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Structuring Knowledge Bases with AI and Machine Learning

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Abstract
In today's world, it is no longer enough for a company to have a better product or service than its competitors to survive and grow. A customer-obsessed attitude is required for businesses to survive and grow. As we all know, competitors can typically quickly duplicate any new market position and even do it better than the organization that started the idea. The more business knowledge your team members have about the products and services your consumers use, the more successful your company will be. You, as an organization, should be swift in responding to your customers' demands to react to the competitive changes in the market. One of the key tools needed for a quick response to this effect is the Knowledge Base System (KBS). This tool can be an internal tool for your employees or an external tool for your customers. This will support the decision-making process, information sharing, products, services, etc. Most organizations have this tool but are not well structured. There is no single correct way to build a knowledge base, but there are multiple methods, each with its own set of advantages and quirks. However, if you follow some basic guidelines, you can be sure that your customers or employees will not get lost in the process. The most basic content format in the knowledge base is an article with text. However, it can include screenshots, photos, videos, audio, and infographics. We can further implement a knowledge-based system with artificial intelligence (AI), which gives room for more productivity in an organization. One thing that constitutes or destroys your knowledge base is its structure. Just like a dictionary won't serve its purpose unless it's organized alphabetically, a cluttered or disorganized knowledge base will confuse your customers and your employees rather than lead them to a solution. You can convert knowledge base articles into FAQs, product manuals, troubleshooting guides, etc. A knowledge-based system might be a game changer for your organization if you want to make your clients happy. In this article, I will walk through the objectives, scope, strategy, and all you should keep in mind when you're building a knowledge base system for your organization.
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1. Introduction

A knowledge-based system is a type of computer system that creates and uses knowledge from different data sources to aid the decision-making process at an operational level, making the decision successful, proactive, preventative, and less complex (Akerkar & Sajja, 2009). A knowledge base is the collection and organization of all types of information into a usable and valuable form using a procedure referred to as knowledge management. Knowledge management techniques are used to collect information, and then knowledge base software is used to create, manage, and deliver that information to end users. These systems use artificial intelligence to help solve issues, particularly complicated ones. These systems are generally used in problem-solving procedures and to help human learning, decision-making, and actions. The knowledge base is a database of educational content that can help your customers and agents obtain immediate help. Think of a knowledge-based system as an online library that stores a wealth of knowledge about your products or services. It is usually part of your help centre, which also hosts the community—a space dedicated to conversations between customers and you. Because it is hosted in the cloud (online) and is completely self-service, your knowledge base can be made available to customers 24/7.

Customers don't need to wait for the support staff to call back the next morning; instead, they can access information from the device of their choice when needed. It can save your customer agents time and energy. Self-service can greatly reduce your support burden, so your support agent can now spend more time on tickets that need their attention. Self-service can allow your customers to solve their problems satisfactorily without your help. Therefore, the next time they encounter a problem, they will most likely search your knowledge base first to see if they can find a solution.

A knowledge base can contain various forms of content, including:

- FAQs: Frequently Asked Questions
- step-by-step process guide
- Articles
- Video demonstrations
- Glossaries and definition lists
- Forum or community features

- How-to articles and tutorials
- Education, academies, and training programs
- Certificates
- Case studies
- Webinars

Since the knowledge-based system used modern technology with a combination of knowledge management and intelligence to provide a system used for activities such as organizational decision-making and training of new staff members, etc., let's examine what knowledge is about.

2. Knowledge Management

In everyday English, the phrase "knowledge" has multiple and diverse implications. We often use the terms "know-how" and "wisdom" interchangeably in contexts. We even use them to refer to knowledge in various contexts. We also hear the terms "data," "information," and "knowledge" thrown around a lot. It is critical to distinguish between what is considered knowledge and what is considered information or data. They are usually seen to constitute a hierarchy, from data through information to knowledge.

