

Intelligent Systems in Businesses: A Paradigm Shift

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Abstract: A system is a set of mutually related constituents that are organized for a common goal. Systems and their associated processes are essential for all companies. Having a system in every aspect of the business whether at shop floor, stores, warehouse or administrative section leads to efficient and smooth functioning. The technologies are changing business face as disruptive business. Today the human face of business is supported by fourth Industrial revolution which uses intelligent systems for better functioning. Not very far into the future perhaps a few human supervisors will oversee a staff of robots. An intelligent system is a device with an embedded, internet-linked processor that has the capacity to collect and interpret data and communicate with other systems. It can reproduce, automate intellectual behaviors of humans. Expert systems and knowledge-based systems are examples of intelligent systems which make business easy and help top management, stakeholders and customers to achieve targets. The paper covers systems and their evolution to the business. This study emphasizes on various domains where new technologies are supporting to integrate complex parts of business.

Keywords — Business, Intelligent Systems, Efficient, Strategy, Automated, smart factory, Industry 4.0

I. INTRODUCTION

Today, for the modern workforce, the era before computerization in business is beyond imagination. Computers have changed the face of business and workplace operating patterns. It is observed that business life cycles are getting shorter. Innovative practices can help companies attain competitive advantage. This has to be Enc complemented by appropriate strategic, operational and tactical decisions. However, such decisions are complicated and time consuming. Decision makers need the right data, to make the right decision at the right time and place (Farjami, 2015). Adoption of computers and then ICT has changed the way businesses operate. It has introduced systems which have the ability to read and organize files for efficient time management and increased productivity. We are not very far from when businesses will want systems which will replicate and automate intellectual behaviors of intelligent human beings. Then businesses as we know them today will see a quantum leap in how they survive and succeed. It can be said that Intelligent Systems in businesses will create a paradigm shift.

II. LITERATURE REVIEW

In the research paper "Literature Review Of Business Intelligence" authors **Rasmey Heang and Raghul Mohan** (2017) said that the implementation of business intelligence systems are making organizations smarter, technologically more advanced as they promote knowledge diffusion, and is further helpful for business for decision making processes. The researchers also focused on enabling factors such as technology, analytics and human resource which play a vital role to the success of a Business Intelligence (BI) project. The researchers conclude that today BI is considered as real business value of the data asset which provides significant improvement in understanding and taking advantage of business opportunities.

Author Schmidt, Rainer; Mohring, Michael; Harting, Ralf-Christian (2015) said, Industry 4.0 is combination of traditional industrial strength and latest internet based intelligent system. Researcher had discussed how transition took place over four industrial. Industry 4.0 framework will leads to produce smart products and services through smart processes using intelligent systems and technologies. The technological backbone for Industry 4.0 is Cloud computing, Mobile computing and big data. Smart products interact with the surrounding without human intelligence. To be smart and unique product, processes and technologies large amount of data is captured, collected, extracted, assembled and finally created. The created data is immediately analyzed can be served for predictive analysis. Processes are also digitized and integrated to attain optimization and flexibility. Thus Industry 4.0 can lead to



mass customization which will helps to reduce customer product return. Thus the new systems are more customer centric.

Researcher **Vuksanovic, Dragan; Vesic, Jelena (2016)** in their research paper "Industry 4.0: the future concepts and new visions of factory of the future development" said that in order achieve digital innovation, one should use hardware and software solutions for the real time estimation of data. Researcher has also done comparison of today's factory and smart factory. For smart factory, software's and systems acts as stimulus. Automation and Artificial intelligence in companies leads to optimization and systemization of various activities such as raw material handling, design, drafting, simulation, product controlling, delivery etc. and improves efficiency.

Authors of the research paper "Business Intelligence as a Key Strategy for Development Organizations" **Fereydoon Azma, and Mohammad Ali Mostafapour (2012)** highlighted the main features of Business intelligence i.e. Organizational Learning and Processing of Smart. According to the authors, every organization is looking to Business Intelligence for increasing profitability by using intelligent and accurate decisions. Using intelligence, companies can predict future prospects of each business which will keep an eye on changes in the market and predict customer behavior. Thus if we take decisions speedily it may hamper quality, but through business intelligence, an organization can not only take speedy decisions, but also take quality decisions which will enhance the productivity of the organization.

Mihaela Filofteia Tutunea and Rozalia Veronica Rus in their paper "Business Intelligence Solutions for SMEs" (2012) said BI development includes series of technologies such as Decision Support Systems (DSS), Executive Information Systems (EIS), Data Warehouse, OLAP and Data Mining. BI is "a strategic information system capable of providing actionable information through a centralized data repository, collected from numerous sources, transformed into meaningful information via BI analytical tools, to facilitate business insights leading to informed decisions". In today's competitive world, using an efficient BI solution for making correct and timely decisons can ensure consistent competitive advantage for any SME.

