An Analysis of Knowledge Management Processes in intelligent chatbot Systems to Meet the Needs of The Government's sector Customers

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Abstract: Artificial intelligence is one of the most notable elements of the Fourth Industrial Revolution, with government sectors adopting AI-supported systems such as intelligent chatbot systems to keep up with the digital transformation and meet the needs of their customers. It is vital to guarantee that these technologies are built on knowledge management processes in order to fully utilize them. This study aimed to analyze the knowledge management processes on which intelligent chatbot systems are based and supported by artificial intelligence techniques to meet the needs of customers of government ministries. The study used the content analysis approach, Drawing upon the literature review and analysis of knowledge management processes on which the intelligent chatbot Systems are based between (2007) until (2020). An application analysis content form was used as a tool for the study. The results of this study show that intelligent chatbot systems are based on the following processes: knowledge extraction, knowledge organization, knowledge storage, knowledge retrieval, knowledge update.

Keywords: Artificial intelligence, intelligent chatbot Systems, customer needs, knowledge management, knowledge management processes.

Introduction:

In response to changes imposed by the Fourth Industrial Revolution, which had an impact on customers' needs, several government sectors adopted artificial intelligence-based systems, whereas conventional techniques and solutions had lost their ability to meet those needs.

The use of intelligence chatbot systems by government sectors has a number of advantages, including the ability to provide support services to customers throughout the day, as well as the ability to manage recurring inquiries, which frees up time for support service employees to deal with more complex issues, as the combination of artificial intelligence and human intelligence provides a service Better, it saves staff time and lowers the cost per inquiry, decreasing customer support costs by up to 30%. (Why Chatbots Need Quality Standards?, 2019)

It is important for the government sector to embrace new systems; but, it is even more important for such systems to be able to extract, organize, store, retrieve, and update knowledge, as well as to fully utilize those systems to meet customer needs.

Failure to consider the knowledge held in chatbot systems' knowledge bases, according to a study (Springman, 2017), may result in more customer complaints and communications requiring human intervention, resulting in higher rather than lower costs. These hoped-for systems will not be realized, according to the research (Peters, 2018), if there is insufficient understanding of the knowledge base to accurately retrieve it to answer varied client enquiries. More research into the integration of intelligent chatbot systems with knowledge management is needed, according to the report (Erichson and Kim, 2020).

Therefore, the current study aims to analyze the knowledge management processes on which intelligent chatbot Systems are based and supported by artificial intelligence techniques to meet the needs of Customers of government ministries. And the current study tries to find an answer to the following question: What are the knowledge management processes on which intelligent chatbot systems are based and supported by artificial intelligence techniques to meet the needs of customers of government ministries?

Study Methodology:

The methodology that has been applied in this study is the content analysis approach, which was based on document analysis from prior studies and literature on knowledge management processes and intelligent chatbot systems between (2007) until (2020). Journals and publications are obtained from a variety of sources, including Google Scholar and.mandumah.com. An application analysis content form was used as a tool for the study.

Knowledge management:

The concept "knowledge" refers to what members of the government sector know about customers, products, processes, errors, and success. This expertise can be found in knowledge bases, shared experiences and best practices, and other internal and external resources**.**

Knowledge management, according to (Ben Amer,2017,37), is "the carrying out of activities that fall within the exploration, ownership, and participation of knowledge, employing it in an economically feasible way to strengthen the knowledge's influence in order to achieve unity of its goal**".**

Although there are many diverse types of knowledge, they all fit into a single typological framework that divides knowledge into two categories:

1- **Explicit knowledge:** it means official knowledge, coded, quantitatively expressed, educable and transportable, which can be shared with other, this knowledge consisted of the knowledge that can be obtained and stored in files and registers of the government sector. It relates to policies, procedures, programs, budgets and documents.

2- **Implicit knowledge:** it relates to which lies in within the individual of technical knowledge, cognitive knowledge and behavioral knowledge. It's not easy to share with others or transfer to them easily.(Mohamed, 2015)

Knowledge management processes:

Knowledge management processes refer to " major processes group and sub-activities that it needs to be done for generating knowledge, these processes provide the key that leads to understand knowledge management, how to

do in the best way. Although these processes vary according to the nature of work of the government sector, they are also crucial to the success of any knowledge management systems." (El-malakawy, 2007, p89).