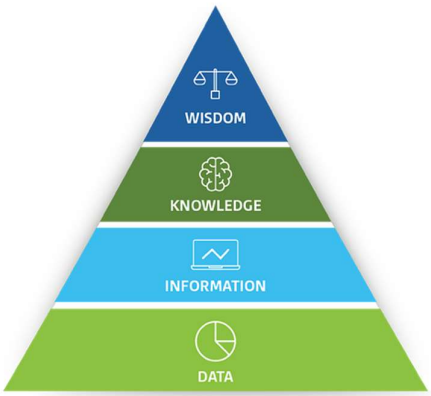

Figure 1: Source: https://blog.stratasan.com/data-driven-decisions-dikw-pyramid

Data > Information > Knowledge > Wisdom

2.1 Data

The term "data" derives from the Latin word "datum," which means "something given." When talking about data, we often refer to the values of quantitative or qualitative variables. Data by itself usually does not indicate a specific meaning, nor does it provide a positive, negative, or neutral meaning to the value itself. Data consists of discrete bits and numbers, facts, and figures. They are stagnant, disorganized, and unprocessed facts. Data is like Legos that we acquire and use to create information. For example, a forecast report may state that temperatures will be in the lower 40s; this is data, but it leads nowhere. However, the interpretation that one applies to the examination of this data may be significant. Such progression might imply that snow and even a storm are on the way. Now would be a good time to put in the snow stakes. This becomes information because data is a prerequisite to information.

2.2 Information

The term "information" is derived from the Latin verb "informare," which means "to instruct," "to teach," or, more precisely, "to inform." Usually, information is the response or answer to a question. Data becomes information when it is placed in context and within the grasp of a cognitive observer. Information shapes the data to arrive at meaning in the eyes of the observer or perceiver. It is a collection of data that facilitates decision-making.

2.3 Knowledge

Information is obtained from data, and knowledge is derived from information. The term "knowledge" refers to a refined type of information that goes beyond simply retrieving facts from raw data. It incorporates all aspects of an enterprise, including communication, management frameworks, organizational culture, organizational structures, resources, documents, people, and their skills. It has a higher degree of abstraction than what individuals have in their heads. It is wider, richer, and far more difficult to grasp than statistical data or information. Knowledge is the awareness of facts in relation to the evolution of information in general. It is the reinforcement of experience and various sorts of education and learning to realize the relationship between facts and information, as well as their reason and meaning. Knowledge acquisition involves cognitive processes, such as perception, communication, and reasoning. It is vital to note that knowledge has multiple meanings depending on the discipline

in which it is used and its context. The organization and the people determine which is which. Your knowledge may be my information, and my information could be your knowledge.

2.4 Wisdom

Wisdom is intelligence and reasoning, which is the ability to think and act using knowledge. Wisdom is defined as what you know, understand, and grasp, as well as the implicit and explicit links between the offered facts (data), information, and knowledge presented. Wisdom entails a comprehensive knowledge of the cause and consequences of a notion in addition to reasoning.

3. Categories of Knowledge

In knowledge management, there are three core categories of knowledge: explicit (documented information), implicit (applied information), and tacit (understood information). These many forms of knowledge interact to produce the spectrum of how humans transfer information to one another. Explicit, implicit, and tacit knowledge are the three major types of knowledge.

