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Personal Knowledge Management System Solution

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Dissertation presented as the partial requirement for obtaining a Master's degree in Information Management

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by

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Dissertation presented as the partial requirement for obtaining a Master's degree in Information Management, Specialization in Knowledge Management and Business Intelligence.

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ABSTRACT

Organizations are in race towards more effectiveness in overcoming any stumbling block that could get their way. They need the right directions in every step they will take towards their goals, so they seize any clue they can frame to know more, by using the principle of knowledge management in which they try to puzzle out any sources of knowledge and ways to utilize them effectively. Their ultimate goal is organizational learning by which they don´t fall by the same mistake twice or miss lessons from their experiences. It is impossible to think of organizational learning separately from individual learning, because as individuals get smarter, they will generate more productivity and effectiveness in organizational work. Personal knowledge management is the mean towards individual learning, it is about being responsible for the knowledge we need, seek, acquire, and use. Many activities and tools have been dedicated for PKM, but the effectiveness of PKM relies on the learning environment wherein the individual is continuously connecting to relevant information sources and learning within a social context. There are plenty of tools that facilitate the skills involved in the process of incorporating a working knowledge that brings value to our lives and the organizations we work in, but knowledge workers need one solution that combines all the necessary technologies to avoid the time and effort spent on transitioning from tool to the other to manage their knowledge. The social aspect of personal knowledge management highlights on the importance of developing and managing social learning networks, and how communities of practice play a big role in providing knowledge workers with the learning environment they need. The goal of this paper is to design a conceptual design of a personal knowledge management solution that can facilitate personal knowledge management activities which support knowledge workers' development of essential competencies to get innovative at solving problems and assist them in their professional development. To formulate the necessary functionalities for successful PKM system the design should meet certain objectives summarized from scholar's viewpoints on how successful PKM is achieved, and the needs of PKM practitioners.

KEYWORDS

Organizational Knowledge management, Personal knowledge management, organizational learning, PKM skills, PKM skills/tool fit, PKM process, interoperability

ACRONYMS

Community of Practice (COP)

Knowledge Management (KM)

Personal Knowledge Management (PKM)

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1 INTRODUCTION:

1.1 BACKGROUND AND PROBLEM IDENTIFICATION

Ego = 1/knowledge, “More the knowledge, lesser the ego. Lesser the knowledge, more the ego.” Albert Einstein. Trying to frame the sense out of this quote, led me to a conclusion that this formula makes more sense than we anticipate. The challenges organizations face when trying to harness individual´s cognitive capabilities in what so called knowledge management are due to a conflict of the ego of two parties. Organizations find it hard to adapt knowledge workers to slake organization´s thirst for knowledge, while individuals can´t simply adapt if they miss their gain in the process (Jefferson, 2006). If organizations can understand the gist of this quote and work the formula out, they will witness more effective knowledge management process flourishing across the organization (Pollard, 2008), (Pauleen, 2009).

Knowledge management is a term used to describe organizational efforts to tap the possibilities of new exploitable knowledge concealed in the existence of different knowledge artifacts that it tries to locate, synthesize, and make explicit for use, and re-use. Knowledge management looks past the people, for what they know and tries to do something with it. It treats people as knowledge-related assets that should be controlled (King, 2009) to not lose any piece of this asset and make use of it in the right context, at the right time, and place by examining the influence of organizational boundaries on the flow of knowledge to better set the right environment for organic knowledge creation (Nonaka & Konno, 1998).

Knowledge management is linked to organizational learning, and one way to conceptualize the relationship between the two is to view organizational learning as a goal for knowledge management (King, 2009), and subsequently knowledge management as a mean to improve organizational learning curve. However, the two has different focuses. Organizational learning focuses on individual, group, organizational, and inter-organizational as organizational learning units, and how they change as a result of experience. While knowledge management starts by looking for knowledge wherever it exists. So, it looks to individuals at what they own, and provide them with the organizational and technological basis for systematic knowledge sharing, which ends up in making them smarter by being exposed to many chances to learn from the flow of knowledge and a constantly growing knowledge base. Basically, the two leads to making individuals getting smarter as a key element for the success of the approach, but they differ at where they start that. Continuous organizational learning resembles existing processes in a learning organization that continuously seek effective ability to adapt to change (Örtenblad, 2001). The smarter individuals become, the more the organization learns (Pauleen, 2009). Learning organization prospers when its members develop more of critical thinking through learning.

Personal knowledge management is a term that organizations shouldn´t be allergic to as it describes the efforts of developing analytical, information, social, and learning competencies (Wright, 2007), as they seek, sense, and share knowledge , to take full responsibility for their own growth and learning (Smedley, 2009). Organizations should give up their ego that stands as hindrance to successful knowledge management initiatives, as most fail because people at all levels of the organization lack the feeling that they are part of the knowledge management initiative (Braganza & Möllenkramer, 2002). They want to grow with the organization, otherwise, it´s not a fair deal for individuals, and be able to learn according to their personal goals beside those of the organization. Instead of a top down

approach that leads back to the individual, organizations should reconsider its orientation towards effective organizational learning, and use personal knowledge management as a bottom-up approach to knowledge management (Pollard, 2008). Because, when individuals has more freedom in the definition of the knowledge they possess and use, they become more effective and capable of collaborating in organizational work consequently leading to improve organizational productivity and effectiveness (Jefferson, 2006).

In Nonaka´s view of organizational knowledge management (SECI Model), four main activities in the knowledge management process were defined that starts from the individual and grows vertically to different levels in the organization and horizontally beyond organizational boundaries (Nonaka, Kodama, Hirose Nishihara, & Kohlbacher, 2014). Socialization, Externalization, Internalization, and Combination are the main sub-processes in this model that explains how knowledge transforms in a relationship between tacit and explicit knowledge, and takes an exploitable aspect enabled by a third type of knowledge Nonaka calls the phronesis, where the organization witnesses organizational learning.

By empowering individuals in transforming their capabilities (Wright, 2007), by being responsible for their role in the process (Frand & Hixson, 1998), it will lead to an increase in the acceleration of organizational learning and it will be able to create the synthesis between knowledge creation and knowledge use.

1.2 MOTIVATION/ JUSTIFICATION

Work problems can´t be solved using routine solutions, because problems vary in terms of complexity by which there are different types of problems knowledge workers encounter that Wright described as routine, complicated, and complex problems (Wright, 2007). And, it´s an issue of ignorance that knowledge workers face (Schmitt, 2018), when they are confronted with novel problems. For Knowledge workers to develop self-awareness and realization of their limitations in solving novel problems as they occur, and be able to synthesize the knowledge available, and learn through the process. They need to develop some competencies to tackle personal knowledge work processes involving four interrelated dimensions: Intensive analytical processes, accessing and applying information resources, social interactions and collaboration as well as, continuous learning(Wright, 2007). Organizations should understand that innovation is the outcome of continuous development of these competencies.

It takes an effective personal knowledge management process to develop these competencies by developing some essential skills that scholars were keen to define through similar converging approaches. Although some are more oriented towards skills/activities centric definition of the process, and other towards exploring the role of technology in facilitating these skills (Cheong & Tsui, 2011), this is evidence of efforts to discover solutions toward effective personal knowledge management. These efforts should be consolidated and integrated into one guide built based on these solutions by understanding how these approaches converge in defining the PKM knowledge process, and the role of technology in this process.

Individuals feel of ignorance problem inflates as the number of intimidating and overwhelming sources increases due to overabundance of data and information. But this information explosion leads to a wealth of tools that offers plenty of possibilities to manage information in the service of personal development of knowledge workers, which in turn lead to more ignorance in how to unite the right set of tools to manage personal knowledge. The importance of personal knowledge management for

a dual organizational and individual development calls for the need to define the settings necessary for effective PKM, and the activities involved in the process to be able to provide a comprehensive solution that facilitate PKM and fits the needs of knowledge workers.

1.3 OBJECTIVES:

The main goal of this dissertation is to design a PKM system solution that can facilitate the development of individual knowledge work competencies and be able to integrate the individual knowledge management efforts.

The purpose of this thesis is to research into the essence of PKM, understand how effective PKM is achieved, and define the objectives for a comprehensive PKM system solution to be able to design such solution that have the necessary functionalities for successful PKM.

This aim can be achieved by the following objectives:
Objective 1: Understand how effective PKM is achieved by studying scholars' viewpoints.
Objective 2: Identify the activities involved in the PKM process by studying PKM practioners processe s.
Objective 3: Define the objectives for effective PKM solution based on scholars' viewpoints, and pract ioners needs.
Objective 4: Design a PKM system solution that fits the specified objectives.

2 THEORETICAL BACKGROUND:

2.1 ORGANIZATIONAL KNOWLEDGE MANAGEMENT VS PERSONAL KNOWLEDGE MANAGEMENT:

There are two main schools for organizational knowledge creation. Both see knowledge as a primary asset for the organization.

The first tries to tangibilise knowledge they identify in individuals, organizational routines, values, processes and store it in a knowledge repository made available for organizational employees based on their needs, but this approach witnessed so much resistance by employees who weren't able to get the knowledge they need from these systems. (Pollard, 2005) made interviews with resistors of an award-winning centralized knowledge resources system concluding the need for personal knowledge management. Because, employees are motivated for a knowledge management strategy that leads to their personal knowledge development rather than an information repository that does not quite serve that purpose (Pollard, 2005).

It has been criticized by the other school which claimed to work in Japanese organizations as stated by (Nonaka & Konno, 1998), who sees the western approach as valuable but limited, and that the organization needs a better approach that orientates the organizational efforts toward continuous knowledge creation and innovation. He proposes the SECI model for knowledge creation where he views the knowledge-creating process as a continuous interaction between two forms of knowledge: tacit and explicit, enabled by a continuous cycle of four subprocesses: socialization, externalization, internalization, and combination. Socialization is when individuals share what they know (tacit knowledge) to create valuable knowledge. Externalization is when the contradicting views of individuals clash, which leads to the synthesis of what is assigned valuable and most fit to the situation by managers. This externalized explicit knowledge should be put to use and combined with prior knowledge through (combination), then internalized: learnt by the individuals(internalization); which leads to grow their tacit knowledge, and what so-called spiral goes on.

(Nonaka & Konno, 1998) emphasizes on describing the environment of the knowledge-creating organization as an enabler of Ba states, which is a social state that can be physical or virtual that puts individuals' tacit knowledge into context through the knowledge-creating process to create new knowledge. Also, Nonaka's approach had so much criticism, one which limits its cross-cultural applicability, another one which points out the lack of defining the role of the individual in making the tacit explicit or internalizing the explicit, and how the created knowledge can be reusable (Bratianu, 2010). The notion of converting tacit to explicit is argued to be flawed as tacit knowledge with an emotional aspect to it cannot be easily converted into explicit knowledge which is bare from emotions (Bratianu, 2010), and that Nonaka didn't take in mind other distinction of knowledge which differentiate reflective knowledge from non-reflective knowledge and the stickiness of knowledge that interferes with the transfer of tacit knowledge from one person to the other or converting it to explicit (Szulanski, 1996). Then, internalization (learning) process that Nonaka didn't consider the incremental, path-dependent nature of knowledge development (Powell, Thomas, McGee, & Soreze, 2007).

Both approaches try to put the individual knowledge into practice, the first by making available a knowledge repository where knowledge workers can learn from it or contribute to it, the second one relies on an ideal environment where knowledge can be continually and incrementally converted between tacit and explicit. Neither one highlights on how individuals learn from experience or develop the skills necessary to do work activities and deal with complexities or how they situate themselves in their social sphere. What's nice about Nonaka's model is their emphasis on socialization to prosper innovation, and how knowledge is valuable when put in context.

While organizations are trying to work an approach to make effective knowledge management strategies, individuals are facing two hard facts: the abundance of information, and change in the nature of work (Pauleen, 2009). Employees at any organization are valued with what they know, and they try to meet the demand of today's jobs that are highly demanding. While organizations have risen the ceiling to the level of expertise their employee should possess. Jobs at entry levels are either for routine jobs which are most likely to hold pause of the personal development process of the individual or open the possibilities for those who don't fall to this routines and develop themselves to fit other possibilities in the job market. Employees try to keep relevant, so they are in continuous search for relevant knowledge. Individuals aspire self-development more than organizations are aware of, but they are already dispersed with so much information they try to work their way into every day to fall to the illusion that accumulating too much information is the answer to all their problems, while the fact is lack of proper management and use of this resources increases stress and distraction (Rock, 2010). This leads us to the importance of personal knowledge management, by which individuals are responsible and aware of how to locate their information resources and develop the expertise necessary to find a balance between achieving professional and organizational work.

