Knowledge Management System Implementation: Expert System

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Abstract. In this millennial era, artificial intelligence is rapidly growth and it is a method that has been used to solve the problem in the variety field such as business, medical, agriculture, mechanical, and so on as a business automation. The usage of this artificial intelligence may allow the computing systems solve the problems roughly at the human level. Even the power of artificial intelligence is quite powerful in this era, but it cannot go beyond the human nature which means it can solve just for a specific problem, but cannot completely replace as a human being. Based on the Yarushkina et.al (2018) the intellectual systems closely related to the artificial intelligence must contain the knowledge of the Problem Area (PrA) and also should have the problem solving methods that can solve the issues in assigning the task such as machine learning methods, knowledge engineering methods, and ontologies method

Keywords: Expert Systems, Knowledge Management, Implementation

1 Introduction

Generally, look at the previous studies about the implementation of the expert system in the organization, there are variety issues before the implementing this system. The first case is studied from the Karna, Supriana & Maulidevi (2018) that study about the relationship between expert systems and knowledge entities which exist to help the organization capture and deliver knowledge from the expert. In this study, the researchers raised an issue which the knowledge sharing between the Knowledge Based System not really profound to allow the knowledge transfer to another party easily with anonymous identity from the machine to another machine without human intervention. So, what they do is they created an interoperability protocol by combining three protocols which are Knowledge Query and Manipulation Language

(KQML), Semantic Web, and Open Archives Initiative – Protocol for Metadata Harvesting (OAI - PMH). These integrated protocols is to ensure the knowledge sharing between other knowledge-bases systems like expert systems, intelligent agent web pages, and knowledge management systems. Then, after integrating these protocols, the intelligent agent which is a person who are having expertise in specific roles and skills will be added as a patch on the Expert System. This person can share his/her knowledge with the others and he/she also needs to understand well on how KQML operates. Intelligent agent enables to enhance the origin of the Expert Systems by added, deleted, and updated his/her knowledge in this system.

Other than integrated three protocols, Yan, Li & Liu (2015) suggest to use D-S theory to develop expert system in implementation of KMS. This theory applies in order to diagnose the nutrient of the expert system and solve the inaccurate problem. Besides, S-D theory also can be used in other fault diagnosis system software in KMS. S-D theory can be an evidence and probability human intervention where it is dealing with the biased evidence and supported evidence. In addition, this theory involves the mathematical calculation to get the accurate probability density distribution function and distribution function. Yan, Li & Liu (2015) found by using this theory to develop expert system, it can solve the inaccurate problem based on a chosen area and it helps the expert systems achieve the artificial intelligence by integrated with software fault diagnosis. Furthermore, the previous study by Kireeva, Pozdnyak & Gazizulina (2019) they suggest to use personality dynamic model by Milovanov (2005) which is also involved the mathematical calculation in order to solve the problems. Basically, this model used by the expert knowledge engineer. In additional, this personality dynamic model used when it related to the secured information. For instance, study from Kireeva, Pozdnyak & Gazizulina (2019) where the issue is about the internet usage in Rusia keeping increasing so in order to protect the information security they need to develop the important component to monitor this information globally because the information is in the organization used as an audit. So, based on the analysis from the knowledge-based (Figure 2.1) the expert knowledge engineer used the personality dynamic model to develop the expert system.

The results from the development allows the expert systems for comprehensive assessment of the information security of the enterprise that taking into the industry component account. The other goods of this model are it allows the interaction from the expert systems to protect the selected asset and identify the main risk globally. Other than that, the personality dynamic model can reduce the development financial and time costs for the conducting the audit activities. Yarushkina et.al (2018) proposed another few methods in constructing the expert systems. This method is known as Fuzzy Knowledge Base Application which since the adoption of three various methods which are machine learning methods, knowledge engineering methods, and ontologies. Machine learning methods undertake from the different versions of neural networks and it has allowed to identify the pattern of knowledge and used it to solve the set of tasks given.

2   Expert System in Medical Industry

The industry that needs the expert system at the most is a medical industry because they need to face unexpected incident that involves human life and death. KMS in this industry covers all the diseases, incidents, symptoms, and healing process. All the nurses, remedic assistance, junior doctors and others can use KMS to refer to the references given by the expert and senior doctors. However, in this section it will discuss how the medical industry construct and implement the expert system in their hospital and specific high risk disease.