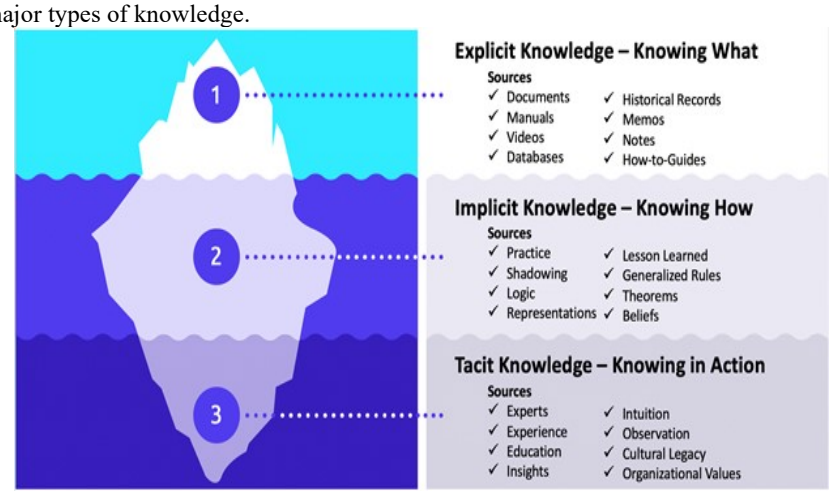

Figure 3: source: https://medium.com/psychology-in-action/show-me-how-its-done-using-augmented-reality-ar-to-tap-the-expert-s-brain-da2455c1af2b

3.1 Explicit Knowledge

Explicit knowledge is referred to as knowledge that has been written down and organized. It is the most fundamental type of knowledge, and it is easily captured, communicated, stored, shared, and transmitted electronically since it is written down and easily available. Knowledge becomes explicit once it is written down and kept somewhere. When data is processed, organized, structured, and understood, explicit knowledge is produced. They are things we know that we can write down, share with others, and put into a database. It addresses topics that are readily stated, methodically documented, recorded, transmitted, and preserved in a database. FAQs, instructions, raw data and associated reports, schematics, your company's data sheets, white papers, research studies, strategy presentation decks, and so on are all part of it. It's formalized documentation that may be utilized for a variety of purposes. Explicit knowledge in business contexts refers to procedures, standards, or jargon that can be quickly learned by new employees.

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3.3 Implicit Knowledge

Implicit knowledge is knowledge acquired without being aware that it is being acquired. It is the most underutilized type of knowledge in every business. It is based on real-life circumstances or applications, on-the-job learning, and personal preferences. These are the sorts of best-practice information or skills that may be transferred from

job to job. Implicit knowledge is difficult to manage from an organizational standpoint since it is not frequently documented.

In practice, the use of explicit information is referred to as "implicit knowledge." It is possible to employ a variety of tactics, but each has potential consequences, which result in a deliberate process of deciding the optimal path of action. As a result, your experience and other learned knowledge are synthesized to complete the task at hand.

3.4 Tacit Knowledge

Tactic knowledge is information gleaned from context and first-hand experience. And it would be the most difficult to explain or document if we were required to do so. Tacit knowledge is the application of implicit information that is distinctive to your firm. The application of employees' implicit knowledge will alter as they go from job to job, depending on what makes your company distinctive. This knowledge could include sales strategies. You cannot become a competent salesperson by simply reading a bunch of books or watching a few YouTube videos. The secret is your ability to understand exactly what your prospective consumer wants to hear, which is the sales pitch. This is the true talent required to become a successful salesperson, and you can only gain these sorts of abilities by practicing a lot and continuously improving yourself. This form of knowledge is extremely tough to impart to new recruits since it is difficult to express.

4. The knowledge management process

The knowledge management process comprises six main components that are aided by various tools and methodologies. When these stages are taken in order, data transforms into knowledge.

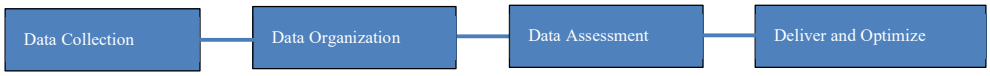

Figure 4: stages of knowledge management process

4.1 Stage 1: Data Collection

The most critical phase of the knowledge management process is data collection. The knowledge you gain may be inaccurate if you gather erroneous or irrelevant data. Data collection should be a procedure in the knowledge management process and should be properly documented, along with its collection points. Some points might be a summary of normal reports. For example, the FIFA World Cup and NBA reports for the last 50 years; the number of missing children in the city of Dallas for the last 50 years; etc. Data extraction techniques and tools needed to be defined as well. The missing children report may be a paper-based report filed with the police department, and data entry teams must manually enter the data into a database, whereas the NBA report may be an online report where the data is directly stored in the database and teams must feed from the source via an API or download the file. This data collection needs to be stored somewhere, so data storage is also defined at this stage of the knowledge management process.