2.2 WORKING KNOWLEDGE

Knowledge is different from data and information (Ackoff, 1989). Many people confuse information with knowledge (Davenport & Prusak, 1998). Knowledge is an outcome of the mind processing information and data that get absorbed by human senses through perception which is a way the mind handles the sensory data or information as they make sense to the mind (models of knowing in the mind), so information doesn't get stored as it's inputted, but according to the logic of the mind, it doesn't yet lead to knowledge. Then, the mind transforms the input through the thinking process by relating it to prior knowledge, and when the internal models of what has been learnt develop to shape an understanding and meaning which a person can rely on, it becomes knowledge. Because internal models in the mind are perceptual in the sense that they are shaped by the mind logic, which may not be true or justified to match reality. I am not arguing here that it should match reality exactly, because it is hard to match reality, but it's about getting closer. So, it's knowledge when what you know is reliable, by which we can use to interpret and incorporate new experiences and information, some call this reliable knowledge working knowledge (Davenport & Prusak, 1998).

(Davenport & Prusak, 1998) has a convincing definition of working knowledge by stating that the value of knowledge is measured by the decisions and actions to which it leads, and it develops through experience by incorporating what works and what doesn't work, it's more like getting closer to reality, by which expertise develops, as experience alter the perception of what might happen to what really happens, it's what he calls ground truth that is acquired by reflecting on experiences

rather than on theories, and that the more we know the more we can deal with complexity and avoid the illusion of accuracy and develop intuition.

So, how does this working knowledge develop?

Individuals have only limited time, and attention, and in the information age distraction is a serious problem. With all this information stimulating our attention, how much of it do we devote to develop working knowledge? Psychologists suggest that attention is either driven by stimulus, or by goals (Crawford, 2016). So, we don't develop working knowledge by chance, and we need to set goals and decide how much effort we're going to consume toward those goals. Personal knowledge management was proposed to guide individual's efforts to make use of information resources and create knowledge.

For realizing the value of personal knowledge management and define the concept in the righteous context we need to start by looking at entities concerned with the value of personal knowledge management for continuous development. The individual is the main element in the personal knowledge management ecosystem where effective personal knowledge management is argued to be a development engine for individual's competencies to thrive in an organizational and societal performance (panel & Schmitt 2016).

2.3 THE VALUE OF PERSONAL KNOWLEDGE MANAGEMENT IN ORGANIZATIONS:

Organizations have been counting on the concept of KM to fructify a workable framework that would guide their initiatives towards effective organizational learning process for so long now. Organizational Learning aims to develop the organization to the state of a learning organization characterized by strategic development or strategic renewal (Crossan, Lane, & White, 1999) by which it learns and develop through experience the ability to compete through complex unpredicted business environment. It is the ability to explore and learn new ways while concurrently exploiting while learning. Conditional criterion for strategic renewal is the continuous motion of exploration and exploitation. Nonaka (Nonaka et al., 2014) emphasizes that organizational development cannot be achieved if organization either explore or exploit, and that they should do both at the same time.

Both complement this condition where Nonaka (Nonaka et al., 2014) defines it as a synthesize between exploration and exploitation and (Crossan, Lane, & White, 1999) as a tension between feed forward exploration and feedback exploitation, which gives new organizational knowledge a justified aspect.

(Crossan, Lane, & White, 1999) illustrates how this is achieved through a process imputed by individual's intuition which leads to organizational strategic renewal through four dynamic processes of intuiting, interpreting, integrating, and institutionalizing that links individual, group, and organizational levels where organizational learning takes place. **Intuiting** is a uniquely individual process and happens preconsciously when the individual recognizes some patterns or possibilities inherent in a personal stream of experience (Weick 1995). Then individual tries to make sense of it through **interpreting** it by conceptualizing it through cognitive maps and realize it as an idea of value to be further advanced and developed effectively when communicated with others through words or actions. This happens at group level where multiple viewpoints arise to define more of the essence of the idea to be oriented to drive actions and understanding through **integration** by developing shared understanding among individuals and of taking coordinated action through mutual adjustment and if

the coordinated action taking is recurring and significant, it will be **institutionalized** by ensuring that this new knowledge get embodied into organization's systems, structures, procedures, and strategy.

Drawing from highly cited scholars' views on organizational learning we conclude the following key points:

1- Individual experiential intuition and rational insights are the fuel for organizational learning (Crossan et al., 1999).

2- Effective judgmental interpretation is achieved and highly dependent on cognitive maps of the interpreters which depends on the environment within they operate. (Peña, 2005).

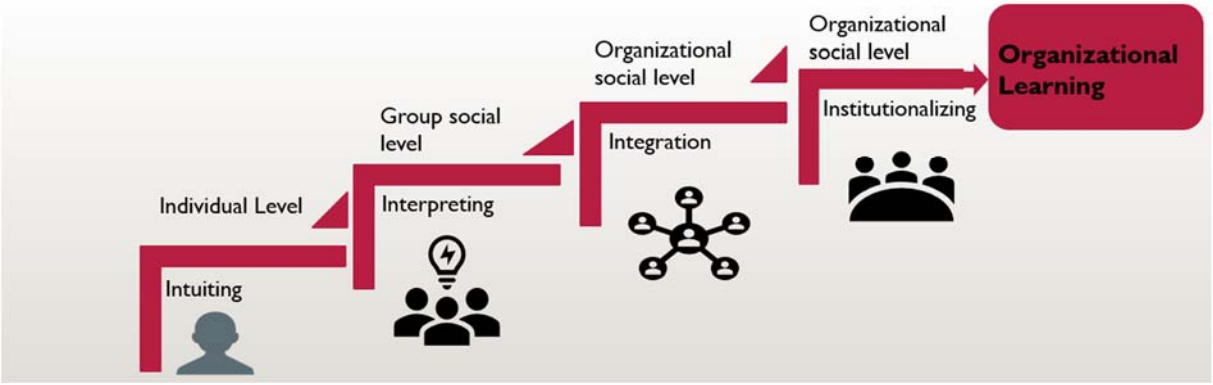
3- Coordinated dynamic social context represents the interactive spaces of interpreter's cognitive maps that is highly interdependent on the environment within it operates.

4- The development of collective intuition and interpretation involves drawing advice and experience from other people rather than from sources of explicit information (e.g., books or manuals. (Crossan et al., 1999).

5- Exploitation is vital for the justified aspect of the new knowledge and Exploitation feedback is also an individual process and rely on individual rational insights, interpretation of data and possible interventions (Crossan et al., 1999).

6- The exploitation aspect of knowledge is defined by the social context through which it is created(Nonaka et al., 2014).

What we may conclude from the above points is that the sustainability of organizational learning and strategic renewal depends on a learning environment that enable emerging self-organized social contexts through which individuals interact and create knowledge with those with valuable interpretation capacity and expertise to rely on. The dynamic social context to be effective will have an interpretive capacity related to the makeup of the group and to the group dynamics (Hurst , Rush , White, & 1989). Also, valuable interpretation capacity and informing sources extends organizational boundaries, which requires a learning environment that is characterized with openness, and the individual should be free to explore external sources and be an agent of an open knowledge society.



Concept model based on Organizational learning theory (Crossan et al., 1999).

We further conclude the role of the individuals in the organizational learning process and later through literature review we define the key competencies imposed on them to enable each of the underlying processes:

1- **Experiential intuiting:** This process depends on individual cognitive maps developed through learning from experience. For its organizational value to be realized intuition should be triggered by organizational context. Individual intuitive ability to recognize a situation at hand relies on the more variations of situations they've experienced with relevant association to the problem situation. This implies on the individual the need to learn and develop effective understanding of situations. Collective intuition addresses this issue and the need of a more comprehensive solution and to assure the ability of individual's intuition to conceive a reliable solution, but this is also dependent on each individual cognitive map domains and the assembly of complementary intuitive abilities.

2- **Interpreting:** It is another individual process that have been described in the context of organizational strategic renewal (Crossan et al., 1999), and it counts on individual's ability to externalize (Express) their intuition and develop it to feasible possibilities through communicating it with others through (Socializing) which leads to synthesis of collective knowledge through ongoing sense making and reflection of the participants interacting within the same social context. The effective development of this intuition is dependent on the nature or texture of the domain within which individuals and organizations operate and from which they extract data.

3- **Integrating:** The value of new knowledge and the justified aspect of it is realized in the integrating process which is also an individual process where individuals' role is to learn the new knowledge and integrate it in their values and actions and the utilization aspect of this process allows more judgmental feedback that feeds back the new knowledge.

The intuiting, interpreting, and integrating processes are continuous in the dynamic context they create, develop, and inform through personal knowledge management activities that take place at the individual level. The nature of knowledge calls on the need to nurture it by creating logical associations among cognitive maps and the essential need for exploitation to

justify these associations within knowledge which depends on the environment through which social contexts emerges.

We can draw from above that three activities continuously and interactively take place:

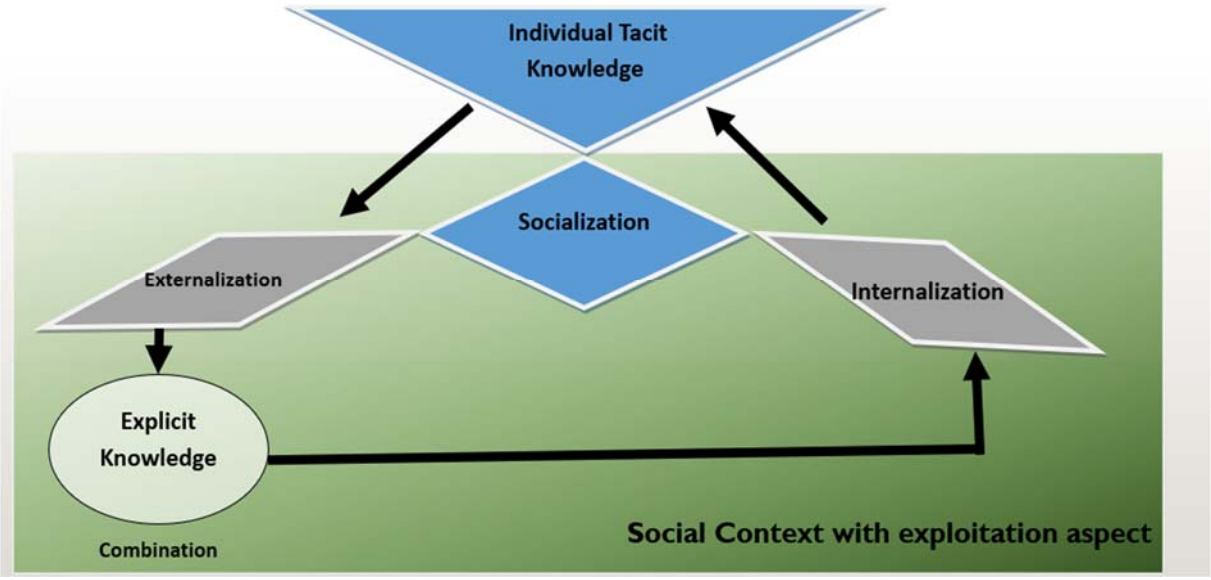
1- **Individual learning**

2- **Individual externalization**

3- **Individual socializing**

Note that these activities are interdependent, and this is due to the nature of knowledge created as a result of the continuous process that encompasses them.

- Individuals' intuiting and interpreting ability depends on continuous **internalization** of relevant knowledge from the environment around them and **socializing** is an important facilitator and enabler for individual learning (Jarche, 2012).
- For this Internalization process to be affective in improving individual's cognitive maps, the individual must continuously **externalize** and interpret his knowledge and that is enabled by his social sharing ability (**Socializing**) within a social context.
- By continuously externalizing the individual's explicit knowledge that is being created and developed from interpreting and making sense of various models of existing explicit knowledge the process leads to new **combination** of knowledge.



A zoom in to the knowledge creation process described by (Nonaka & Konno, 1998).

From a summary of the activities discussed above and based on Nonaka's Ba concept (dynamic context with exploitation aspect) as an enabler for continuous knowledge creation through four subprocesses (socialization, externalization, internalization, and combination), I developed the above conceptual model that zooms into the knowledge creation process at the individual level (Nonaka & Konno, 1998).

The activities involved in the knowledge creation process have been defined by Nonaka as subprocesses of continuous spiral of knowledge creation process at organizational level that take place in various bas (Nonaka & Konno, 1998), but as we can see these processes are individual interdependent processes that lead to individual learning and development as well as knowledge creation and doesn't have to be in an organizational context.

We understood that organizational learning and strategic renewal is the result of individual Externalization, Internalization, and Socializing activities within social contexts. The effectiveness of those activities depends on the learning environment wherein they take place. Individual personal development depends on these activities as well. The activities underlying Externalization, Socialization, Internalization, and Combination subprocesses need to be defined as well as the characteristics of the learning environment.

The environment where individual activities span affects the nature of those activities (Crossan et al., 1999) as well as the dynamic context by which knowledge is created and justified (Nonaka & Konno, 1998).

