of information and they take time to search the related information and to choose the best to use. When there are the loads of information it could have like the consequence of the less reactive answers. As a result, the knowledge becomes more and more an imminent question of research in last periods.

It is significant that the usage of technology in banks and the social process of the use of technology are synchronized (DeSanctis and Poole 1994). With adapted policies, technologies can support to transfer knowledge and maximize the advantages of several initiatives of management (Ali and Ahmed 2006). The banking sector is one where high management practices are held and speed to cope with the competition is required by the international alliances in this business (Alhousary and Underwood 2016).

Abbas et al. (2013) concludes in the study that banking industry of Pakistan requires developing positive relationship between knowledge sharing and knowledge activities which can promote the knowledge creation process. Banking sector needs to be able to understand knowledge management better to find ways to practice knowledge management strategies for effective performance and for creating knowledge responsive culture. Abbas et al. (2013) mentions in the study that knowledge activities must be focused to increase the performance of banking sector.

CREATIVITY

The term creativity is connected since centuries from geniuses, artists, scientists, and philosophers. Albert Einstein's perspective on creativity reflects wisdom and vision through these famous quotes "Creativity is intelligence having fun" and "Creativity is seeing what everyone else has seen and thinking what no one else has thought". Pablo Picasso was curious about sustaining creativity which is clearly revealed by his quote "Every child is an artist; the problem is staying an artist when you grow up". Vincent van Gogh's perspective shows creativity is achieved by initiating and achieving small tasks, which is reflected in his famous quote "Great things are done by a series of small things brought together".

Many researchers have defined creativity from many different perspectives. The term creativity is applied on person, process, or product. According to Brem et al. (2016) a creative product is the result of either a creative process or a creative person which is considered to be an object. Giampaoli et al. (2017) mentions creativity has gained more attention in literature as it is the most important trait for organizational success.

Starting from the early thoughts on creativity, Stein (1953) states that a novel and useful work is creative work that should be satisfying in some point in time. May (1959) suggests a mindful encounter of humans with the connected objects is creativity. Hence, the early definitions on creativity focus on 'novel', 'usefulness' and 'mindfulness'. Torrance (1969) defines creativity is an ability of finding gaps, coming up solutions to solve problems, producing unique and novel ideas, and having a sense of connecting novel relationship between ideas. Adding further to the definition, Gruteen (1998) states creativity is about divergent thinking and the generation of ideas. A three-dimensional concept says that creativity must have novelty, usefulness and surprise (West et al. 2013), and another dimension of elegance is added to the definition of creativity (Cropley and Cropley 2005) mentions creativity is the ability to apply knowledge to solve problems.

Summarizing all concepts and elements, creativity is defined as the aptitude of coming up novel and unique ideas, identifying gaps, finding solutions, and solving complex problem with elegance and mindfulness.

MEASURING CREATIVITY

For measuring individual creativity, researchers have given scales and constructs usually based on self-assessed reports. Starting from the early creativity test given by Guilford (1967) names test of divergent thinking which measures creativity focusing on four elements originality, fluency, flexibility, and elaboration. Torrance (1974) presents the extended version divergent thinking named Torrance Thinking Creativity Test (TTCT) and added two more elements in his test, abstractness, and resistance. Khatena (1977) presents another test named Khatena-Torrance Creative Perception Inventory (KTCPI) which measures creativity by measuring artistic inclination, intelligence, individuality, sensitivity, initiative, and self-strength.