4.2 Stage 2: Data Organization

When data has been collected and stored, it needs to be organized. This stage is where the company or organization will define the rules on how it should be organized, such as categorized, indexed, or classified. For example, all purchase-related data can be stored together in the same database table. This type of organization helps keep our database accurate. Normalization can also be used if there is much data in the database; that way, the data is logically arranged and related to one another for easy retrieval. When data passes the organizing stage or step, it becomes information. If you collect incorrect or irrelevant data, your results may be inaccurate. Data collection should have a standard procedure.

4.3 Stage 3: Data Assessment

At this point, information needs to be summarized, then presented in a format such as a graphic or tabular form, and stored appropriately. To be sure that it will be of benefit to the business, it needs to be accurate, up-to-date, complete, and consistent. The information will be analyzed to find relationships, redundancies, and patterns, and we will eliminate redundant information. This is where we verified, validated, and prioritized the information.

4.4 Stage 3: Deliver and Optimize

The result of the information we analyzed at the Data assessment stage becomes knowledge. The next step in the process is to share or distribute the knowledge by using software implementation.This encompasses making the knowledge available to those actively seeking it (pulled on demand) and to those who could apply it for the benefit of your organization (proactively pushed). If you make the knowledge-based software publicly available, it can be

accessed from anywhere via the Internet.

5. Database and Knowledge Base

A database is a management framework for your data. Databases are as diverse as the information they contain.
Types of databases

- The relational database
- Flat-file database
- Hierarchical and network databases
- Object-oriented database
- Object-relational database

Let me take a completely different position: Neither databases nor knowledge bases store knowledge; information is what they store. So far, knowledge can only exist in a human mind because only humans can relate the identifiers in an information system to the world of reference, at least if we do not consider mathematical constructs subjects. I.e., they are carriers of the interpretation functions between referents and referees. Any plausible information can "induce" knowledge in humans. The only difference is that knowledge base aims for structural and logical similarity of information while adhering to the human way of relating with a persistent identity and explicit propositions, possibly also rules, under the constraint of being formally logically consistent and not contradicting empirical reality within a useful precision. This makes knowledge bases particularly effective for integrating heterogeneous information. I'd regard it as decoration to name a query "What do you know?" since the machine will not know the author anyhow, not more than any database. The fact that databases, in general, have partial information about the world of reference is also not peculiar to knowledge bases. A database is a concrete technical solution for storing and organizing data; it is typically limited to these functions only. In contrast to that, a knowledge base is a technology to store "knowledge." For this purpose, it can use a database, but it is not limited to these functions. A knowledge base can use many databases or combine or enrich information from public data sources. So, the knowledge base is large and a heterogeneous source for many kinds of information.

6. Why Is a Knowledge Base Important

A knowledge base that is well-written, well-organized, and well-designed serves as a teaching tool or learning aid for new employees in your company. It also serves as a self-service to your end-users because they can assist themselves in searching for the necessary information. Knowledge bases are of two types: formal knowledge bases and informal knowledge bases.

6.1 Internal knowledge base

Companies mostly used internal knowledge base Software to capture the knowledge that employees should properly perform their jobs; companies adapt knowledge management tools to keep everyone updated on the latest happenings. It is for the company's internal use only, i.e., no access to others except company employees, and it can include information about:

- Employee onboarding: what a new employees should expect in their first few weeks, and whom to go to with questions when they have issues
- Human Resources: Where to Find Employment Privileges and Company Information Policies, processes, and procedures
- Company announcements: - Keeping team members up to date on the most recent developments
- Training team: answering commonly asked questions for the team

6.2. External knowledge base

An external knowledge base allows a company or organization to share information with public-facing customers about their products and services. It may require a customer login before accessing the knowledge base, depending on the implementation. The idea of the external knowledge base is to serve as a FAQ section for your customers to find answers to their questions.