It's the responsibility of the individuals to strategically develop themselves (Pauleen, 2009) and to actively participate in contextual learning. Personal Knowledge management is a concept that draws on this necessity and scholars have expressed their views on what does PKM entitles where some have described the competencies needed by the individual (Wright), others have listed some skills (Avery, Brooks, Brown, Dorsey, & O'Conner, 2001), while (Cheong & Tsui, 2011) have summarized scholars contributions and concluded a dynamic framework. Some have shared it as process they've been practicing in their professional development (Jarche, 2012), and another practical study was conducted on digital nomads PKM activities and the enabling environment they continuously seek (Digital Nomads). (Chatti, 2012) has a different view where he defines PKM as personal knowledge network composed of Internal theories in use and external network of knowledge artefacts and the ecologies that emerge on top of this Network. (panel & Schmitt 2016) have contributed the most to personal knowledge management and has been developing a general-purpose solution for knowledge worker that meets the criteria for personal development based on PKM4D framework he proposed to validate his work.

2.4 PERSONAL KNOWLEDGE MANAGEMENT DEFINITION AS A SUMMARY OF LITERATURE REVIEW

From literature we can define personal knowledge management to summarize our understanding of how scholars describe it; "Personal knowledge management encompasses all the activities that lead to personal learning and development of individual's working knowledge, the nature and effectiveness of these activities rely on environmental conditions that affect the motivation and support needed to learn (panel & Schmitt 2016), the relevance and affordances of information needed (Jarrah i et al., 2019), and most importantly enablers for continuous externalization of one's cognitive maps (Expression) in proper social contexts that allows its interpretation and synthesis with

other's cognitive maps which leads to its development through (Learning) internalization as a result of sense making and self-reflection. Working knowledge develops if the dynamic social context (Ba) (Nonaka et al., 2014) (Chatti, 2012) through which the individual is continuously interacting is capable of validating the value of exploration outcome with exploitation feedback".

Let's break this definition into the statement they impose to look into how I developed such definition of personal knowledge management from reviewing scholars view of this concept. The definition breaks down to the following statements:

-PKM is all the activities that lead to individual personal learning and development (Jarrahi et al., 2019), (Avery et al., 2001), (Jarche, 2012).

So, based on that we need to look at those activities and how they can be facilitated.

- It relies on an environment that support learning and professional development (Chatti, 2012), (Jarrahi et al., 2019).

It is important to understand the characteristics of a learning environment, the role of the individual in this environment, and how does it serve his learning journey.

- PKM depends on the ability to find relevant information sources efficiently.

Due to information overload, knowledge worker is challenged to overcome distraction and be able to find information sources that are relevant to the context through which the individual is seeking and validating information. It is necessary to look at those challenges and how is the knowledge worker able to overcome them. (Jarche, 2012), (Chatti, 2012),(Jarrahi et al., 2019).

- PKM activities lay in continuous externalization and internalization process that takes place in an emerging dynamic social context and one's learning capacity and development cognitive maps are affected by cognitive maps of those he socializes with (Crossan et al., 1999), (panel & Schmitt 2016),(Chatti, 2012).

Since individual cognitive maps develop as a result of reflecting on and making sense of interaction of other's cognitive maps, it is important to understand how individuals can strategically achieve such learning states where they express their information in relevant contexts while collaborating and learning from relevant sources.

- Utilization of information in necessary and is defined based on the social context by which individual is interacting.

Individual working knowledge or problem-solving capabilities cannot be achieved without putting information into utilization context. (Nonaka et al., 2014), (Chatti, 2012), (Jarrahi et al., 2019),(Crossan et al., 1999).

To expand on the statements above we'll go through scholars view on personal knowledge management that resulted in the previous definition of personal knowledge management.

2.5 FIVE AREAS OF FOCUS FOR PERSONAL KNOWLEDGE MANAGEMENT (PAULEEN, 2009):

(Pauleen, 2009) highlighted 5 practical areas of effective PKM:

1. Developing a personal knowledge management strategy to: anticipate, explore, find, connect, learn, act.

2. Lifelong learning based on future goals and self-interest.

3. Communication and Interpersonal skills as enablers of **self-expression**, **perception taking**, **reflection and interpretation**, and **social knowledge networking**.

4. Use of technology and the ability to deal with information overload through information literacy and personal library skills.

5. Forecasting and anticipating through continuous research and effective information management.

Note that (Pauleen, 2009) emphasized on the interrelation and interdependence of these areas and the need for strategic synergy of the corresponding activities by applying them in a context of strategic self-development.

2.6 SEVEN PERSONAL KNOWLEDGE MANAGEMENT ESSENTIAL SKILLS (AVERY ET AL., 2001)

Beside definitions, they also expressed some models and skills they believe are the guide to personal knowledge management. (Avery et al., 2001) skillset for effective personal knowledge management system is a quite interesting, as he highlights on 7 essential skills:

1. Retrieving information: which entails strategically gathering information from different sources, be it an electronic source or through experimentation and oral inquiry. It's an iterative process to capture relevant information.

2. Evaluating information: it is like a filter where information is filtered to help retrieve relevant information. He suggests that the intelligence use of simple electronic tools such as "relevance raters," can be relevant to the effective evaluation of information.

3. Organizing information be able to make the right connections between prior and new knowledge.

4. Collaborating around information: it depends on the communication skills and can be facilitated by use of current communication technologies.

5. Analyzing information: developing understanding and meaning of retrieved data or information.

6. Presenting information: An effective presentation assumes "not only an understanding of audience, but a clear understanding of the purpose of the presentation as it relates to audience".

7. Securing information: by developing and implementing practices that help to assure the confidentiality, integrity and actual existence of

information.

2.7 PKM SEEK, SENSE, SHARE FRAMEWORK (JARCHE, 2012)

(Jarche, 2012) view on PKM developed through being a practitioner and his PKM process has been developed over years of awareness and perception of personal knowledge management and drawing on best practices in this field through his own professional journey. His model of the process is manifested in the following interdependent processes:

1- **Seek:** building personal network by connecting to relevant information sources of people and content which serves many functions:

- informing space which enables flow of relevant information.

- incubator for interpreting conversations and highly interdependent with the sense making process.

- a source of support and motivation and a door to new possibilities.

This process counts on continuous *filtering* and *validation* activities based on some criteria.

2- **Sense making:** Expression of our understanding and thoughts of a subject through conversations are fundamental activities for sense making.

This process puts knowledge into context through ongoing conversations, interpretations and reflection that enable development of new knowledge and validation based on exploitation feedback. Here Harold emphasizes on the importance of *utilization* of new knowledge. Through this process knowledge worker is continuously *validating* and *synthesizing* new knowledge.

3- **Sharing:** It is important for knowledge worker to be appreciated as a contributing node in the social sphere in order for the functionalities of their social networks to be achieved.

(Jarche, 2012), personal knowledge management process is a result of constant navigation between three types of networks: the collaborative network which is formal socializing with teams and colleagues to solve work problems or accomplish organizational goals, communities of practice that can change your practice by gathering with other individuals on mutual learning goals and share freely what you know for all of you to widen your scope of understanding on certain subject, and social networks are the long-term relationships you build to explore diverse opinions, ideas, and opportunities.

2.8 PERSONAL KNOWLEDGE NETWORK MODEL (CHATTI, 2012):

(Chatti, 2012) criticizes previous knowledge management models from the sense that they view knowledge as a process, or a thing and he argues that a better model should focus on knowledge as a network.

He proposes the PKN model aiming to address the tacit nature of knowledge and tap on the human role in the development of knowledge from continuous interaction with a learning environment.

He builds this model on top of two concepts: The PKN and the Knowledge ecologies that emerge from them.

He argues that knowledge management implies continuous development of PKN and the ecologies that emerge from them, where personal knowledge network is a unique network of tacit and explicit knowledge nodes (external knowledge networks) and one's theories in use (internal knowledge networks) which represents individual's norms and strategies for achieving value and assumptions that bind strategies and values together.

Both networks are of dynamic natures, and to guarantee organizational learning the theories in use should always be questioned and validated while in use to correct errors and adjust as required by the context of the problem under the condition of double loop learning where the change in theories in use transcends the scope of current situations through critical reflection to a change in the internal networks of individual and organizational strategies and assumptions.

For this to be achieved organizations must provide a supporting learning environment that allows for open, emergent, and self-organized knowledge ecologies which are individual dynamic interactions that emerge from the functioning of PKN in open dynamic contexts.

(Chatti, 2012) views Technology as an enabler for the PKN model and he emphasizes on the characteristics of effective communication for knowledge creation and the environment that allows questioning the norms and strategies in use and enable organizational learning based on critical reflection.

But he doesn't mention the activities the individual is involved in to deal with information overload and distraction, and although he emphasizes on the importance of externalizing one's tacit knowledge in the emerging context, it is not defined how may the knowledge worker do that in both an effective and efficient manner.

(Chatti, 2012) concept of ecology on top of PKN emerges with individual awareness and perception of how to utilize valuable informing sources nodes that fit the developing context but the importance of a setting for the individual in a supporting environment is neglected an explanation. Community of practice that can provide individuals with such setting is something we should address its role in providing the individual with a support mechanism, authorship stage, enabler for connectiveness and a driver of opportunities for recognition and establishment of context. (Wenger, 1998)

The value of communities practice has been evident in a practical study that describes the activities that usually take place by knowledge workers in a learning environment for which COP has a vital role in providing such environment (Jarrahi et al., 2019).

2.9 DIGITAL NOMADISM PERSONAL KNOWLEDGE ECOLOGIES

An empirical study was made to identify those PKM activities that knowledge workers do to leverage digital technologies in order to construct a functioning knowledge ecology by studying digital nomads who are characterized as being independent from organizational settings and have the sole responsibility on their learning and development journey.

The finding identified five PKM activities that enable Knowledge workers to create, distribute, and apply knowledge using digital technologies outside the traditional organizational knowledge context:

1- Social Sharing: Knowledge worker gets involved in collective negotiation of meaning through:

   - Consulting one another regarding problems and solutions
   - Benefit from the experience of others to develop responses to difficulties
   - Receive feedback on projects and give others feedback when needed
   - Talk to people in which they have interest and stay UpToDate
   - Participation in coworking spaces to be able to network with people and exchange knowledge and collaborate on a shared context

2- Networking: For social learning to be effective, this requires a social infrastructure consisting of other knowledgeable human agents that are eager to collaborate or build on one another knowledge. Digital nomads find likeminded people and meet with them on discussions via social media groups and through coworking spaces. They usually gather in communities of practice and this is the bases for mostly how they foster social sharing and build their networks. By interacting with a larger community, digital nomad establishes connections within their profession, but also join a supportive network for working remotely.

3- Self-managing and reflection: Digital Nomads rely on self-reflection to evaluate their career growth and learning by reflecting on what they know and assessing what is necessary to know to move forward toward their goals. This requires eliminating distraction streams of information and engaging with deeper thinking, sorting out priorities, career strategies and life options. Note taking and diagraming are essential activities they depend on to process information. They struggle with push information that causes distraction, so they limit that to relevant sources, or they position themselves in more comfortable environments for concentrated thoughts and actions.

4- Reinventing: Digital Nomads also realize the importance of utilization by pursuing project-based work and are oriented toward problem solving which puts the responsibility on them on reinventing new solutions by transforming ideas, experiences, and general knowledge into a solution that directly addresses the project at hand. They capture intuition and insights through note taking.

5- Managing and making sense of Information: Information overload imposes on digital nomads the challenge of properly seeking and capturing relevant information. It is essential to make sense of information as they seek it by intentionally pacing and filtering only the relevant, and they may either immediately use this information in the proper context or keep a temporary store if it and schedule it for when they're ready to consume it and make sense of it.

   This study resulted in a conclusion that personal knowledge management ecologies gets embedded in larger communities of collaborators, clients, and peers who are often extensively mediated by digital technologies.

2.10 PERSONAL KNOWLEDGE MANAGEMENT FOR DEVELOPMENT FRAMEWORK:

(panel & Schmitt 2016) has been doing a valuable contribution to the field of personal knowledge management. He's constantly exploring the field and the interdisciplinary aspect of it and exploiting his findings in the development of a PKMS (Knowcation), that he's constantly validating by different approaches within which he develops a PKM4D framework to validate the PKMS. Also, this framework serves as a reference for other scholars or PKM practitioners to validate if their PKM efforts meet the underlying criteria of the Framework and provides the means to assess possible interventions in case of inhibitors for professional development.

The criteria imposed on the development of a workable solution to such complex goal to design a personal knowledge management system that can enable and support professional development of the individual emphasizing on the social dimension of learning to empower the collective spirit to feedback the individual ability to learn and develop can be summarized in the following:

1- Accessibility easiness means the ability to access information resources and KM applications at low cost.