Another test named the adjective check list which carries 30-item scale and measures creativity level (Gough 1979) and then the widely used measuring tested Kirton Adaption-innovation Inventory (KAI) which measures the creative style (Kirton 1976). KAI has 32 items related to creative performance which measure personality dimensions such as ability to adopt, ability to innovate and so on. The summary of all these tests are mentioned in table

Table: Tests to Measure Creativity

Author	Year	Creativity Test	Measuring Parameters
Guilford	1967	Guilford's test of divergent thinking	originality, fluency, flexibility, and elaboration
Torrance	1969, 1974	Torrance Thinking Creativity Test (TTCT)	originality, fluency, flexibility, elaboration, abstractness and resistance
Kirton	1976	Kirton Adaption-innovation Inventory (KAI)	32-Item scale
Khatena	1977	Khatena-Torrance Creative Perception Inventory (KTCPI).	artistic inclination, intelligence, individuality, sensitivity, initiative, and self-strength.
Gough	1979	A creative personality scale for the adjective check list	30-item creative personality scale

Measuring Employee Creativity

Research is still providing evidences that tests mentioned in table 1 are valid and still widely in use. Many researchers have developed constructs, measures, and scales to measure employee creativity by considering early tests to measure creativity.

Employee creativity is the creation of useful and new ideas by individual employees (Zhou and George 2001). Creative employees use their voice to exhibit creativity, they propose new ways of doing things and make suggestions on improving things. Thus, creativity is the type of voice behavior and employees perform creatively with the expression of voice (Withey and Cooper 1989).

Everyone is naturally creative; we only need to create is a driving force to enhance creativity in human beings. Creativity is an analytical task (Gurteen 1998); every interaction in our lives is about creativity. The individual and organizational creativity play the driving force to create innovation.

Creativity is initiating new ideas and coming up with new ways of performing things which carries risks because the new ideas may not bring desired positive results (Zhou and George 2001; Withey and Cooper 1989). Literature suggests that useful feedback from colleagues related to handling task increases employees' interest in performing task creatively (Utman 1997). A useful feedback from colleagues increase the employee's perceived effectiveness of creativity; thereby it increases creative activities of employees (Zhou and George 2001).

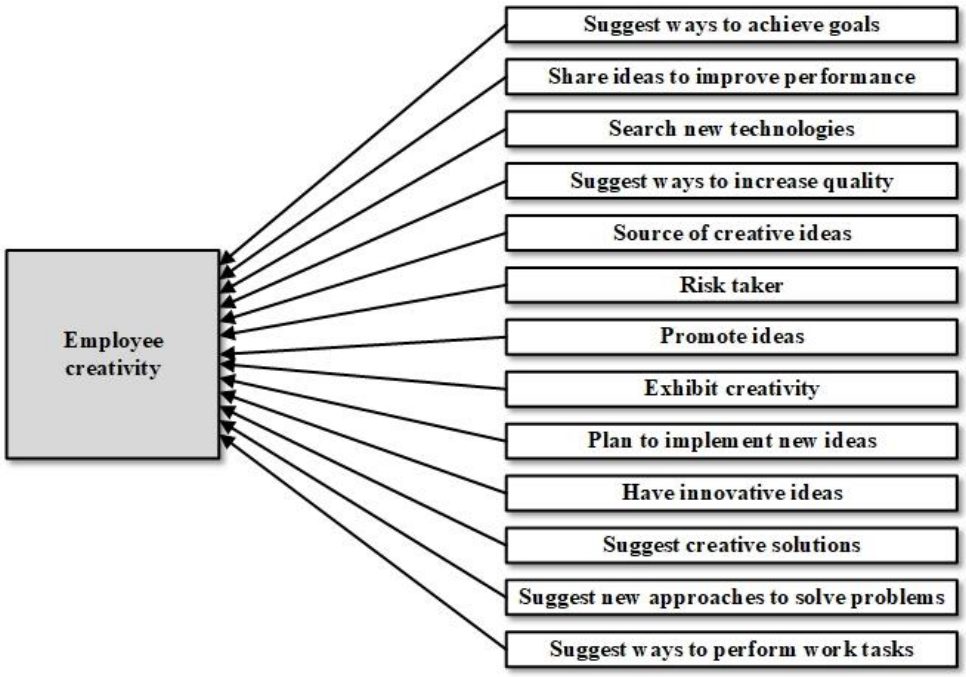


Figure: Measures to Measure Employee Creativity (Sigalaa and Chalkitib, 2015)

Sigalaa and Chalkitib (2015) conducted a research to measure employee creativity; their research has 13-item scale. These 13 items are based on the literature that discusses about employee creativity. The literature review in this section also highlights same measures and constructs which develops scale of measuring employee creativity. To measure employee creativity, questionnaire is adopted from research of Sigalaa and Chalkitib (2015).