Different processes of knowledge management, such as the processes of extracting, organizing, storing, publishing, and sharing knowledge, rely on several artificial intelligence techniques, such as artificial neural networks, genetic algorithms, and intelligent agents, can give tools like semantic analysis, text mining, determining beneficiary characteristics, and pattern matching. (bamflah, 2016)
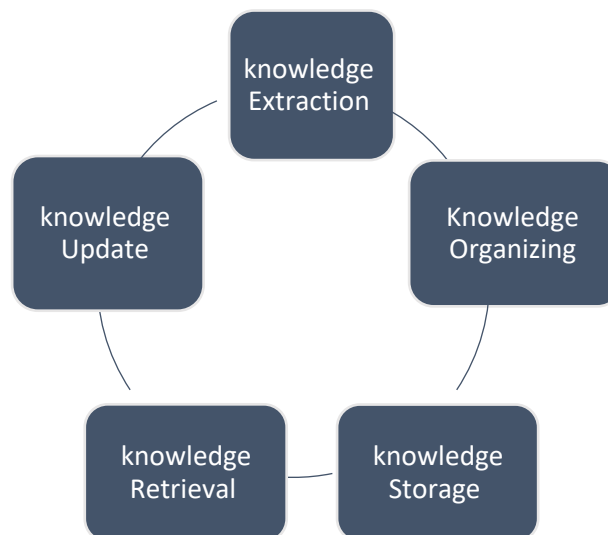
To identify knowledge management processes that can be supported by artificial intelligence, consideration was given to a group of studies that the knowledge management processes were reviewed and analyzed; as the following table shows.

Table (I) The knowledge management processes addressed by some studies

The knowledge management processes addressed by some studies								
Knowledge management processes	(Moradi, Aghaie & Hosseini,2013)	(Murad & Kurdy,2020)	(Peters,2018)	(Nyakonu,2020)	(Huang, Zhou & Yang, 2007)	(Kim, Kwon & Kim, 2020)	(Al-Ashqar, 2018)	**The ratio**
Knowledge diagnosis								**%0**
knowledge acquisition							√	**%4.7**
Knowledge generation						√		**%4.7**
Knowledge extraction	√	√	√		√	√	√	**28.5%**
Knowledge storage	√	√	√			√		**19%**
Knowledge organizing	√	√						**9.5%**
Knowledge Retrieval	√		√	√		√		**19%**
Knowledge Update	√						√	**9.5%**
Knowledge applying								**0%**
Knowledge transferring								**0%**
Knowledge sharing		√						**%4.7**
Knowledge spreading	√							**%4.7**

It is clear from table (I) that the most knowledge management processes supported by artificial intelligence techniques, according to the studies reviewed, are: (knowledge extraction, knowledge organization, knowledge storage, knowledge retrieval, knowledge update); Because it achieved the highest percentage as the most frequent

knowledge management process in the studies reviewed, and this indicates the consensus of studies on those processes, and considering that intelligent chatbot Systems are among the intelligent Systems, which are based on knowledge management processes, it can be said that (knowledge extraction, organizing Knowledge, knowledge storage, knowledge retrieval, knowledge update) are the processes upon which these systems are based, and accordingly the current study will address them, and in a manner appropriate to the nature of the study and its variables, and the following figure illustrates those processes:

Figure (I) knowledge management processes that intelligent chatbot systems are based on- source: researcher

knowledge management processes that intelligent chatbots systems are based on:

1. Knowledge extraction:

It's an analytical process for exploring and researching massive and enormous data (data summaries, models, relationships between data, etc.); to extract useful patterns and find relationships of the correlation between its elements, it's a complex and indirect process consisting of a series of interconnected stages. (Damd, 2012).

It is defined as a tacit or explicit knowledge development process from knowledge and information or analysis of past knowledge. For the government sector, knowledge can be gathered from both internal and external sources. (Titi, 1431)

The study (Peters, 2018) indicated that thousands of tickets are stored daily in databases when providing support to customers, which should be invested and benefited from by extracting knowledge from them using data mining techniques, storing and organizing them in the knowledge base of intelligent chatbot Systems to provide knowledge that meets the needs of clients.

Knowledge is extracted by data mining through the following basic steps:

- Understanding the nature of the government sector and the problems which need successful solutions.