2- Operable autonomy gives knowledge workers sovereignty and enable them to take lead in their professional development without worrying about lack of tools to facilitate and make the process easier.

3- Expressive creativity is having more than tools by which kw are empowered to participate and express themselves creatively and personalize their own environment.

4- Collaborative choice is another criterion that means to have numerous options on where, how. And for whom they will put their new knowledge to work.

5- Relational interactivity focuses on the social dimension of professional development and the ability to learn by connecting to others to share ideas and participate in social learning.

6- Creative conversations is mainly enabled by social gathering tools like social media that facilitate conversations or collaboration on negotiating meaning and knowledge creation.

7- Also (panel & Schmitt 2016) highlights Ecological reciprocity as a criterion which is the opportunity to contribute back to the social learning system and give back to the environment. This gives individuals feel of accomplishment and enable them to position themselves as interactive beneficial nodes in the learning environment that doesn't only benefit from social information resources but can also act as an important knowledge resource for others.

8- Personal mastery is another criterion that takes professional development to a new level of self-actualization and the desire to become the best version of one's self and actualize one's own potential.

9- Institutional performance is about organizational learning and where the organization becomes a learning organization as a result of encouraging individuals to be responsible for their own learning and provide a learning environment that supports professional

development not at the expense of organizational kms but as means to foster a fruitful co-evolution for strengthening institutional performance.

10- Innovative capability is the ability to become innovative entities and participate in disrupting organizational products, processes, relations and result in adequate cultural shift.

11- PKM4D criterion encouraging empowerment involves helping others to achieve self-actualization, avoiding overlooked potentials, and encouraging individual participation and engagement in creating the future and supporting the formation of community that empowers its members through the power of the collective.

12- Technological progress is mostly accomplished when the collective effort tries to find the best solutions to world problems from multiple alternatives and we've seen how the internet ability to connect the world had accelerated technological advances and professional development is when the individual is empowered and able to participate in making the world a better place.

2.11 THE CONCEPT OF ECOLOGY VS COMMUNITIES OF PRACTICE:

Knowledge Ecology according to (Chatti, 2012) is a "complex, knowledge intensive landscape that emerges from the bottom-up connections of PKNs".

Knowledge ecologies emerges naturally and dynamically depending on self-organized entities as they interact in social contexts in an adaptive manner as they learn from experience. This leads us to understand that (Chatti, 2012) concept of ecology is describing the states of which interconnected elements of a social network interact in social contexts to create knowledge. But this is dependent on factors such as the intentional networks of individual elements, the environment through which they interact around social contexts and their capacity to learn from experience. He compares the concept of ecology with communities of practice in that knowledge ecologies develop in more open settings than that's of communities of practice where interactions are defined by mutual engagement that binds individuals as a social entity around a domain that is continuously developed and studied by its members through shared practice (shared repertoire of communal resources such as routines, sensibilities, artifacts, styles,..).

Knowledge Ecology is a social entity with no such boundaries defined and is driven by independence and autonomy rather than membership, mutual engagement and belonging to a community. Within a knowledge ecology a knowledge worker doesn't have to interact intensely with other members of COP but rather interact as they're involved in situated learning with anyone from their PKN that is continuously developing as the knowledge worker find relevant to his needs and doesn't have to rely on how community of practice is evolving and growing.

Knowledge ecology according to (Chatti, 2012) builds on individual personal knowledge networks that is dependent on the environment within which an individual operates. But we cannot ignore the role communities of practice play in setting such environment and how a knowledge workers participation of communities of practice help them in doing their role better by interconnecting and thinking along others who face similar challenges and depend on relatively analogous problem-

solving capabilities Emily Webber. Participation in communities of practice is valued in terms of connecting knowledge workers to reliable informing sources about a domain as well as involving them in situated learning (Walker, 2005), due to the participation-reification duality that exist with communities of practice (Wenger, 1998). Also it gives knowledge workers the opportunity for recognition for what they know and enable knowing (using what they know in practice) which allow their knowledge to redevelop with those of others, a stage for individual to contribute in the knowledge society and get feedback on their contribution.

Communities of practice is a group of people who genuinely care about same real-life problems or hot topics and interact regularly to learn together and from each other. “Thinking together” process is a key part of meaningful communities of practice where people mutually guide each other through their understandings of the same problems in their area of mutual interest and individual is able to externalize his knowledge with the right people that will redevelop their knowledge together through negotiation of meaning informed by relevant shared practice that they collectively develop when their contribution synthesize through mutual engagement and negotiation of joint enterprises (Pyrko, Dörfler, & Eden, 2016).

We can view COP to which a knowledge worker belongs as a node in his personal social network that extends his knowledge ecology to interconnections with likeminded people and a way to benefit from: -engaging discussions, new working relationships, ability to share his views, co-develop solutions to problems, opportunities to see what others are doing, and some tools, documents, or techniques he can use in his work.

According to situated learning theory, learning takes place in the same authentic context it is applied (Wenger, 1998). Focusing on context with a dynamic feature has been the focus of (Nonaka et al., 2014), (Jarche, 2012), and (Chatti, 2012). (Wenger, 1998) concept of identity under the theory of social learning and how the burden of identity is shifting more to the individual as we’re dealing with enormous possibilities of what to learn and who to become has to be addressed with finding dynamic social context to which learning occurs as a result of practice and negotiation of meaning. Communities of Practice helps develop our identities as a result of a tension between one’s experiences and COP’s competence to define common practice among the community.

In today’s world we belong to many communities and we’re left with the burden to develop identity in a complex social system and choose what social settings and practices to follow is a tough decision to make. Our identity develops as we become creators of knowledge and contributors to society as opposed to mainly consumers of information in ICT world (panel & Schmitt 2016). COPs enable the contexts wherein we can position ourselves as social learners and develop our identity as we engage in social learning.

Working knowledge is developed through learning in practice, and practice is a property of COPs. Wenger. Our identity develops and we create knowledge as we navigate through a landscape of practice but what allows practice and gives context to our learning are communities of practice.

2.12 THE ROLE OF TECHNOLOGY IN FACILITATING PKM:

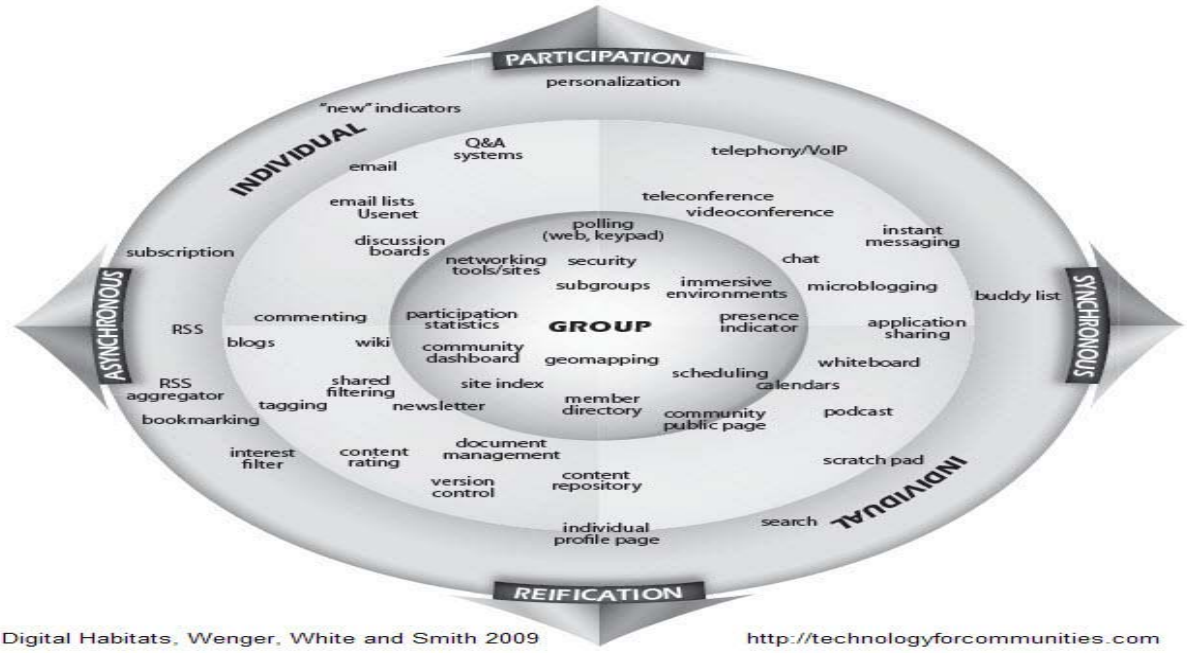
PKM is a set of tools and systems that are used for managing knowledge and/or personal/professional relationships. A characteristic of such systems is the fact that they are open and designed to invite collaboration and to facilitate social interaction. (Tsui, 2002) argued that the IT based PKM tools are mainly divided into group-based and personal based KM tools.

However, the fragmentation of these different systems and their lack of interoperability constitute important roadblocks towards an optimal usage of these tools for PKM (Razmerita, Kirchner, & Sudzina, 2009).

(Agnihotri & Troutt, 2009) emphasized on how important it is to understand how these tools and techniques can facilitate the process of finding the solutions for knowledge worker's needs. It should involve aligning and studying the PKM skills and tools simultaneously.

(Agnihotri & Troutt, 2009) suggested that the PKM Skills-Tools Fit as the core of PKM model and is based on the Task-Technology Fit (TTF) theory of(Goodhue & Thompson, 1995). The TTF theory stated that there is a positive relationship between the available technology tools and an individual's performance; the technology must be utilized and have a good fit with the tasks. In the context of PKM, the tools must fit the skills necessary for individuals to perform effective personal knowledge management.

Learning in the landscape of practice requires tools that can underpin existing polarities within the landscape including togetherness and separation, participation and reification, and the individual and the group. (Wenger, Fenton, Hutchinson, Kubiak, & Wenger, 2014) lists some of the tools and place them with respect to the identified polarities:



Learning in the landscape of practice (Wenger, Fenton, Hutchinson, Kubiak, & Wenger, 2014).

Separation is due to the fact that social learners don't necessarily live or work together which creates a separation in time and space. This diversity leads to participation in different contexts that

brings people together as a source of richness for learning together. Technology is the main enabler for togetherness despite being separated.

Meaning creation among social learners happen in two ways: Through participation and engaging in conversations, reflection, activities, doing things together, and more social learning activities. While reification is creating meaning by reifying what matters about being together. Technology provides new ways to participate in community interactions, new ways to connect with people and learn from each other. It also provides new ways to produce, store, share and organize documents, media files, links and other artefacts whether created collectively or individually.

Although individuals participate in communities of practice, their experiences are still personal. An Individual can have multi-membership and be active in some and less so in others. Technology allows the Individual to filter information to fit their needs, to locate others, to find connections and important events, to reify and share with others, to gather news feeds from their various communities in one place. It also helps in sustaining communities and making them visible through directories, maps of members' location, participation status and insights on community growth and graphic representation of the health of communities.

2.13 PKM ACTIVITIES ADOPTED BY PRACTITIONERS

To examine the activities for personal knowledge management adopted by practitioners, we conducted a qualitative analysis on 15 blogs through which PKM practitioners have shared their PKM processes.

A blog is a discussion or informational webpages that is frequently modified, Blogs have been featured as a main PKM tool (Efimova, 2005), (Jarche, 2012),(Razmerita et al., 2009). They're used as PKM repositories, learning journals, or networking instruments Lila Efimova. Besides that, they can provide so much insights as a source for qualitative data analysis because of the convenience and ease of access to data, richness and depth of information available, unbiased by researcher influences (Jones & Alony, 2008).

It depends on the type of research to whether qualitative analysis of blogs is adequate, and our mission is to understand PKM from the viewpoint of those who practice it which makes this study insightful.

15 Blogs Titling My Personal Knowledge Management Process or Framework were found online, and the bloggers have diverse job roles presented in the table below:

BLOGNB:	JOB ROLE
BLOG1	SOFTWARE ARCHITECT
BLOG2	DEAN OF TEACHING AND LEARNING
BLOG3	BUSINESS MANAGER
BLOG4	PUBLIC SPEAKING COACH AND RESEARCHER

BLOG5	**BUSINESS FOUNDER AND AUTHOR**
BLOG6	**FOUNDER OF A CONSULTING COMPANY**
BLOG7	**COLLABORATION PRACTICE LEAD**
BLOG8	**FOUNDER OF A LEARNING ONLINE STUDIO**
BLOG9	**TALENT DEVELOPMENT STRATEGIST**
BLOG10	**AUTHOR AND IT SPECIALIST**
BLOG11	**A SPECIALIST IN APPLIED INSIGHT MAPPING**
BLOG12	**AUTHOR**
BLOG13	**COMMUNICATION MANAGER**
BLOG14	**FOUNDER OF A COMMUNITY THAT SUPPORTS AND PROMOTE CREATIVE TEACHING AND LEARNING METHODS**
BLOG15	**FOUNDER OF A CONTENT CURATION TOOL**

We can see how knowledge workers with diverse roles understand the value of PKM and practice ther knowledge management to deal with information overload and be more effective in their jobs and they have one obvious thing together which is they all use blogging as a personal knowledge management activity.