According to Kingston (2018), in the implementing Expert System of Knowledge Management System there has an outline approach in order to guide the surgeons in the diagnosis and treatment of thyroid disease. This is because some of the expertise in the medical industry are not available widely and somehow simply too busy to answer all the queries from the patients. Another problem from Kingston (2018) study is the best expertise is not applied to the problem because of the time restrictions. So, from the problems, the researcher list out all the possible feasibilities which are business case and technical feasibility. The first feasibility is business case there has one of the expert systems which known as Alan Pridder Replacement Expert System (APRES). This system helps the surgeons increased their productivity whereby it can reduce their time taken to solve a problem for the patient who had thyroid issue. Second, technical feasibility which involves task and knowledge, and application complexity. In context expert system, task and knowledge responsible to perform a variety major knowledge-based task, such as creation, classification, monitoring, diagnosis, assessment, prediction, planning, design, configuration and control tasks for the surgeons ease their time to make the diagnosis while application complexity is the ability of the system to support another feature tasks in the system such as analytic tasks and synthetic tasks. The results from this guideline of feasibilities it helps surgeons aware with the interfaces of the expert systems and critical safety.

According to Khong, Lee & Dawang (2017) this study is aimed to develop the expert systems known as Pressure Injury Clinical Decision Support System (PI-CDSS) and then examine the consistency of the system. So, the authors used the knowledge management methods which are knowledge acquisition, knowledge representation, knowledge application, and knowledge evaluation. In knowledge acquisition there involves the PI-CDSS workflow, the in knowledge representation it is more with the implicit knowledge that represents into the knowledge based and inference engine just by using a commercialized, third-party software, and decision rule management. Then for the knowledge application is more to the authoring the decision matrices that registers by the level 3 competence nurses in the hospital while knowledge evaluation is used to evaluate the PI-CDSS performance after three months. The results from the development PI-CDSS shows it helps the nurses in making the evidence-based decisions and automatically generates the data input from the Wound Management System.

In addition, study by Santra et.al (2019) aims to develop the medical expert system for Low Back Pain (MES-LBP) that can improve efficiency of knowledge representation scheme using the structures of the data frame and originates the reliable resolution logic through the Bayesian Network. The problem with this study is demanded of

LBP updated and accurate information is highly because it related to the human body. The researcher solves this issue just by using medical expert system and artificial intelligence that performing the reliable diagnosis while justifies the therapy for the LBP. The medical expert system will enable to assist the general physicians, nurses, junior doctors, and care-givers in the hospital. The development of MES-LBP involves four building blocks which are user interface, working memory, knowledge base, and inference engine. The LBP patient will go through all the building blocks in order to get the diagnostic results and will keep in the knowledge-based as a reference for the expert physicians or other authority that related to the patient know the diagnosis result. In this study, the researcher used one method of knowledge management only which is knowledge representation which the researcher proposes to use Bayesian Network in developing the MES-LBP. Bayesian Network involves a lot of algorithm in order to ensure the expert system productive and efficient that can give accurate and relevant information to the patient, doctors, nurses and other physicians. The result from this study, by the development of the MES-LBP all the involvements committee in LBP can access the information also can assist them how to solve the disease.

Afterwards, the study from Jadhav & Sattikar (2014) which it is just about the review of the expert system application in medicine. In this study, the researchers list out the major components of the expert system which are consists knowledge base, inference engine, user interface, domain expert, knowledge engineer, blackboard, reasoning improvement, user, and hardware. Not all the components are mandatory included in one application or system. Basically, the expert system has knowledge base, inference engine, user interface, and knowledge engineer. In addition, the study shared the expert system categories such as rule-based expert system is a knowledge that represent by a rules series, frame-based system refer to knowledge that represent as a frame series, hybrid system which is involved several approach like Bayesian Network and fuzzy logic, model-based system is a structure model that pretends as a structure and system under pre-production, ready-made system more about the utilizing the software packaged, and real-time system is the designated system in order to produce just-in-time response. The current existing expert system applications in medicines are AAPHelp which is for the severe abdominal pain that has been developed bt Leeds University, INTERNIST which to support the diagnosis, then University Pittsburgh improvise the system to INTERNIST- I that can diagnose the complex diagnosis problems in general internal medicine, MYCIN application used to diagnose and recommend the treatment just for a particular blood infections, CASNET (Casual A Sociational NETworks) or also known as GLAUCOMA used for glaucoma diagnosis and treatment, PIP (Present Illness Program) as a medium to gather all the data and generate the hypotheses regarding the progress of patient disease with the renal disease, ABEL (Acid-Base Electrolyte program) to manage the electrolyte and acid base imbalances, ONCOCIN used to assist the physician for cancer patient who are received chemotherapy treatment, DXPLAIN can provides justification of the disease reasons consideration, give the useful suggestions for further clinical information, and list the clinical manisfestations, and the last application in medicine is QMR (Quick Medical Reference) in order to diagnose the decision-support with a knowledge base of disease, diagnosis, findingsm disease accociations and lab information.