KNOWLEDGE AUTOMATION AND EMPLOYEE CREATIVITY

Many scholars have focused the bond and connection between knowledge and creativity. From the perspective of knowledge management Chang et al. (2019) identifies three types skills in customer

focused organizations, interpersonal skills, organizational skills, and a blend of both. Creativity is a soft skill which is an important domain of performance specifically where knowledge is used and shared among employees. Knowledge sharing allows generating creative idea by establishing strong social capital which stimulates individuals to a divergent frame of thinking and brain storming (Rhee and Choi 2017).

A major challenge for information professionals and knowledge managers is managing knowledge assets to help organizations avoid reinventing the wheel. A challenge they face is to contribute to changing the mindset of individuals to enable knowledge sharing in organizations (Semertzaki 2017).

Botega and Silva (2020) states knowledge plays a very important role in the success of organization as managing knowledge on creativity is progressively significant to organizations create a competitive edge. Empirical evidence reveals that involvement of employees in SECI enhances individual creativity, individuals who engage in the process of knowledge creation and knowledge sharing are more creative (Baldé et al. 2018).

Literature provide many evidences related to knowledge automation and creativity. The summary literature (Table 2) highlights the connection between automation and creativity. The essence of these evidence proves that the increase in knowledge automation increases creativity.

Table 2: Summary Literature on Knowledge Automation and Creativity

Year	Author/s	Focus	Approach/ Method	Findings/Contributions
2020	Botega & Silva	Knowledge management and creativity	Prototype design	Designed a prototype of knowledge-based system to support knowledge management on the selection of creativity and innovation techniques for design.
2019	Muro et al.	How machines are affecting people and places	Backward and forward looking analyses	Impact of automation is studied from1980 to 2016 and from 2016 to 2030 of 800 occupations. Finding reveal automation will benefit people and will work as positive stressor.
2019	Kaiser	Creativity and automated teaching design	Exploratory method	The automated teaching design processes serve as creative problem-solving machines.
2018	Baldé et al.	Knowledge creation and individual creativity	Deductive approach	SECI model of knowledge creation facilitates the relationship between individual level creativity, team level intrinsic motivation and trust.
2017	Semertzaki	Knowledge managers and soft skills	Literature review	Competencies required by originations for knowledge professionals to embrace new challenges and seize new opportunities in the increasingly volatile workplace.

2017	Rhee & Choi	Knowledge management behavior and individual creativity	Deductive approach	Developed knowledge management behavior framework connecting individual creativity. Knowledge manipulation is positively related to individual creativity those with high social status.
2017	Giampaoli et al.	Knowledge management and creative problem solving	Deductive approach	Knowledge management infrastructure has the impact creativity. Knowledge management infrastructure enhance the capacity to find new creative problem-solving solutions.

THE KNOWLEDGE AUTOMATION AND EMPLOYEE CREATIVITY (KAEC) MECHANISM

The Knowledge Automation and Employee Creativity (KAEC) mechanism (Figure) assists to evaluate the level of knowledge automation, assesses employee creativity, helps to find the validity and reliability of knowledge automation and employee creativity, and evaluates the relationship between knowledge automation and employee creativity. The Knowledge Automation and Employee Creativity (KAEC) mechanism has five stages which will be beneficial for policy makers to deduce policy related to knowledge management framework.