Most of the PKM practitioners' activities that were studies are influenced by Harold Jarche Seek, Sense, and Share Framework (Jarche, 2012), and they all have mutual activities they do to find and collect from relevant information sources, process and interpret the information they've gathered, and create and share their own interpretations and ideas.

The seeking process is directed by current projects and learning goals to be able to judge the relevance of the information and filter to what's useful and insightful to current projects. The seeking process depends on developing and creating Personal Learning Networks (PLN) to connect to relevance rather than noise.

The most highlighted feature of the process is its dynamicity as it's continually changing and evolving. The activities that were redundant and mutual along all blogs were:

- Developing a PLN (Personal Learning Network) as a main source of relevant information
- Filer information by connecting to the right information sources, using RSS feeds and following experts on subjects of interests.

- Collecting information through Notetaking, and the organization of information through classification and tagging has been emphasized and described as the most essential for future retrieval.
- Curating and combining new pieces of information with existing knowledge as a way of expressing understanding.
- Mind mapping the organization of the knowledge repertoire to be able to enhance it and make logical connections among concepts.
- Creating original content is a way to put knowledge into practice and make sense of it.
- Putting Knowledge in Practice by learning to solve problems and do projects while continuously seeking and interpreting new relevant information.
- Reflecting on knowledge created while participating in social contexts and allowing feedback on personal interpretations and ideas.
- Blogging and participating in shared Wikis is the main source for reflecting on and utilizing what's been learnt.
- Sharing with others and Contributing to the social learning system allows feedback, reflection, and is a way to contextualize what we're learning.

2.14 INTEROPERABILITY DEFINITION

Since individual use multiple tools to manage their personal knowledge management process, it is necessary that these technological tools can easily exchange information and can work together to accomplish specific tasks the individual would like to perform on his information, also PKM process depends a lot on collaboration at the seeking, sense making, and sharing level(Jarche, 2012). "Interoperability is the ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services exchanged to enable them to operate effectively together" (Kasunic & Anderson, 2004). Such interoperability is becoming increasingly important with increasing volumes of data and multiple sources of data as well as resource types.

Our first approach to interoperability is the design and hopefully creation of one PKM platform that incorporates all the needed tools for effective PKM. But one of the main requirements of the system is to be searchable and allow only relevant search results and push of relevant information sources only to enable focusing and eliminate distractions and this draws on the apparent need for semantic interoperability. "Semantic interoperability is a requirement to enable machine computable logic, inferencing, knowledge discovery, and data federation between information systems. Semantic interoperability is therefore concerned not just with the packaging of data (syntax), but the simultaneous transmission of the meaning with the data (semantics)".

Other interoperability requirements are yet to be studied such as syntactic interoperability which is prerequisite for semantic interoperability as it involves a common data format and common protocol to structure any data so that the manner of processing the information will be interpretable from the structure(Wikipedia) .

3 RESEARCH METHODOLOGY:

The main objective of this research is to articulate a design of personal knowledge management for professional development platform that addresses the need for interoperability of tools that facilitate the personal knowledge management activities and provide the individual with the ability to position themselves in a learning environment and initiate the emergence of social contexts or participate in them to enable the development of their problem solving capabilities. For the design to functionally fit knowledge worker's needs for effective personal knowledge management, we have to translate our conceptual research into functional features that apply effective problem solutions. We found that our objective to design such artefact can be treated with design science research methodology which have been introduced to fill the gap in the research field to offer a reliable methodology that provide more than a theoretical contribution to IS research and yield artifacts to solve observed problems. It is seen as a balance between Design science approach of systematically designing and creating a new product that passes through an iterative design process which is continuously being informed through evaluation and validation methods and the exploratory course of work in Research methodology that explain theories in the attempt to prove assumptions (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2008).

3.1 DESIGN SCIENCE RESEARCH METHODOLOGY:

Research activity that follows design science research is intended to build new or invent artifacts for solving an understood research problem, make research contributions, evaluate the designs, and to communicate the results to appropriate audiences. We follow a process model that has been built on the previous models following a consensus building approach to synthesis the best elements of all. It consists of six activities in nominal sequence presented below (Peffers et al., 2008):

1- Problem identification and motivation: It is important to study the problem conceptually so the solution can capture its complexity, and the value of the solution to surface. It motivates the researcher to seek a solution and also sets the stage for validating the solution to fit the problem. It puts the researcher in problem solver mode and output is a mental model for the characteristics of research outputs that provide some guidance to reviewers, editors, and consumers, about what to expect from DS research outputs. A mental model for the conduct and presentation of DS research will help researchers to conduct it effectively.

2- Define the objectives for a solution: Identifying if the objectives come from our understanding of the problem and how it can be solved. The main objective of the system is to address the problem in the best way we're able to think of, so we can design the system with the best solution in mind and compare against those criteria.

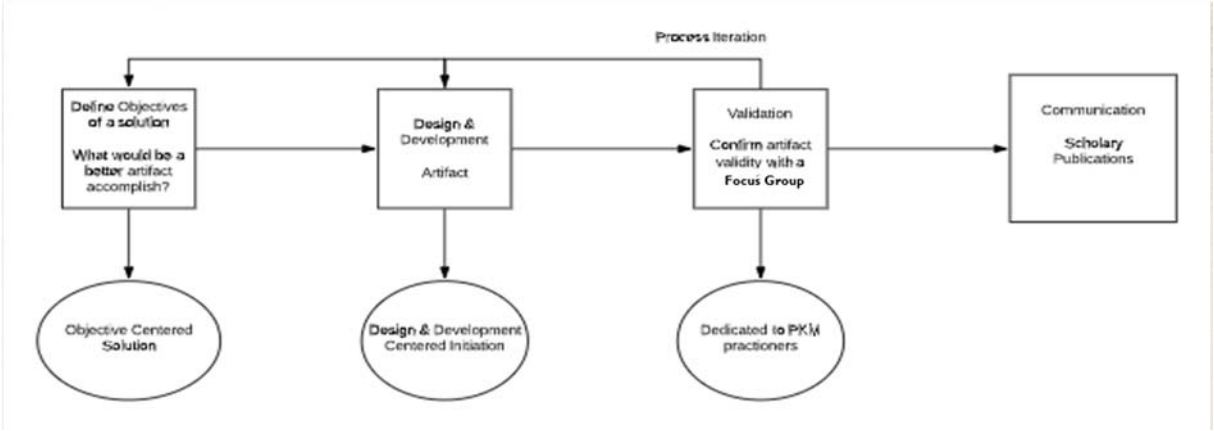
3- Design and development: a design research artifact can be any designed object in which a research contribution is embedded in the design. It involves deciding on the system's functionalities and its architecture and then creating the actual artifact. The design requires knowledge of theory that can be the base for the system's functionalities.

4- Evaluation and Validation: It could include such items as a comparison of the artifact's functionality with the solution objectives, through simulations, the results of surveys, or client feedback. From this step you can iterate back to the design step to try to improve the effectiveness of the artifact or to continue on to communication.

5- Communication: Communicate the problem and its importance, the artifact, its utility and novelty, the rigor of its design, and its effectiveness to researchers and other relevant audiences, such as practicing professionals.

It's not mandatory to follow the sequence of the process as described above. We may start at any step (Peffers et al., 2008).

3.2 STRATEGY OF IMPLEMENTATION



DSRM Process Model

This section is to represent the DSRM Framework, and to explain the strategy for implementing the design science research methodology, In this paper we follow **Objective-centered Solution** where we start with defining the objectives as we already described the value of personal knowledge management as a solution for knowledge workers struggling to make the best out of their learning journey and how it can help individuals in professional development and how it leads to organizational learning, and we base our design of the artifact on these objectives.

Then we **validate** our design by conducting a **focus group** with knowledge workers and try to evaluate the usefulness and viability of our design model. And we **communicate** the design of our artefact through the dissertation itself.

3.3 FOCUS GROUP:

An important task in information system design is the continuous evaluation of artefacts, in order to conclude if the artefact is both valuable and viable.

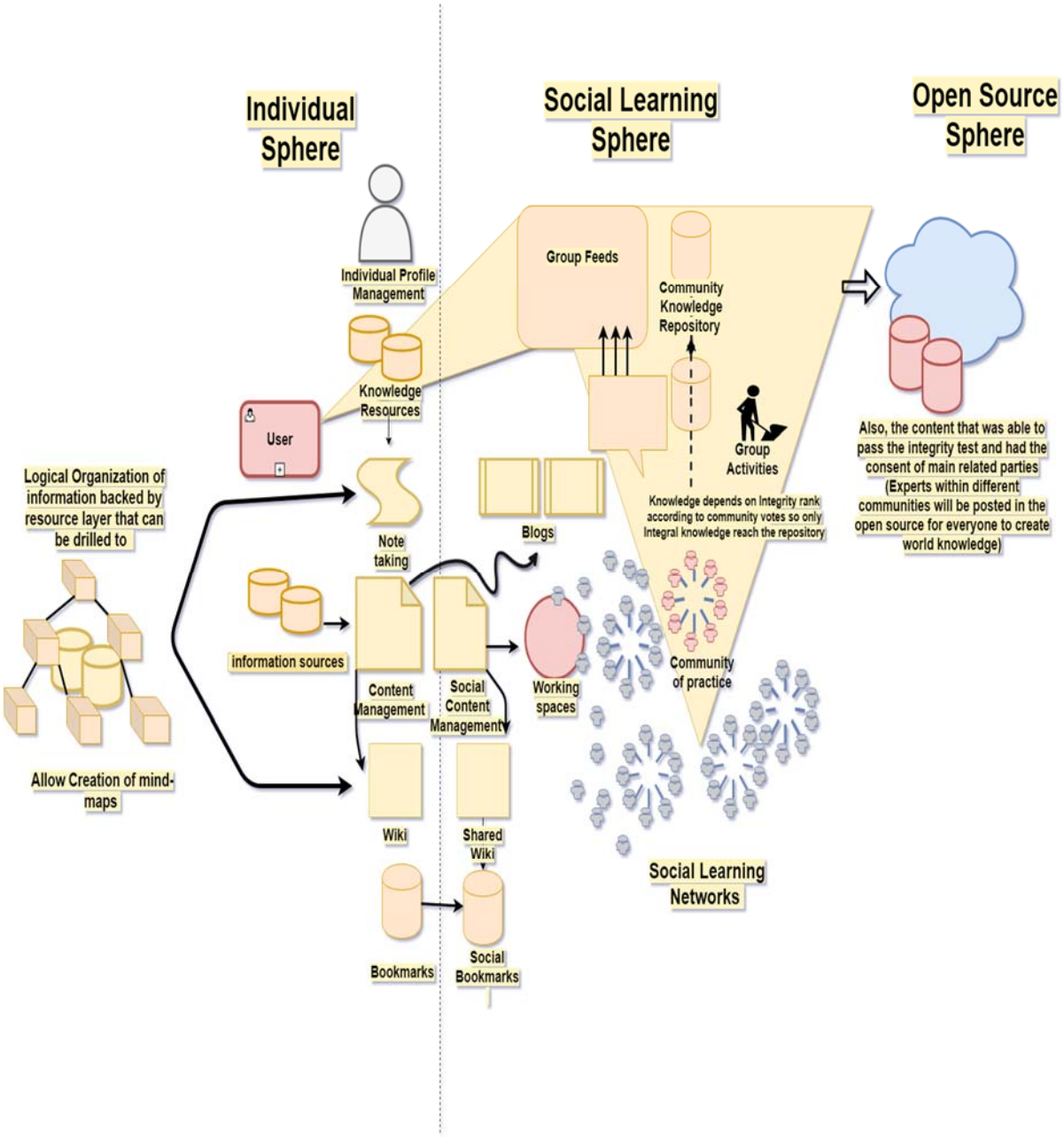
Evaluation of artefacts could be a complex process, as it is not done once, and you don't know how many iterations of designing and evaluation are needed until the artifact is fully developed and successfully validated. In our situation, the design model is in its conceptual phase, and is built on the idea of finding a solution for knowledge workers to effectively manage their personal knowledge, so it's important to evaluate the artifact by listening carefully to potential users' opinions. So, our first attempt to evaluate the artefact in our first iteration of designing and evaluating the design will be using a focus group.

It is recommended to use an interactionist approach in validating an artefact, and we think that focus group is the appropriate interactionist approach that we'll rely on in the validation of the first version of the design in how well it will fit its purpose (O'Raghallaigh, 2012).