3   Expert System in Business Industry

Even though in medical industry use expert systems frequently, business industry also the second highest industry that implement expert system in the organization in order to maintain and improve their competitive advantage based on their knowledge and experiences. A lot of research related to the expert system in business industry have been done by other researchers globally. One of the study related to this scope is done by Velasquer & Lara (2017) which aims to presents the details of the knowledge management implementation in Energy Companies in Peru. The issue that force researchers to complete this study is about the challenges in implementing the knowledge management methodology in the Energy companies in Peru itself. So, what the researchers does is they propose the expert system to these companies. The proposal clearly state and explain about the mission and vision of the expert system development, objective the implementation, values of the tangible and intangible assets once this system started, methodology used in developing this system, equation background and attributes, uncertainty equation, and equation weights. The results from the expert system proposal, the Energy companies in Peru 80% workers are satisfied with the expert system because it able to ease their workloads and start to generate the trust and group in the workplace.

The other study in this context is from Rajput et.al (2014) where their study aims to propose the ontology based on the expert system but it for the suspicious detection. In 2014, most of the financial institutions all over the world need to report the suspicious activities in business transaction especially for the bank sector. This issue was enforced by the government to all the financial institution make a report as soon as possible and as much as they have the information to the local financial government. The researcher used three major steps in proposing the Ontology based expert system which comprises ontology construction, ontology researning, and the last one is query on inferred ontology. Each steps taken need to complete the sub-phases in order to ensure the system well develop and may achieve what the objectives of the expert system development. The use of the ontology methods correctly will enable the expert system works more efficient as it requires less computation and it is also able the expert system reuse the knowledge base that companies have before. The knowledge base can be used in different applications even across the similar domain.

Next, the completed study by Wagner (2017) focuses on the content analysis over thirty years from the previous case studies regarding the expert system. Expert systems had major spike in late 80s until early 90s. These systems are in field operations, finance, and management. Besides, the highest industry that implement the expert system in their organization is accounting and financial services, manufacturing and medicine industry. These three industries are react on the advancement of technology quickly and try hard to adopt with the expert system at the early stage of the implementation. Regarding the taxonomy of problem domains in implementing expert systems in business industry over thirty years were divided into three categories which are analysis problems, synthesis problems, and combination of analysis and synthesis problems. The major issues in the analysis probles are classification, debugging, diagnosis, and interpretation while issues in synthesis problems are configuration, design, planning, and scheduling. For the combination of the analysis and synthesis

problems are command and control, instruction, monitoring, prediction, and repair. The highest rate for the issues of problem domain regarding the expert system is diagnosis while the least issue is correction/repair.

4 Expert System in Agriculture Industry

In agriculture industry, expert systems are needed in order to guide the botanist and farmer on how to take care their farms and plants correctly. Most of the organizations in this industry still not aware about the benefits of the expert system, that is why they are slow in implementation of the knowledge management system.Refer to the previous studies, one of it are from the agriculture industry and research done by Devraj, Jain & Deep (2015). Their research aims is to diagnose the insectpests of the major pulse crops that highly consumed the pulse crops. The research problem in this study is the farmers lacks on the information on the production and technology protection on the plants and farms, so what they should do is they need to reguire quick access to all the potential information and need to take prompt conclusion to handle their crops proficiently and effectively. The researchers, used knowledge management methods to solve the agriculture problem. The knowledge management methods that have been used by the researchers are knowledge acquisition and knowledge representation. Then, for the expert system they are focus on the inference engine and user interface. In the knowledge acquisition process the knowledge engineer collects the knowledge driven by expert, then encodes the knowledge for the knowledge base, and then the knowledge engineer will verify the knowledge in collaboration with the expert in order to acquire the resultant knowledge base. Furthermore, for the knowledge representation process the knowledge engineer gather the knowledge into a machine executable format. Gathering the knowledge and specializing the computer can helps the farmer ease of access an find the resolving problems as an reference on how to solve the problems correctly. So, by using expert system it can provide online help in order to pulse growers and extent the workers on specialized in using a system in order to diagnose insect-pests in pulse crops. It was involved designed blueprint, system development, and system implementation because it is to ease the usage to the domain experts in conducting the important operations. However, the expert system must had user-friendly interface in order to help the farmers and workers can used the expert system properly and easy to access the sources on it.

5 Conclusion

In a nutshell, generally is a crucial system the every organization in every industries need to have it in order to ease their work, to gain more knowledge, to help them to solve the problems, helps them in doing a problem solving, etc. In development and implementation of the expert system they are not hard to do it because it has the knowledge engineer who are will ensure the system are working well and the information in the system will fulfil the user requirement and need. Knowledge acquisition

is the mandatory of knowledge management method that need to use in every development and implementation of the expert system, use a same methods but gather the different information and knowledge based on the industry. Knowledge representation method mostly used by the business industry in order to develop and implement their expert system in a better way. For the expert system components, the system required to contain at least three components such as user interface, inference engine, and knowledge engineer who are responsible to ensure every single information and knowledge are available. Expert system has a lot of benefit to the industry and organization like increase their profit, improve their competitive advantage, gain more knowledge, help the user in doing a decision, etc. In a short way, expert system is a major success to the industry and organization because of this system had the power of knowledge and information that can be accessed by everyone related to the field and industry.

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