- step-by-step user guides
- Commonly asked questions
- Troubleshooting guides
- Feedback
- new products and services

7. Benefits of a Good Knowledge Base System

A good knowledge base should consist of detailed information about the company's products and services, be self-serve and be easy to follow. The knowledge base is a very useful tool not only for your customers but also for your

support agents and internal teams.

You can add anything that gives value to your customer or your internal staff, ranging from human resources and regulations to legal frameworks, etc. You can customize the knowledge base that will help your customers, which reduces the workload on your support agent. The benefits of a good knowledge base system are not limited to the following:

7.1 A well-organized knowledge base keeps your clients satisfied.

Consumers in today's world don't like to call for support. Most of them prefer self-service over human interaction. The most cost-effective way to grow your business is by focusing your efforts on achieving customer obsession. The aim of any organization is to exceed its customers' expectations by creating a positive customer experience. Creating a knowledge base gives your customers the chance to solve their problems without your help, which is one of those key customer obsessions things. It's almost as if you get to answer the questions before they even think about them or ask them. A good knowledge base should significantly reduce the number of phone calls your customers must make to find answers to their problems.

7.2 Customer Retention

Customers increasingly want organizations that provide excellent customer service. Knowing that satisfied customers will buy more frequently and become word-of-mouth advocates for your brand, which is an excellent marketing tool that can help you increase brand awareness and improve your reputation both online and offline, it's easier to convert an existing buyer into a repeat customer than to turn lead into a client, and loyal customers are worth ten times more than a new acquisition. When your customers face any difficulties with your product or services, they register support tickets. If the service representative does not know about these issues or cannot get them resolved on time because of call volume or a knowledge gap, you are losing customers. If you have a good knowledge-based system on your customer's side, the customer will not need to create any tickets in the first place. If you also have a good knowledge-based system for your employees, the interaction with consumers will be faster. Your customer service representatives will respond to the support ticket faster because of the knowledge-based system in place. This issue will be resolved, the ticket will be closed, and your customer will remain your customer. Having a good knowledge base system will keep consumers informed and satisfied, which increases customer loyalty and retention.

7.3. Increased engagement and better productivity for employees

Occasionally, it is required that employees of a company work together and share information with other team members. When teams are dispersed throughout the world in various time zones and languages, this practice becomes difficult to achieve. Company employees can get the latest information, like training sessions at their convenience, human resources regulations that will be updated later, legal frameworks, etc., by using the knowledge base system. Having a knowledge base will ultimately benefit the company because all required information needed by the employee is already available in the knowledge base's articles. Because your staff and customers could come from different nations and speak different languages, a good knowledge base ought to be translated into several languages.

7.4 Authority and Better Search Engine Optimization

More sales chances might be obtained by establishing your authority online. This demonstrates your trustworthiness and knowledge in your field. When you have such authority, search engines like Google prioritize your site, your website ranks better in search results, and your traffic grows. To gain more visibility and clients, businesses worldwide invest huge sums of money to raise their Google rankings. if the visitors to your website require a certain piece of information and they can find the answers there. your page has a strong chance of ranking well on Google without any further work if the visitors to your website require a certain piece of information and they can find the answers there. If you also have good and engaging content and the right knowledge base implementation, your company should have a good ranking in Google searches without any SEO specialists.

8. Structuring Your Knowledge Base

There is no single correct way to build or structure a knowledge base. multiple methods can be used, each with its own set of advantages and quirks. However, following some basic guidelines will ensure that our customers will not get lost in the process.