The dependence on developing theories that justify why the design should work is not enough, and there should be a focus on observation-based justification for the explanations offered by the design theory, as it may be justified to work according to theory but it may not really work when implemented (O'Raghallaigh, 2012). The aim of an interactionist approach is to fill that gap as it incorporates various stakeholders' interests and perspectives when determining the value of socially embedded systems.

More factors have led to our choice of conducting a focus group, as we wanted a cost effective method, and we wanted to interactively discuss the value of this idea to knowledge workers and be in direct contact with potential users of the artifact (Brandtnera, Helfertb, Auingera, & Gaubingera, 2015). Also, it allows more flexibility as the choice of the number of participants can be small, with 4 to 6 people, called mini-focus groups or from 8 to 12.

Conducting focus group research in a design science project: Application in developing a process model for the front end of innovation.



4 PERSONAL KNOWLEDGE MANAGEMENT SOLUTION DESIGN:

4.1 PERSONAL KNOWLEDGE MANAGEMENT SYSTEM

Since we're valued by our working knowledge that is developed by practicing in context not by mere accumulation of information, there's a need to unify all the tools that would facilitate our professional development and learning, and the environment that will provide the social aspect of learning.

We defined PKM by summarizing scholars' definitions and we explored the makeup of effective PKM. Now we move forward with our understanding by outlining the requirements of effective PKM solutions that will guide our design of the PKMS.

4.2 ASSUMPTIONS

The objectives of the system are summarized from literature review where we already presented scholars views on PKM and the activities involved in the process, and the settings necessary for the process to take place, also by taking into consideration practitioners experience with PKM and their PKM activities, and by concluding from the criteria for professional development:

- The system should be able to position the individual in a learning environment and allow connection to the right information sources.
- The theory of social learning where communities of practice provide such settings inspire the objective to support the formation of communities of practice and multi-membership to different COPs.
- Allows the ability to manage and grow a learning social network.
- The system should allow effective notetaking and storage of information.
- The system should allow effective organization of information with proper classification and tagging that allows future retrieval.
- Semantic features Interoperability should be addressed to allow retrieval of knowledge and flow of relevant information sources to the individual based on current learning goals.
- The system should provide the tools for creative curation and content management essential for the sense making process described by (Jarche, 2012).
- The individual should be able to manage profile and showcase his contributions to the social learning system.
- The system should provide coworking spaces for coworkers to work together.
- The ability to create or participate in Wikis, and blogs is essential for knowledge workers as these are featured tools for Personal Knowledge Management.
- Allow feedback on knowledge worker interpretations and ideas.
- The system also should drive opportunities for the knowledge worker by showcasing his contributions and portfolio and match it with organizations human resources needs.
- The system should allow collective effort to create world credible knowledge and other social goals that could serve humanity.
- The tools should be customized based on community's activities and type of practices.
- The system should allow professional learning and the development of important skills based on knowledge worker's needs.
- Allow sharing content with others as relevant for the both parties.
- Allow project management and team building among knowledge workers who share the same mission or goal.

In summary, the learning environment and system tools should allow the individual to develop his own personal knowledge network and to autonomously participate in a social context to solve his own work problems and achieve professional development benefiting from other social entities as relevant to the evolving context.

4.3 DESIGN OF THE SYSTEM:

Drawing on the problem of noise and distraction that hinders the PKM process, our main goal of designing this system solution is to shift attention from social networking sites that are based for sharing personal information and killing time on entertaining content to actually put effort in managing one's own information sources, create knowledge and contribute to the social learning system.

The main recipe for professional development is to maintain focus and attention on searching for information and solving problems, which depends highly on who we are surrounded by which either strengthens the consistency of our effort or loosen our ties to our knowledge goals.

We described before how knowledge creation is a continuous process involving socialization with others which enables both internalization and externalization of knowledge and for this to be achieved the knowledge worker needs a learning environment which supports that and provides context for creating working knowledge.

So, we're assuming what the knowledge worker needs based on literature review from connecting to the right information sources, collecting and organizing relevant information, curation of information and content creation, developing a proper social identity and contributing to the social learning system, and using the right set of tools that facilitate knowledge creation and professional development, and based on our assumptions we try to design a PKM system solution that meets those needs.

> The system was designed to provide the learning environment that knowledge workers need for effective PKM based on social learning theory. It represents more of a social networking site that gives individuals a platform to create and share knowledge as they continuously learn from experts, COPs, and others with credible information which allow feedback and reflection on what can be improved and to highlight on one's contributions where the individual is known by what he knows so instead of sharing their private life they'll be sharing their learning journey.
>
> It provides the user with personal space to manage his own profile and control how to present himself to his/her social network. Individuals have the necessary tools to perform PKM activities effectively such as note-taking, organization of information sources and saving relevant sources as bookmarks. Also, the necessary tools for curation of information and content management with the ability to layer the content with information sources to drill to which adds resourcefulness to the content.
>
> The system should focus on facilitating effective information retrieval, managing and connecting to the relevant information sources to allow as much control possible over the information available to the user to be more like the user chasing the information rather than passive information overwhelming and distracting him. The user can control feeds that come from his personal social network by topic of interest, so he doesn't have to see feeds about (Digital Marketing) while his topic of interest that day is (Research Science).

The user controls to whom he connects and manages his social network that functions as a source of information and as a stage to express what he has learnt, so continuous internalization and externalization of information can take place. The system has all the user needs to build a social presence and become a consistent contributor with his knowledge so he can do blogging, or managing wikis, sharing bookmarks with others and collaborating on a social context as well as manage their profile that showcases their contributions to the world.

As we discussed the importance of participating in COP ahead in this report, we consider COP as the main building block of our platform, where Individuals can manage multi membership to different communities of practice and have different roles based on need and effort made in each COP which is a main knowledge resource, learning sphere, and support mechanism for the individual. Individual can view Newsfeed from different COPs in different tabs based on topic and can interact with content to which he can rank integrity. Also, individual can contribute to COPs and have his knowledge ranked by COPs members and if his knowledge passed the integrity test it would be able to contribute to Community's Knowledge repository and may reach the open source knowledge base. There's also the ability for individuals to participate in co-working spaces outside COPs sphere of organizations settings.

Each COP type has tools based on its kind of practice and have a discussion board, training courses for its members to train them on COPs competencies as well as allow learning relationships between its members, it has expert board of directors, and different roles to be assigned to members based on contributions. Different activities can take place within COP which allow negotiations of meaning and collaboration on content creation or as well as different context which can be any type of project decided by its members which may lead to interventions.

Organizations can benefit by creating their own COPs and from their employees PKM initiatives and interactions with other COPs which imports lots of useful knowledge on to how to solve organizational problems and reach organizational goals.

What's been posted on COP's discussion board goes to members feeds based on their feeds control settings, so it can be viewed and ranked according to integrity, and edits can be proposed, and critics can be added so the creator of the content can review feedback and remarks and edit the content accordingly. The content that was able to pass the integrity test and had the consent of main related parties (Experts within different communities) will be posted in open source for everyone to create world knowledge). So, the collective effort to rank the content that was shared by knowledge workers and COPs can lead to the creation of a credible open source knowledge base.

4.4 VALIDATION:

Our attempt to validate the usability of this proposed PKM solution is through conducting a focus group. The best available way now is a focus group because the design model is still in the idea stage and needs more detailing and then deciding on the physical design of the system which allows technical implementation.
To evaluate whether this PKM solution meets knowledge worker's needs, 5 participants volunteered to participate in the focus group. Since the PKM solution is for everyone who deal with information and have a learning and professional development goal, participating of university students who also have professional careers were a perfect fit for the interview, in addition to a PHD Professor which can be identified as knowledge workers and personal knowledge management can facilitate their learning and professional development efforts.

Participants names won't be mentioned in this study and will identify them as P1 for the PHD professor, P2, P3, P4, and P5 for the master's students who are involved in different professions.
I started the focus group by sharing a paper that has a story about a knowledge worker who was successfully managing his personal knowledge to reach his goals, so the participants would understand the concept of personal knowledge management, followed by a definition of personal knowledge management to assure their understanding, then the paper demonstrates the objectives used to design the system.
After making sure the participants understand the concept and they're ready to evaluate the design, I presented for them the design model through a PowerPoint, and also provided a paper that has the design model with a detailed description of the model in case they need to refer to it through the interview.
The questions that were answered and discussed through the interview are:

Q1:

a. *Did you all understand the concept of Personal knowledge management?*

This question was necessary to move forward and make sure that participants are ready to evaluate the design model.

b. *Do you think personal knowledge management can facilitate your learning and professional development?*

This question was asked to understand the relevance of our solution proposal to the participants needs.

Q2: *Do you agree on the usability and viability of the solution?*

Q3: *What are your remarks and suggestions to develop the design of the system*?

As the focus group meeting was very rich, it was only included a synthesis of the answers of each participant to the three questions in the content of this section. Although it was considered important to incorporate the all transcription of the meeting inside this study, so it is possible to find it in annex 1.

<u>So, Regarding Q1, part a) the answers were:</u>

The interviewees: yes.

<u>Regarding Q1, part b) the answers were:</u>

P4: Yes, because it will allow me to filter out the information that may not be useful for my purpose and focus on sources of information with relevant information, and I believe it benefit a lot my purpose of learning.

P2: For me this is perfect, because for example I'm doing a masters in oil and gas and sometimes it's very hard to find people that can help you so it's so much effort put in searching for a piece of information. But if I can find very easily find communities and experts in my field that can help me. Interacting in this learning sphere is something I liked, and I think is so valuable for me.

P3: I think this is a very valuable solution that we don't have right now. It can definitely fit into my personal knowledge management...

P5: I really liked the idea, I studied computational marketing in Italy, and it was a good experience, but everything I've studies was theory. As I study, I always forget most of the information. In my opinion, this solution would help me and help students in general to study. If I make my profile on this site as a student and the professors can use the site to evaluate my understanding of the subject. By studying, and sharing my understanding of what I've learnt, and sharing my practice and knowledge so I don't forget the information and at the same time there's the ability to find the information I need more efficiently so for now there's so much information full of noise which distract us when we want to find what we need. So, if I'm able to find information easier, as for now there are so much information full of noise which distract me when I want to find what I want. So, if I'm able to find information easier. Also I liked the idea of the community that can help me, as if I study with the community I'll be more encouraged because there are people that are interested in and learn the same thing which encourages me to continue to study more and learn from the process and put my contribution also, so I really liked the process you mentioned.

The answers regarding Q2 were:

(mainly regarding system usability)

P2: The content discussed in the Communities of practice by its members, can it be shared outside the Community if the user doesn't trust the feedback of this Community and want further validation?

The interviewer: The content can be shared by the user with other parties from his personal social network to get further validation. The user can take more actions on the content such as suggest edits and provide feedback to the content creator.

P2: I like it but if it only passed to the open source, because it can be checked by really experienced people and by people that really care about what you wrote and gave feedback and have fully validated the content. So, it will be more valuable. Because when you're inside the social learning sphere this causes confusion for me as other users can steal the information or your ideas and post it another place on the site.

The interviewer: The site isn't just about the open sphere; it is supposed to provide for the user the social learning environment where he can learn and share with others.

P2: so, for example this feedback that I take from experts in the field, what can I do with it? Can I take it and share it inside my blog for example?

The interviewer: You can benefit from the feedback to develop on the content you shared with them. They give you remarks, and they can criticize your content and that would help you evaluate what you're learning.

P2: so, this helps in developing what I'm doing? What I mean, after I have developed everything, and it passed to the open source I have the full Idea of what I've started with, it's where I can get the full vision of what I did.

The interviewer: The goal of this system is not for your knowledge to reach the open source, it's for you to be able to learn with others, it's for you to have the tools to collect what's valuable from the information that you're exposed to everyday. So, you have the goal like Ali to create a startup, with this system you can be a member of a community of startups where people share their struggles, and how they overcome their struggles. You can benefit from experts, and you can participate with the community in its common practice and learn through that new things that matters for you and helps you develop your startup. If you were able to reach a point where what you shared have granted validation from your community, and then from experts that would be valuable for you but that not

the main purpose of the system. The purpose of the system is to facilitate managing your personal knowledge.

P2: How is it evaluated? Who will evaluate my knowledge without having to reach the open source?

The interviewer: You can share with any one from your social network, and those in your social network will evaluate your content. Also, your content can reach beyond those in your social network through your blog or communities of practice you share with.

P2: So, even people from my social network can evaluate me?

The interviewer: Yes, those who decide to view your content in your social network can validate but that is based on their choice to view content that is relevant for them and if your content matches what they'd like to view. The most important thing here is to view information that is relevant for them. So, you can't decide who will see your knowledge, you can control that only.