Author Geissbauer, Dr. Reinhard; Vedso, Jesper; Schrauf, Stefan (2016) has explained the drivers of industry 4.0 which plays vital role in the business transformation. The drivers are -

1. Connecting digital and integration of vertical and horizontal value chains

2. Digitization of product and service offerings

3. Digital business models and customer access

Survey talked about smart products and services which

are foundation for disruptive business. The new model will significantly increases the performance of top or bottom line of industry. Thus various segments from business will to achieve targets.

In the research paper "Business Intelligence during times of crisis: Adoption and usage of ERP systems by SMEs" authors **Antoniadis and Tsopogloy (2015)** had focused on adoption of Enterprise Resource Planning (ERP) systems in enterprises and SMEs, which helps organizations in knowledge dissemination and apt decision making processes. In the time of crisis, SME's divert resources from "expensive" tasks such as training and integration of new software to the more essential ones. It is here that ERP systems and their Business intelligence capabilities could be fully utilized to gain potential competitive advantage.

III. RESEARCH METHODOLOGY

The objectives of this study are to

- 1) Identify different types of systems.
- 2) Understand the importance of intelligent systems in business
- 3) Explore applications of BI in modern business.

For the purposes of this study, secondary sources have been used from the literature on systems, evolution of the system and intelligent system, concept and various case studies on the topic.

IV. SYSTEMS

An information system can be defined as a set of devices, components and operating system designed considering ideas from end user to produce information. Systems exist or are created to perform a specific function. System is a set of group of components that interact to produce information. Systems as they are prevalent in industry may either be

A.Abstract or physical

Abstract or physical in form. An Abstract System is a non-physical one in which the Input-process-output is an orderly arrangement of interdependent ideas or constructs. Physical system is made up of tangible entities that may be static or dynamic in nature which operate together to accomplish an objective.

B.Open or Closed

Open or Closed for interaction. An open system continually interacts with its environment whereas a closed system is isolated from environment influences.

C.Permanent or temporary

Permanent or temporary in nature. A permanent system is one which has a relatively long lasting time span of existence. Temporary systems on the other hand, have a short time span.

D.Natural or Manmade



Natural or Manmade system. When the system exists in or is created by environment / nature, it is called as natural system. When the system is prepared by man it is called a man-made system.

E. Deterministic or Probabilistic

Deterministic or Probabilistic for outputs. In deterministic system, the occurrence of events is accurately predictable. Probabilistic system is one in which the occurrence of events cannot be predicted.

EVOLUTION OF SYSTEMS

In all these years there has been continuous improvement and updating in the systems. The traditional systems were less costly and were user friendly but the accuracy, decisiveness at different levels, time information management and speedy completion of operations was lacking. Gradually, with the development of computer systems and its implementation, businesses started to organize all of their information in an accessible manner. A system is nothing but set of interconnected and interdependent components that are organized for a common goal. Systems and their associated processes are essential for all companies. Having a system in every aspect of the business whether at shop floor, stores, warehouse or administrative section leads to efficient and smooth functioning. A strategy to implement such smart systems will help integrate complex parts of business.





Source:https://www.conceptdraw.com/examples/types-of-information-system-in-diagram

The diagram above illustrates the hierarchical evolution of systems in an organization. The complexity of the systems is directly proportionate to the nature of data and knowledge. As systems become more complex, it can be seen that as one shifts from use of basic or raw data to conversion to information which in a documented form is explicit knowledge and through practice evolves into tacit knowledge.

Organizations use transaction processing system for operational level work and functions to guide and support shop floor workers and front line staff. This category of staff usually has the role of providing the data required to take operational decisions.

Middle level managers use Management Information Systems (MIS) to help the smooth functioning of the organization. These management-level systems help the management evaluate an organization's performance by comparing current year with previous years. MIS can provide periodic, exceptional, on demand, push reports and responses which have pre specified fixed format. At a higher level of management, Decision Support Systems (DSS) are used to facilitate a base for knowledge and its integration into the organization. A DSS is an organized collection of people, procedures, software, databases, and devices used to support problem-specific decision making and problem solving. The focus of a DSS is on decisionmaking effectiveness for resolving business problems. These systems are interactive and are often used to analyze existing structured information to resolve weak problems and identify the possible effects of their decisions for the future.

Executives and senior managers can analyze the environment with the executive information system which helps organization to identify future trends in business and course of action for attainment of strategic objectives. Executive Information System is meant for top executives who do not require intermediaries.