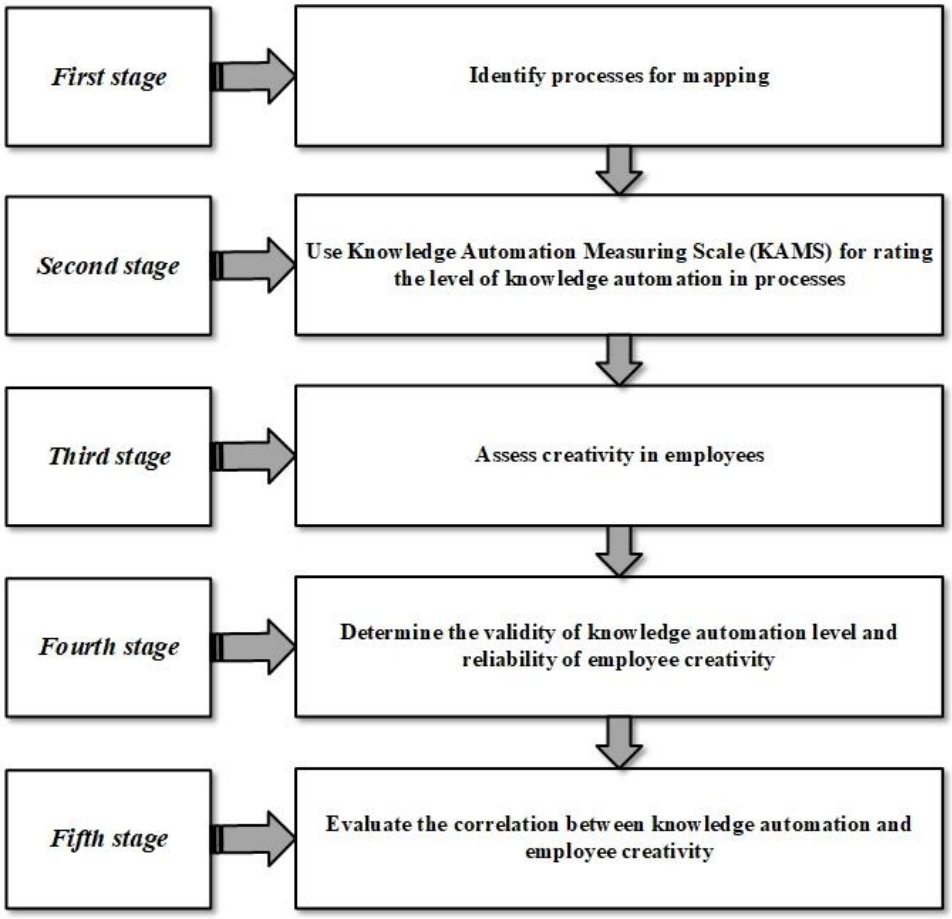


Figure: The KAEC Mechanism

The First Stage: Identify Processes for Mapping

The first stage of Knowledge Automation and Employee Creativity (KAEC) mechanism is to identify processes for mapping. In the first stage, from major processes of organizations top processes are identified for mapping.

The Second Stage: Use Knowledge Automation Measuring Scale (KAMS) for Rating the Level of Knowledge Automation in Processes

The second stage of Knowledge Automation and Employee Creativity (KAEC) mechanism is the use of Knowledge Automation Measuring Scale (KAMS) for rating the level of knowledge automation in processes. Knowledge Automation Measuring Scale (KAMS) is developed by Shaikh and Bhutto (2020) for measuring the level of involvement of machine in a process. With the help of Knowledge Automation Measuring Scale (KAMS) processes are mapped.