P2: For me this is perfect, because for example I'm doing a masters in oil and gas and sometimes it's very hard to find people that can help you so it's so much effort put in searching for a piece of information. But if I can find very easily find communities and experts in my field that can help me. Interacting in this learning sphere is something I liked, and I think is so valuable for me.

P3: I think this is a very valuable solution that we don't have right now. It can definitely fit into my personal knowledge management. But I think the idea of the restrictions on the open source sphere is something that would hinder users' efforts as it is subject to the agreement of certain experts. For example, there's currently some working open sources of knowledge for example for code development and basically how It works is that there's admins on this site who check this information if it's good or not and there's those who rank you, so the more papers you submit the more credit you get the more expert you become on this site, so the people will listen to you and they'll read your papers and there's no more the need from a pool of experts so basically everybody is an expert, and everybody has a little bit of expertise, for example you now have some expertise on personal knowledge management systems and maybe some other people will have more experience and everything but they don't know this particular knowledge that you have. So, I think in this case it would be better if everybody can be expert and publish to the open source.

(mainly regarding system Viability)

P1: How do you control what content can be shared on the Community Discussion? Are there some criteria to accept or reject the content?

The interviewer: The way in which the content posted on Group Discussion can be moderated has to be figured out later as well as the ways in which the content to be viewed in Community Discussion can be filtered by members has to be formulated to ensure the most appropriate way is chosen that guarantees the user has the best experience in viewing the information according to his needs.

The integrity rank is taken into consideration and the ability of the users to achieve high integrity rank allows more visibility in Community discussion to members who visit the community to view its content.

The reach of content in members feeds from sources they're connected to such as Communities also depend on integrity rank. The need of the users is a priority and the content to be viewed should not be distracting so the filters should be reasonable, as for now what I know is that the user can limit content view by topic to be able to focus on one topic of interest at a time.

Regarding Question 3, the answers are as follow:

P1: Again, I want to ask you the same question. How do you decide what gets shared or not, and how can you decide that this information is good, and this is not, this person has more or less credit? How do you decide that? So, these decisions are important so we can keep the process working from the user to the open source.

The interviewer: Yes, I think this is so important, and should be figured out later. It is important also to explain how the integrity rank works and how the integrity rank for each user is calculated. This is a challenge for us to figure out how user contribution will be controlled and how user effort will be evaluated. And our biggest challenge is how to make everything interoperable.

P1: There should be rules that controls that.

The interviewer: Yes, this is something that need to be developed and integrated into the system solution, it is figuring out how the system will function in more detail. There are many ideas for that, like maybe there could be standards for controlling the content for each community, or maybe there's special communities that will search and decide how content on this site should be regulated.

3: I think this is a very valuable solution that we don't have right now. It can definitely fit into my personal knowledge management. But I think the idea of the restrictions on the open source sphere is something that would hinder users' efforts as it is subject to the agreement of certain experts. For example, there's currently some working open sources of knowledge for example for code development and basically how It works is that there's admins on this site who check this information if it's good or not and there's those who rank you, so the more papers you submit the more credit you get the more expert you become on this site, so the people will listen to you and they'll read your papers and there's no more the need from a pool of experts so basically everybody is an expert, and everybody has a little bit of expertise, for example you now have some expertise on personal knowledge management systems and maybe some other people will have more experience and everything but they don't know this particular knowledge that you have. So, I think in this case it would be better if everybody can be expert and publish to the open source.

P2: I agree with you but how can you be sure that those experts are right? That's why you need some moderation on who can share in the open source and what to be shared because everyone would have an opinion but it not necessarily right.

P1: Of course, but you also have the community vote on your content, so basically if you had enough vote from community members on the integrity of your content in community discussions and if there's a person who come and say oh you're wrong on this then you have to develop it to get the content right so you get the vote of that who disagreed at first.

P2: Yea, now I understand. Okay I got your idea.

The interviewer: But there's the fact that there's many communities concerned in developing the same subject, such as many communities discussing and developing knowledge on Digital Marketing, how do we ignore the agreement of other communities on the content published in the open source when one community have posted based on its internal votes.

P3: Yea, there can be many knowledgeable sources, basically they can differentiate it by the title of information they are posting and differentiate with the type of the piece of content they can add. Some would share a video and other texts, so if basically the type of knowledge that can be posted in the open source sphere could be anything, this diversity will allow more to share and to add to the open source sphere.

The interviewer: I take your point of leaving the decision for communities to decide if the content gets to open source sphere and that expert pool could be a restricting and an unnecessary step.

P1: Yes I also agree with her, it feels like an extra step where there's already the community who have voted on the validity of this information, so maybe it's better for this content who already passed the community votes can be directly published in the open source knowledge base.

P2: Regarding this, what if my community is not big enough to have valid votes on the content? Maybe at this point it would be necessary to have a pool of experts to control the content.

P3: In that case we have small communities, right?

So, basically the solution here would be to promote the community to add more members, have more experts to get the integrity rank needed but don't forget that anybody can comment and flag your content and development of content isn't limited to one community. The integrity rank of content decides on what content is published in case of conflict.

4.5 DISCUSSION:

The result of the focus group we conducted to evaluate the system solution design after analyzing participants opinions and feedbacks show common agreement on the relevance of the solution and alliance with participants needs.

They all agreed that the PKM solution proposed can benefit them especially with the difficulty they face in finding the needed information and remembering what they learn.

They find managing their social networks and participating in communities of practice provide them with a closer source of reliable information and a way to validate their understanding of what they've learnt and their interpretations.

Trusting the validity of information on the site is a concern to some of them, but I explained that the collective effort of the user personal social network and the communities he's a member of will hopefully address this issue by continuously discussing what's being shared, reviewing, and giving feedback on the content shared by the users to allow development of the content to become more valid and worthy of user's attention.

But the viability of content regulation on the site and addressing how the content will be ranked and validated on the system was questioned as the idea of the integrity rank seems vague and the criteria for assessing the content are not mentioned. Our main point of the integrity rank is to process the collective effort of users to decide on the validity of the content, and its reach to community knowledge base and reach to more users outside user's social network, but how these efforts are regulated and how to balance and process these efforts need to be addressed. This is the main challenge that was identified by focus group participants which decides on the viability of the system

and its ability to meet the main objective of designing the solution which is to easily find needed information that is relevant and trustable.

The idea itself is appreciated, but it is requested more clarity and detailing of how the system will function.

Suggestions were given on eliminating the process of controlling what's being published on the open source by a pool of experts and letting the collective vote of a community decide on that. This was proposed by a participant and agreed on by others as they saw the control of a pool of expert could restrict some valuable knowledge from reaching the open source.

Another suggestion is to let communities decide on the criteria for regulating its content, beside system standards that must be addressed to clarify the viability of the system.

One more suggestion was to make partnerships with 3rd parties to provide physical space for the communities to meet and exchange information outside the virtual word which is so valuable for effective communication between community members.

A general advice was to add more definition to the design itself.

So, the summary of answers for the three questions would be:

For Q1, they understood the concept of PKM, and they agree that PKM is what they need for better learning and professional development.

For Q2, the system is definitely usable but the viability of what's been proposed in terms of regulating content need more clarity and definition.

For Q3, remarks were given regarding the importance of defining how content will be regulated on the site, also other suggestions were proposed.

It was important to evaluate my design of the PKM system solution through this focus group, and that participants approved on the relevance of my contribution, and I think that the efforts made in this dissertation to meet objective of developing a solution that can facilitate the development of individual knowledge work competencies and be able to integrate the individual knowledge management efforts has been rightfully initiated. Although, I am still in the initial stages of design and there are more iterations to reach a comprehensive design, this valuable focus group review will help me a lot in my second iteration.

5 CONCLUSION AND FUTURE WORK:

5.1 CONCLUSION:

The need for effective personal knowledge management has been addressed by many researchers, and the effectiveness of individual efforts towards professional learning and development demands a learning environment, and a context to provide the utilization aspect of PKM. There are many PKM models proposed by scholars where some focus on the social dimension of PKM (Chatti, 2012) , others specified some skills essential for the process (Avery et al., 2001), some scholars have shared their own PKM processes Harold, and one have made much effort in defining the criteria for Personal learning and development to which he based his PKM system solution and is still researching and working on developing his solution (Schmitt 2016). Summarizing all these scholars' contributions and the PKM activities shared by PKM practitioners, the outcome are the objectives of a PKM system solution that we attempted to design through a conceptual model and compare its functionalities with those objectives.

There is still so much work ahead of us to specify the functionalities in detail and address the interoperability requirement and how it can be achieved. Also, future work will be to tackle this issue and to study all the available tools used for different PKM activities and compare them to choose the technologies that fits PKM skills the most, which will help us identify the features of the system. More studies should be done to understand the needs of PKM practitioners and their feedback on current PKM solutions to be able to address their challenges with the new solution we're proposing.

To provide users with the most rewarding experience from participating in communities of practice we should define all the functionalities the COP should provide, and to do that we must study more about COP and the activities that may take place as a mean for practice.

After conducting the focus group, we believe that the system solution is usable and will benefit knowledge workers and facilitate their knowledge management efforts. We also believe that the objectives we summarized from scholars' views on PKM were met through the solution, the attainability of this solution and more detailing of the full functionality of the solution is needed.

5.2 LIMITATIONS:

But there are so many limitations that doesn't allow full validation of the solution yet on the viability of the solution, as so much details are yet to be formulated and more in the designing processes need to be detailed on how the content will be regulated in communities of practice, how integrity will be calculated for each users and for the content, and how it is processed to decide on user content reach, evaluating user contribution, and what makes it to community knowledge repository. How content will be validated to reach to reach open source, and what standards will control the open source documentation need also to be addressed.
The result of the thesis until now are the main elements of the solution, and what the solution will be capable of.

5.3 FUTURE WORK:

To continue the logical design of the system and detail the functionalities, a strategy that I intend on using in the future to choose the best tools and functionalities to be incorporated in the system solution to fit PKM skills is to evaluate current PKM tools that lack interoperability but proved function-able and able to facilitate different PKM skills and choose the fittest to add to the system.

The goal is to unite the best PKM tools and technologies in one system benefiting from the idea of a social networking site and the community of practice power, as well as the objective of creating the world reliable and trustable knowledge source. The objectives of a PKM solution we summarized were addressed so the solution proves usable, but more work and effort is needed to clarify how each such solution is viable and to elevate the usability of the system solution by adding more features.

We also need to research the interoperability requirement and the need to fully understand the interoperability requirement for the system to ensure usability of the system.

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ANNEX:

Focus group meeting transcription

Transcript: Five participants without defining their names are labeled P1 for the PHD university professor, P2, P3, P4, and P5 for the master's students who are involved in professional activities.

The interviewer: Thank you for taking the time to participate in this focus Group.

First, I printed for you some papers which include a story about a person who managed his Personal Knowledge so you can understand the concept of Personal knowledge management without the need for me to explain it which makes it easier for me and you.

So, I request that you read the story, and the definition of the Personal Knowledge Management concept that follows as I want you to understand the concept first and if there's anything you didn't understand please ask me. Thank you.

Are you all done with reading the papers?

The interviewees: yes.

The interviewer: Did you all understand the concept of personal knowledge management?

The interviewees: yes.

P2: yes, but we understood that Ali has went through all these activities that you call personal knowledge management and that the final outcome was a collection on notes and lessons he learnt that he plans to combine in a book. But how did Ali trust the sources of information to learn from and rely on?

The interviewer: Ali had the challenge to build a successful startup, so he connected to people that were identified as experts in the field to learn from, trust is built through the process as Ali gets answers he need to overcome challenges he faces every day and he validate this information as he put it in use and identifies what works and what doesn't work.

The goal from developing and managing a personal social network is the ability to get closer to information sources and minimize the time and effort needed to find information.

Also, in the papers I've given you, I included the objectives I summarized from scholars' views on Personal Knowledge Management that the system design that I'm trying to develop should meet and comply with.

Now, I'll present for you the design model that we're here to validate through your feedback, and at the end If there's anything that need further explanation please tell me.

After explaining the system design model....

P2: The content discussed in the Communities of practice by its members, can it be shared outside the Community if the user doesn't trust the feedback of this Community and want further validation?

The interviewer: The content can be shared by the user with other parties from his personal social network to get further validation. The user can take more actions on the content such as suggest edits and provide feedback to the content creator.

P1: How do you control what content can be shared on the Community Discussion? Are there some criteria to accept or reject the content?

The interviewer: The way in which the content posted on Group Discussion can be moderated has to be figured out later as well as the ways in which the content to be viewed in Community Discussion can be filtered by members has to be formulated to ensure the most appropriate way is chosen that guarantees the user has the best experience in viewing the information according to his needs.

The integrity rank is taken into consideration and the ability of the users to achieve high integrity rank allows more visibility in Community discussion to members who visit the community to view its content.