V. INTELLIGENT SYSTEMS

Further revolutionary changes in Information Technology have resulted in development of artificial intelligence (AI) or intelligent systems. An intelligent system is a device with an embedded, internet-linked processor that has the capacity to collect and interpret data and communicate with other systems.

AI tries to attain expert-level proficiency in resolving problems in different areas by understanding patterns and recognizing them for specific tasks. These are called knowledge-based or expert systems. AI is mainly associated with methods of developing systems which reflects intelligent behavior features. Typically these systems are designed to have capabilities to replicate the human sensing and thinking. They can perform functions such as advising, demonstrating, developing a solution, helping humans in decision making, diagnosing, understanding and analyzing input, forecasting results, validating the conclusions. The main components of expert system include – Knowledge Base, Inference Engine and User Interface.

1) Knowledge Base

Intelligence of the machines or systems is a function of learning and knowledge. The success of expert system mainly depends upon how accurate and precise the knowledge with us is. If knowledge repertoire has highquality domain-related knowledge then the expert system will work well. Expert systems are based on both, factual and heuristic knowledge. Factual knowledge is that task



oriented knowledge that is widely found in textbooks, reference books or journals etc. whereas heuristic knowledge is more experiential but comparatively less accurate. It is the knowledge of good guessing, analyzing and reasoning.

2) Inference Engine

The second component, Inference Engine acquires, manipulates and controls the knowledge from the knowledge base, uses efficient procedures and rules which help in deducing an accurate, flawless solution. It follows two philosophies- forward chaining and backward chaining. In forward chaining, an expert system has to answer the question, "What can happen next?" and in backward chaining "Why has this happened?" Whatever be the strategy, the system comes to a possible solution.

3) User Interface

Once the work of inference engine is over, user interface guides the user on how to interact with the Expert System. Thus it explains how the AI Expert System has arrived at a particular inference. Zeng et al. (2006) define BI as "The process of collection, treatment and diffusion of information that has an objective, the reduction of uncertainty in the making of all strategic decisions."

Sometimes BI also referred to as competitive intelligence (CI), market intelligence, customer intelligence, competitor strategic intelligence, intelligence, and technical intelligence. The figure below shows how intelligence changes over period of time like, dumb systems, guided systems, smart systems, brilliant systems, genius systems and global intelligence systems. Embedded information is the norm now. We realize that an ideal system today, not only needs to perform certain pre-defined functions but also automate functions using certain analytics in business. The rationale of intelligent systems in business is to assist smooth flow and dissemination of business information inside and outside of organization. It identifies and then processes the information into useful managerial knowledge and intelligence. The BI analytics automates a lot of tedious work.



Figure 2

Source: Law of Increasing Intelligence of Technical Systems by Navneet Bhushan

INTELLIGENT SYSTEMS IN MODERN BUSINESSES

Continuous improvement and development in IT industry has changed the business world. Although term artificial intelligence was coined in the year 1956, the concept is popular and relevant today. Intelligent systems which have ability to comprehend, analyze and understand are finding applications in different sectors. High data volumes, advanced algorithms, and efficiency in computing power and storage. According to Online Analytical Processing (OLAP), "The term Business Intelligence (BI) refers to technologies, applications and practices for the collection, integration, analysis, and presentation of business information". With the implementation of BI organization will cater "decision making; better customer handling and engagement; understand current trends in business, resolving faster business issues; reduced various costs; better productivity; increased profits; increased market share. Thus intelligent systems are a knowledge development system which not only automates work but also brings in a host of related advantages.





Figure 3

Source: https://www.e-reading.club/bookreader.php/ 1005460/Polyakov_Arpsychology_and_structured_design_ of_artificial_intelligent_systems.html

VI. BI APPLICATIONS

According to Rajan 2008, BI is the conscious, methodical transformation of data from all sources to provide information that is business-driven and results-oriented, change from a reactive approach to a proactive one; automate and integrate as many steps and functions as possible in business, analyze and integrate powerful capabilities in business events. Some areas where BI works for business betterment are outlined below.

A. Customer analytics

Customer analytics help companies to understand who the customers are and how to track and retain each



customer. Through this customer analytics, the important customers can also be identified and retained. Customer profiling, targeted marketing, customer satisfaction and customer loyalty are aspects of customer analytics that benefit sales, marketing, and service organizations as they interact with the customers.

Customer analytics embrace the continuous improvement individual customer profiles that of incorporate demographic, psychographic, and behavioral data about each individual. It also keeps track of customer likes and dislikes which will help in campaigning and promotions of new product / service offered by companies. Again in customer analytics, personalization feature keeps track of customer's profile just like in the olden day's salespersons who used to remember details about his or her individual customers. It also maintains metrics for measuring customer lifetime value. Nowadays AI chat-bots are exceedingly used for customer service. They quickly answer customer's queries; hold a conversation with any customer about any issue at any time of the day. Thus there is increased customer engagement and interactions.