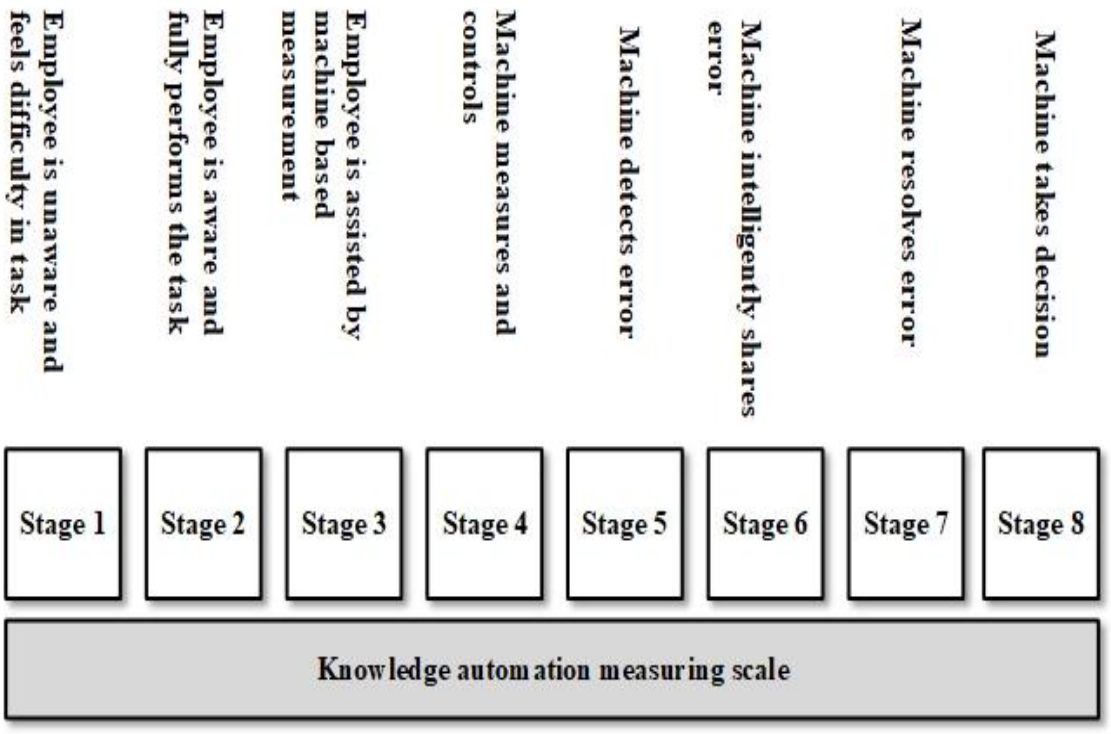


Figure: Knowledge Automation Measuring Scale (Shaikh and Bhutto, 2020)

The Third Stage: Assess Creativity in Employees

The third stage of Knowledge Automation and Employee Creativity (KAEC) mechanism is assessing creativity in employees. For assessing employee creativity 13-item measuring scale (Sigala and Chalkiti 2015) are adopted and rated on Likert's 5-point scale (Likert 1932).

The Fourth Stage: Determine the Validity of Knowledge Automation Level and Reliability of Employee Creativity

The fourth stage of Knowledge Automation and Employee Creativity (KAEC) mechanism is determining the validity of knowledge automation level and finding the reliability of employee creativity. In this stage content validity through experts is found and reliability statistics is calculated with the help of statistical analysis tool (SPSS 20.0).

The Fifth Stage: Evaluate the Relationship Between Knowledge Automation and Employee Creativity

The fifth stage of Knowledge Automation and Employee Creativity (KAEC) mechanism is to evaluate the relationship between knowledge automation and employee creativity. To find out the relationship between variables, ANOVA (Analysis of Variance) test is conducted by using SPSS (Statistical Package for Social Sciences). The relationship between variable are hypothesized and validated.

CONCLUSION

The literature review concludes by reviewing the literature on topics related to the study. The concepts on data, information, knowledge, wisdom, automation, process, and creativity, connects with knowledge management process, measuring knowledge, and employee creativity. The selected and necessary literature review is based on knowledge pyramid, revised knowledge pyramid, SECI (socialization, externalization, combination, and internalization) framework, Bohn's eight-scale stages, and creativity tests. Starting from broader areas of knowledge management and creativity, the literature review narrows down to knowledge automation and employee creativity.

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