The reach of content in members feeds from sources they're connected to such as Communities also depend on integrity rank. The need of the users is a priority and the content to be viewed should not be distracting so the filters should be reasonable, as for now what I know is that the user can limit content view by topic to be able to focus on one topic of interest at a time.

P3: You described how the outcome of the content being developed and ranked by communities can reach the open source after experts from different communities have agreed on its integrity, but is the open sphere the same source that's users use to create there content such as the input is also the output?

The interviewer: No, there are external sources of information and the user is free to use external sources. But the open source can also be referenced in the users new generated content. The open source is an attempt to collectively develop a better source of information that is reusable.

P3: The goal of the user could be to reach the open source sphere and put information there, but what if user knowledge couldn't reach the open source as to the way this information is evaluated by certain members who've been identified as experts and they may never agree on the content. Also, the user can share content with his social network, and it can be valuable information. So, how can the user balance his efforts as there's so much hard work to do. They must be able to choose where to put this information.

The interviewer: The user can choose where he wants to share his knowledge.

P3: How does he decide that on this complex scheme of channels such as blogging, wikis, different communities, and the open source?

The interviewer: He can decide which channel he want to use to share his knowledge and he's not obliged to choose one over the other or choose them all. He can decide how much effort he wants to put and what's the appropriate channel and audience for the content he's sharing. This complex scheme of channels offers the features to share at any channel accessible by the user and the user can decide what features he want to use.

P3: So, what's the condition that need to be met for them to contribute to the open source sphere?

The interviewer: If the content has passed the integrity test of the community, and has reached the community knowledge repository, then it may reach the open source only if all experts of communities concerned with that topic agree on the integrity of the content.

P3: Why would it be valuable to the user to do all this effort and his information may or may not get to the open source? What's the value of contributing to the open source?

The interviewer: When the user posts something on Community discussion, it won't necessarily reach the open source, it also depends on the effort of the whole community to develop the content by submitting the right feedback to develop to the point that makes it integral enough. So, what reached the open source also is the outcome of the collective effort, but the contribution of the content creator who developed the content to this point is appreciated and recorded to be rewarded in many ways and most importantly it will positively affect his social presence within the social learning system. The main goal of the system is to evaluate the knowledge worker by what they know and the more effort the user can put to that the more he'll be rewarded. That's the driver for contribution but is there's no rules that oblige the user to contribute through a certain channel or to a certain extent. Also, his contribution is also something they can show to recruiters so they can be identified by what they really know.

The interviewer: You've already starting commenting on the design itself, but I have some questions that I want to ask you to make sure you agree on the importance of Personal Knowledge Management. So, I would like you to answer the following question:

Do you think Personal Knowledge Management can facilitate your learning and development efforts?

P4: Yes, because it will allow me to filter out the information that may not be useful for my purpose and focus on sources of information with relevant information, and I believe it benefit a lot my purpose of learning.

P2: I like it but if it only passed to the open source, because it can be checked by really experienced people and by people that really care about what you wrote and gave feedback and have fully validated the content. So, it will be more valuable. Because when you're inside the social learning sphere this causes confusion for me as other users can steal the information or your ideas and post it another place on the site.

The interviewer: The site isn't just about the open sphere; it is supposed to provide for the user the social learning environment where he can learn and share with others.

P2: so, for example this feedback that I take from experts in the field, what can I do with it? Can I take it and share it inside my blog for example?

The interviewer: You can benefit from the feedback to develop on the content you shared with them. They give you remarks, and they can criticize your content and that would help you evaluate what you're learning.

P2: so, this helps in developing what I'm doing? What I mean, after I have developed everything, and it passed to the open source I have the full Idea of what I've started with, it's where I can get the full vision of what I did.

The interviewer: The goal of this system is not for your knowledge to reach the open source, it's for you to be able to learn with others, it's for you to have the tools to collect what's valuable from the information that you're exposed to everyday. So, you have the goal like Ali to create a startup, with this system you can be a member of a community of startups where people share their struggles, and how they overcome their struggles. You can benefit from experts, and you can participate with the community in its common practice and learn through that new things that matters for you and helps you develop your startup. If you were able to reach a point where what you shared have granted validation from your community, and then from experts that would be valuable for you but that not the main purpose of the system. The purpose of the system is to facilitate managing your personal knowledge.

P2: How is it evaluated? Who will evaluate my knowledge without having to reach the open source?

The interviewer: You can share with any one from your social network, and those in your social network will evaluate your content. Also, your content can reach beyond those in your social network through your blog or communities of practice you share with.

P2: So, even people from my social network can evaluate me?

The interviewer: Yes, those who decide to view your content in your social network can validate but that is based on their choice to view content that is relevant for them and if your content matches what they'd like to view. The most important thing here is to view information that is relevant for them. So, you can't decide who will see your knowledge, you can control that only.

P1: Again, I want to ask you the same question. How do you decide what's get shared or not, and how can you decide that this information is good, and this is not, this person has more or less credit? How do you decide that? So, these decisions are important so we can keep the process working from the user to the open source.

The interviewer: Yes, I think this is so important, and should be figured out later. It is important also to explain how the integrity rank works and how the integrity rank for each user is calculated. This is a challenge for us to figure out how user contribution will be controlled and how user effort will be evaluated. And our biggest challenge is how to make everything interoperable.

P1: There should be rules that controls that.

The interviewer: Yes, this is something that need to be developed and integrated into the system solution, it is figuring out how the system will function in more detail. There are many ideas for that, like maybe there could be standards for controlling the content for each community, or maybe there's special communities that will search and decide how content on this site should be regulated.

P2: For me this is perfect, because for example I'm doing a masters in oil and gas and sometimes it's very hard to find people that can help you so it's so much effort put in searching for a piece of information. But if I can find very easily find communities and experts in my field that can help me. Interacting in this learning sphere is something I liked, and I think is so valuable for me.

The interviewer: The last question I think you've answered most of it, but I need to make sure I ask you this. Do you have any remarks on the utility and viability of such solution? What do you suggest I should add to the design, or things you think I should change?

P3: I think this is a very valuable solution that we don't have right now. It can definitely fit into my personal knowledge management. But I think the idea of the restrictions on the open source sphere is something that would hinder users' efforts as it is subject to the agreement of certain experts. For example, there's currently some working open sources of knowledge for example for code development and basically how It works is that there's admins on this site who check this information if it's good or not and there's those who rank you, so the more papers you submit the more credit you get the more expert you become on this site, so the people will listen to you and they'll read your papers and there's no more the need from a pool of experts so basically everybody is an expert, and everybody has a little bit of expertise, for example you now have some expertise on personal knowledge management systems and maybe some other people will have more experience and everything but they don't know this particular knowledge that you have. So, I think in this case it would be better if everybody can be expert and publish to the open source.

P2: I agree with you but how can you be sure that those experts are right? That's why you need some moderation on who can share in the open source and what to be shared because everyone would have an opinion but it not necessarily right.

P1: Of course, but you also have the community vote on your content, so basically if you had enough vote from community members on the integrity of your content in community discussions and if there's a person who come and say oh you're wrong on this then you have to develop it to get the content right so you get the vote of that who disagreed at first.

P2: Yea, now I understand. Okay I got your idea.

The interviewer: But there's the fact that there's many communities concerned in developing the same subject, such as many communities discussing and developing knowledge on Digital Marketing, how do we ignore the agreement of other communities on the content published in the open source when one community have posted based on its internal votes.

P3: Yea, there can be many knowledgeable sources, basically they can differentiate it by the title of information they are posting and differentiate with the type of the piece of content they can add. Some would share a video and other texts, so if basically the type of knowledge that can be posted in the open source sphere could be anything, this diversity will allow more to share and to add to the open source sphere.

The interviewer: I take your point of leaving the decision for communities to decide if the content gets to open source sphere and that expert pool could be a restricting and an unnecessary step.

P1: Yes I also agree with her, it feels like an extra step where there's already the community who have voted on the validity of this information, so maybe it's better for this content who already passed the community votes can be directly published in the open source knowledge base.

P2: Regarding this, what if my community is not big enough to have valid votes on the content? Maybe at this point it would be necessary to have a pool of experts to control the content.

P3: In that case we have small communities, right?

So, basically the solution here would be to promote the community to add more members, have more experts to get the integrity rank needed but don't forget that anybody can comment and flag your content and development of content isn't limited to one community. The integrity rank of content decides on what content is published in case of conflict.

P1: How do you know that this person is a good expert or not? Are there criteria for identifying experts?

P2: Yes, why couldn't be criteria?

P1: There should be a rank or criteria that weight people on their ability to vote or give opinion.

P2: I think maybe the pool of experts is necessary when there's not enough feedback, this step should be eliminated if the weight of votes on a content have net the integrity criteria only.

The interviewer: The point of communities is that they can have shared practice and they can decide on criteria to control the content that is posted on community knowledge base. Members can also critique and flag the information that have already reached the knowledge repository and they can flag it to be discussed again in the community, so the content is continuously validated and developed.

P2: I liked the way you described it, because it allows knowledge to be validated and developed.

P1: I think the model need to be better organized by clearly separating the individual sphere from the social sphere, from the open source, so it can be easier to read.

We understand that there's three columns but it's not clear which belongs to which column. For-example, is working space from the individual or the social sphere?

The interviewer: The working space is where the user interacts with the social sphere to collaborate on projects. So, it's from the social sphere.

P2: Has this idea been implemented before? Is there anything that's been done that seems like what you're describing.

The interviewer: There are so many tools that are available to manage your personal knowledge, but there's no system that unites all and focus on the social dimension of learning and providing an environment for knowledge exchange.

P1: Can we give more comments?

The interviewer: Sure!

P1: I noticed there are symbols that have labels and there are others that don't and this would make the model not clear enough, so you should label everything.

These symbols could mean a different thing to different people, therefore I suggest you give definition to each symbol to enable correct interpretation of your design model.

The interviewer: Thanks for your remarks. I agree and I think that I should add to the side of the model a collection of symbols with their definitions to be a reference for those who are reading my model to understand what each symbol means.

P1: Yes, when you don't take into consideration the background of the second party viewing your model, and what interpretations they will have based on their understanding of the symbols that may lead to confusion.

The interviewer: Thanks for your advice, I will make sure to edit the model to include more clarity and definition.

P5: I really liked the idea, I studied computational marketing in Italy, and it was a good experience, but everything I've studies was theory. As I study, I always forget most of the information. In my opinion, this solution would help me and help students in general to study. If I make my profile on this site as a student and the professors can use the site to evaluate my understanding of the subject. By studying, and sharing my understanding of what I've learnt, and sharing my practice and knowledge so I don't forget the information and at the same time there's the ability to find the information I need more efficiently so for now there's so much information full of noise which distract us when we want to find what we need. So, if I'm able to find information easier, as for now there are so much information full of noise which distract me when I want to find what I want. So, if I'm able to find information more easier. Also I liked the idea of the community that can help me, as if I study with the community I'll be more encouraged because there are people that are interested in and learn the same thing which encourages me to continue to study more and learn from the process and put my contribution also, so I really liked the process you mentioned.

The interviewer: Thanks a lot for giving your feedback, and I'm glad you liked this idea and you can see its usability for you.

P2: There's something I need to ask! For the community of practice like in some areas like chemical engineering for example, they need to do some experiments and other physical activities to practice and learn. Can we for-example in communities of practice do something like experiments together for example? To do activities in physical and not on the internet, you know?

The interviewer: Yea, the community depending on its type and kind of practice decide on the activities that members can do together for the purpose of learning and developing competencies. It's the choice of the community to do activities outside the virtual world.

P2: So, the whole project, your idea doesn't support these kind of activities by providing places to meet for-example? Such as a special space to do experiments?

The interviewer: This is offered by the community that decides this. Each community has its own practice, identity, and its own way of doing things.

P2: So, there's no place for members to engage more and interact and learn with each other's more?

The interviewer: Yes, there will be all these depending on what the community decides. What we offer through our solution is a way to connect knowledge workers and provide a virtual place to host communities of practice for users from around the world to participate.

P2: For-example, If the project does contract with universities so the university would help Communities to do certain activities.

The interviewer: It's the members of the community or administration of the community based on what roles are responsible for moderating community practice to organize and provide such offerings and partner with universities or other parties to make engaging physically possible and do meetups and events.

P2: Sometimes, it's not enough to connect virtually, sometimes it's needed to connect physically and do physical activities and experiments, so the project doesn't support any of these?

The interviewer: Possible users for this site or types of communities is limitless, so we can't enable such service for the communities.

P1: I think it's one thing the community, the members with commons interests and purpose that belongs to communities of practice. Another thing are the procedures and methods to put the community interacting, such as workshops, conferences, or other activities. One thing is the community itself where it can be physical or just virtual, but to put people interacting, we can do this in different ways so especially with physical meetups which create stronger connection such as the one created at work. But still this depends on the community practice and its identity.