- Understanding the data: an issue of knowing and understanding the data is the most important issue related to data engineering; the understanding helps the designers to use algorithms and practical tools in knowledge extraction, this process is performed by specific steps which are collection, characterization, and verification of the data quality, then performing an indicative analysis procedure for data.

- Initializing data by selecting it, formulating and transforming variables, then integration, designing, and formatting of the data.

- Formulating and validating solution models to get the best solution to the under-study problem.

- Evaluation and interpretation of the model results.

- Publication and distribution of the model inside and outside of the government sector so the recipients can get the results that guide the decision-making process according to decision lists, decision tree and rules, functions, and clusters (clustering) to the relevant data.. (El-aamry, 2010).

The knowledge extraction can be done through looking into database, texts, web data or special social networks data of the government sectors. The study of (Huang, Zhou, and Yang, 2007) has developed an improved intelligent chatbot Systems that automatically feeds its knowledge base. By automatically extracting knowledge from one of the online discussion forums and storing it in the system base, I was able to demonstrate the effectiveness of the proposed system by extracting (111,147) pairs of (questions - and answers) from (2000) forum topics and storing them in the knowledge base in under two minutes, which is impossible to do manually.

2. Knowledge organizing:

Knowledge organization is a collection of procedures aiming at classifying, indexing, and drawing knowledge so that it may be easily identified and accessed for benefit. Knowledge maps or ontologies can be used to organize the selected knowledge into organized groups that aid in classification. (Al-Sharari.2020).

In a nutshell, knowledge maps are "a formal representation of a set of concepts within a given field of knowledge as well as the links between these concepts," (Al-Sayyid, 16, 2013).

The research of (El-Khozaay and El-Sereehy, 2019) focuses on ontology's significant role in the development of intelligent systems in a variety of fields, as well as its role in knowledge representation, organization, and classification of concepts and terminologies in the system knowledge base, which facilitates information and knowledge search and recovery using modern digital technologies.

Intelligent chatbot systems must have knowledge maps, which serve as an access guide to the knowledge stored in the system's knowledge base; that is, it is possible to determine whether the required knowledge is available in the knowledge base or not, allowing the system to determine the best way to answer the customer's inquiry, either by retrieving it directly from the knowledge base if the knowledge is available, or by determining the best way to answer the customer's inquiry, either by retrieving it directly from the government sector website or Relevant entities when they are not available in the knowledge base.(Nyakonu,2020)

The study (Moradi, Aghaie and Hosseini, 2013) found the effectiveness of artificial intelligence techniques in building knowledge maps for intelligent systems automatically, as it can identify new knowledge attributes (meta data) added to the system, through the following:

1. Defining the attributes associated with the new knowledge, and defining its field of knowledge based on the keywords and sentences contained in it. Among the attributes that can be given to knowledge are title, creation date, format, source, keywords, description, and so on.

2. Searching the knowledge map to find the relationship of new knowledge with other knowledge.

3. Determine the link of new knowledge with other knowledge.

These maps are used to facilitate access to the knowledge stored in the knowledge bases of intelligent systems, as they indicate the locations of the knowledge in the knowledge base, and thus It does not contain knowledge but refers to it, that is, it serves as a guide to accessing to knowledge. (Bamfleh, 2016).

(Al-Nashrati,2014) believes that the structure of knowledge maps or ontology is represented in the following elements:

1- **Entities**: which are defined as vocabulary, concepts, or keywords that can be extracted from knowledge, and are the main component in the structure of maps, and represent the first level within them.

2- **Ideas:** or what is called categories, and they are the second component in the structure of maps, and refer to the basic classification in a field; It includes a group of entities that share common characteristics, and categories are not limited to entities only but extend to include sub-categories, to be the main category that includes sub-categories in a hierarchy.

3- **Properties:** These are also known as features, and they describe each of the categories and vocabulary in the map according to the characteristics that distinguish them from others and are self-determining. It determines the nature and type of the relationship that connects an individual to an individual, a category to a category, and an individual to a category.

4- **Relationships:** Relationships are one of the most important features that characterize knowledge maps. Where the relationships in the structure of the maps are characterized as having description, nomenclature, and semantics; This ensures that intelligent systems achieve knowledge integration between different entities.