8.1 Who are you writing for?

The first step in the process is to understand whom you are writing to. People usually visit your knowledge base for three reasons: first, when they must buy a product or service; second, to seek customer support after the purchase of a product or service; and lastly, for general inquiries. They are interested in the products you offer, but

they have not yet purchased them. They may feel frustrated when trying to get information or solve a problem if the content is unclear. Have a clear purpose; always keep this in mind when you build or write a knowledge base. If your purpose is clear and the customer gets the information they need, they are likely to learn more about your product or service and discuss it with friends, family, and the community. If your knowledge base is a forum where they can post questions or requests, then ensure sure you frequently respond to their requests so that the lack of interaction will not ultimately cost you sales.

8.2 Target Audience

You should get useful demographics about the target audience, such as gender, age, and knowledge of technology. These can help you choose the most effective content format. For example, if your average customer is a male, middle-aged person who is comfortable reading and implementing, a "how-to-use" article or product manual may help him. However, if your customer base is younger, more tech-savvy, and has a shorter attention span, then he or she may prefer to watch videos. Also, try to see where customers in that country are located and the languages they speak. You will want to attract customers in the language of their choice, not the language of your choice! Such insights can help you build a knowledge base that can truly help your customers when needed!

8.3 Strong purpose

When you create any type of educational content, you should think carefully about the purpose behind it. Without a strong purpose, your content will lack clarity. Therefore, we must first consider why we should establish a knowledge base. If your company runs an e-commerce type of business, do your customers often ask you about shipping and delivery? If yes, you can cleverly place some FAQs on your help center to solve their problems immediately. Let's say you work for a SaaS company and your customers are learning about the onboarding process, which is incredible.

To help customers, you can create a series of "how-to" articles or a complete entry guide. You can also provide checklists to help the customers track their progress. Another common type of support query involves asking for troubleshooting advice. If, at some point, you find a common problem topic in multiple support tickets, please take a step back and analysed the problem. Maybe a fault in your technology can be resolved. or a supply chain mechanism that needs to be slightly adjusted. Either way creates enough knowledge-based content to help customers in need while working hard to solve the problem.

8.4 The current problem

Finally, if your customers are seeking your advice on how to make the most use of your product, take the opportunity to compile a list of best practices to help them understand it better. At this point, you might be tempted to start building the knowledge base right away, but I will ask you not to. Pick up a piece of paper and a pen to brainstorm on how to organize the knowledge base. It’s easy to break down the document into a structure that makes sense to you. Don't forget that your knowledge base needs to be suitable for your customers. Use flowcharts to create a basic structure, add broad categories, then add subcategories, and then add possible knowledge base articles. You can analyse past support records to see what customers frequently ask. The process of solving this problem takes a long time, but once it is done, it becomes much easier. If your company must list all its knowledge base content together, it may cause confusion. None of your customers can browse your help centre to find the appropriate information at the correct time. Having a centralized knowledge base system that leads to multiple product-specific knowledge bases is a good choice. It allows the reader to follow a structured path, which makes it easy to find answers to questions without making them difficult to understand.

8.5 Centralized Knowledge Centre

Anyone should be able to catalog current or ongoing issues and be able to introduce new processes or procedures inside the organization using a reliable knowledge base system. They should be able to access information quickly, which helps save resources and time and increases productivity at work. For this to happen, there is a need for a centralized knowledge base where all documentation is in a single place.

Having a centralized knowledge base system as your organization's single main source of truth will increase efficiency and transparency. Any individual or team of many organizations does create informative content through what they’ve learned—through practice and process navigation, both internal and external to the company—but finding those contents when needed is always the problem. Having a centralized knowledge base where all content is stored for the use of the organization based on being categorized, indexed, or classified will make it easy to find such information when needed. Centralized knowledge training makes onboarding new employees quicker and less expensive than sending them to a conventional classroom. and you may just grant them single-login access to the training based on their roles or job titles, and they can read the material (video, audio, document, etc.). They can go through guides and tutorials as often as they need.

9. How a Knowledge Base Is Built

Let's take the medical diagnosis system as an example. Medical professionals will have the key knowledge about a particular problem; knowledge engineering comes along, and they will question, query, and interrogate the medical experts to discover everything that they know about this situation. They then collate the facts from them and codify all those facts into a database, which now drives the knowledge-based system. Now, users can interact with the facts in the database using an inference engine and a user interface. The user interface is where the user will enter his question, and the inference engine does the job of evaluating the question against facts in the database and getting responses to questions based on rules set for the facts in the database, and the user can ask further questions if needed. With such a system, whatever an expert with their body of knowledge can do to solve a problem, it could also be solved with the use of a knowledge-based system. or an expert system for it. For example, in a credit check situation, a financial professional will have to decide whether someone is high-risk or low-risk based on the evaluation of this person's financial situation. Another example is credit card transaction checking, Consequently, if a series of unusual activities is seen compared to usual behavior, or certain patterns of behavior are noticed, on your credit card, the system can raise a flag. Now that we know how a knowledge-based system is created, we should also know that it has its limitations. The knowledge engine engineer must identify the tricks used by an expert to quickly arrive at the appropriate solution. If they don't identify those tricks and their accuracy, they could have problems using such an expert system. The system may take a long time to conclude, or it may take a circuitous route to the conclusion, resulting in system inaccuracy. If the expected data or facts don't exist in its database, or if those facts change, the appropriate conclusion will not be reached. All this happens because the knowledge engineer may not have asked the correct questions. Remember, they are not experts in that domain; they only codify the system.

9.1. Artificial intelligence (AI) and knowledge-based

Artificial intelligence (AI) is a part of computer science that focuses on the concept of creating intelligent machines that can interact with humans to solve complex problems. AI provides a mechanism (an algorithm) to enable computers to "acquire knowledge and use knowledge to demonstrate intelligent behavior." AI is the reverse of the knowledge base, or you can refer to it as the two sides of the same coin. A knowledge base is the result of the collection, organization, analysis, and optimization of data into information. AI can use an existing knowledge base, expand on it and generate knowledge in ways that humans cannot and will not be able to achieve or imagine.

9.2. Knowledge base, AI, and machine learning implementation

Artificial intelligence is a computer system that can emulate human ability and perform intelligent human behavior. AI can learn from different data patterns. Data changing dynamically and proceeding autonomously allows for efficient and accurate data collection without requiring human interaction. As your organization grows and more products and services are developed, your organization's knowledge base also grows with it; the same is true for the customer support centre. Now, resolving a customer's problems often involves finding the source of many parts and related documents.

The use of AI tools like natural language processing, which can help generate content based on keywords, will make it easy to fetch out various information and respond to customers' agents. With the development of artificial intelligence (AI), organizations are now leveraging AI to answer their customers' questions and give them guidelines for products and services, which also helps in decision-making. AI is a unique and powerful tool. It is suitable for this task because it can learn from past interactions with your customers and use that information to make faster and better decisions in the future. It can learn how your customers think, so it can improve its performance and responses over time.

10. Conclusion

The main objective of integrating artificial intelligence (AI) with existing knowledge management systems is to improve your organization's productivity, not to replace human involvement. The integration of existing knowledge management systems with artificial intelligence can be performed in many ways. For example, organizations can use chatbots to communicate with their customers, answer questions and resolve problems related to products and services by using machine learning to recommend articles or podcasts to customers or analysed customer emails. This helps the organization improve productivity and reduce workloads and human error. We essentially replicate human knowledge into a computer that contains all the relevant knowledge from a specific domain, and if the computer has all the facts, it can make better decisions with fewer errors. With the growth and on-demand for artificial intelligence (AI), it is certain that Future knowledge-based systems could, and should, look considerably different. we should be able to validate information more quickly. more reflexive, thorough, and reliable. our future research directions should be how to make knowledge-based systems discoverable and open to aggregation and reinterpretation to create powerful knowledge-based ecologies

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