3. knowledge storage:

It is the process that includes retaining and perpetuating tacit and explicit knowledge, facilitating search and access, and facilitating ways to retrieve it. The use of artificial intelligence techniques has a prominent role in all its stages. (Juma, Dridi and Khalil, 2020).

Government sectors store their knowledge; To protect it from loss in the event of its employees leaving work, and so that their undocumented tacit experiences do not pass with them; Hence it is not used. (Bamfleh, 2016).

Knowledge storage helps to re-apply practical solutions in a codified manner, as well as to take specific actions that avoid wasting organizational time and resources in repeating actions and procedures that have proven success. It is necessary to choose the appropriate knowledge to store it first, and then make sure that it is correct and complete. Stored knowledge takes various forms, including:

- Written documents and information stored in knowledge bases.
- Human knowledge stored in expert systems.
- Knowledge of documented organizational procedures and processes.
- Acquired knowledge of employees and work networks. (Ibrahim, 2013).

(Baali, 2020) indicates the importance of information technology in improving the efficiency of knowledge storage processes, as it produces advanced systems that retain knowledge and facilitate its retrieval. The most prominent of which are knowledge bases, data stores, and electronic libraries.

The knowledge base of the intelligent system contains a set of knowledge and experiences related to the cognitive domain of the system and is considered as the backbone of it, as it is based on knowledge, and is an important repository for it, and knowledge is usually represented in knowledge bases using natural language processing techniques. Knowledge is equipped with retrieval mechanisms that range from simple query languages to intelligent agents. (Ibrahim, D.T.)

4. Knowledge Retrieval:

The process of searching for and providing access to knowledge for the purposes of retrieval and application is known as knowledge retrieval. The retrieval process' effectiveness is determined by the level of knowledge organization in systems knowledge bases, which cannot be accessed and made available for use without it. There are a variety of approaches for retrieving knowledge, including artificial intelligence algorithms and statistical analysis, which includes clustering.(Bamfleh, 2016).

The extent of benefiting from knowledge depends on the extent of the ability to retrieve it and considering that retrieval requires knowledge of research techniques and appropriate retrieval methods to access knowledge, and the desire of customers to obtain immediate answers without searching in the huge sources of knowledge for government sectors, intelligent chatbot systems were used, and a study indicated (Peters, 2018) indicates that intelligent chatbot systems retrieve knowledge from the system's knowledge base, by matching it with the customer's intent or the entities extracted from its input; To get the most suitable answer. Or from the context of the conversation through the use of machine learning algorithms. Thus, each response retrieved by the system can be controlled, thus avoiding inappropriate responses.

 Knowledge retrieval was not limited to providing appropriate responses to customer inquiries, but also exceeded them to provide responses that are compatible with customer data stored in knowledge bases, and a study (AlKubaisi and AlShemery, 2013) suggested a system that contains a customer database. This system is designed to help customers who are not They have knowledge of search techniques and knowledge retrieval methods to reach the knowledge that matches what they are looking for, and that falls within their areas of interest only, by

reducing the number of sites that appear to the client in addition to reducing the number of words the client enters the search box.

5. knowledge update:

The process of updating and sustaining knowledge focuses on revision, growing and nurturing of the knowledge. The knowledge management system must include means of updating, adding, modifying and re-correction and the knowledge should be able to growing and renewal. (El-sharary, 2020).

The revision focuses on what is going on with knowledge to make it ready for use, and the knowledge that is devoid of value needs to be re-enriched to become applicable to other areas, as knowledge retention is very important, especially for government sectors that suffer from high rates of work turnover, and knowledge needs to be updated. (Al-Jabali and Al-Harayza, 2012).

The study (Moradi, Aghaie & Hosseini, 2013) found the effectiveness of artificial intelligence techniques in updating the knowledge stored in the knowledge bases of the proposed system to support marketing decisions by removing the old unused knowledge such as knowledge about products that are no longer produced now, or projects and services that have been discontinued or changed.

Conclusion:

Intelligent chatbot systems are based on a set of knowledge management processes supported by artificial intelligence techniques and machine learning algorithms، which allow the systems to automatically extract knowledge from various knowledge sources within the government sector or related parties and then organize the knowledge and determine its metadata to save it in the system knowledge base, update the knowledge by removing the outdated and unused ones so that it can be retrieved and provided to customers in real-time.

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