Food delivery companies are using Chabot's in different ways such as one can order food and get the status of delivery and information about account transactions etc. Some of the famed brands which are using AI Chabot for delighting customers include Starbucks, MasterCard, the Wall Street Journal and Pizza Hut etc.

An example of use of software to understand and analyze customers' data to take efficient decisions in business is ZOHO CRM Software. It enhances customer relationships by use of better forecasting. It uses Zia: the conversational AI as a tool which perform actions such making a chart from CRM data, calling a customer, placing an order or changing a status or reminding about scheduling a meeting etc.

B. Hotel industry Analytics

Today leading hotels use analytics for establishing the optimal price for guest rooms for revenue management. Hotels are also looking at analytics for quantitative expertise in the areas such as conference facilities, corporate events and catering. It also assists operations like adjusting room lighting, adjusting temperature, operating gadgets in room, gamification and amusement etc. With the help of these systems, results are generated which augment s to frequent customers and assess the likelihood of those customers shifting to competitors.

The famous Henn na Hotel in Japan is using robots as staff for day to day hotel work and to serve guests in the hotel. The robot at the gate carries customers' luggage to rooms. Robot Churi-chan (AI assistant) adjusts room lights and provides information on climate conditions.

Some other examples of hotels using Artificial Intelligence to improve guest experience include "Rose" the

chat-bot in Cosmopolitan of Las Vegas, Hilton World wide's AI concierge, "Connie" and "Edward" the AI chat bot at Radisson Blu owned Edwardian Hotels which can assist guests by delivering information on local bars and restaurants as well as deal with complaints

C. Recruitment analytics

Recruitment is a critical function for every organization as not hiring the right candidate will affect organizational productivity. Recruitment analytics helps to streamline the hiring process. It tracks i.e. finds the right candidate and refines sourcing by predictive analytics. The data can be collected from social media sites or job portals like naukri.com, monster.com etc. Such analytics also helps in mapping opportunities to the right talent in order to improve employee retention. These days personality predict applications/software are being used which accurately predict psychological traits of human behavior from digital footprints. It also helps to identify the best candidates.

The Psychology Center, University of Cambridge, had come up with a system named "Apply Magic Sauce" which had trait prediction engine based on digital footprints such as individuals' browsing information, Facebook IDs, status, various post and tweets etc.

HireVue is also site where hiring is simplified with AI driven prediction and inefficiencies in traditional hiring can be removed.

Unilever uses Artificial intelligence to screen and assess around 1.8 million job applications to recruit more than 30,000 people a year. Unilever also has AI-powered tools to help them adjust to their new role and be ready to work immediately.

L'Oréal adopted AI and Machine Learning to focus on value-added tasks in recruitment. For the screening process L'Oréal adopted Chabot, Mya which helped job seekers like a human recruiter, screening potential candidates for the company.

D. Human capital and resource analytics

The concept of human capital was defined as the discounted value of future earnings. But human capital is never measured directly in terms of productivity. 'The human capital of a company ... is the sum of the current and future economic valuation of the skills and capabilities embodied within all the individuals that make up the total workforce of the organization' (SSE 2015). Human resource analytics (HR analytics) focuses on applying analytics to the employees of an organization in the light of improving employee performance and attaining better return on investment. HR analytics gathers data on employee efficiency and aims to provide insight into relevant decisions about how to improve these processes. Industry examples of firms which used AI for improving efficiencies of the HR function include



• Xerox, which used extensive data analysis to find out how to retain its customer service employees.

• Juniper Networks, which used data compiled by LinkedIn to analyze where the best employees come from and where they go after leaving the company and devise new strategies for attracting and retaining the best talent.

• Royal Dutch Shell, which used results from video games played by its idea-generators for identifying characteristics of people whose ideas would succeed at Shell.

E. Supply Chain Analytics

In the present times, intelligent supply chain management is transforming the traditional warehouses, retailers, operations and process. Block-chain is the tool which uses the Internet of things for analytics. Top benefits of blockchain are transparency, security, traceability and security. Supply Chain analytics helps machine-aided purchases such as voice ordering through voice assistants like Amazon's Alexa. Such tools help the supply chain industry to be more vibrant and effective in their operations.

Instances of companies adopting technology to improve their supply chain and logistics include UPS which uses an AI-powered GPS tool called ORION (On-road Integrated Optimization and Navigation) to create the most efficient routes for its fleet and Rolls Royce which partnered with Google to create autonomous ships which uses AI to safely transport its cargo

F. Tourism Analytics

Indian railway catering and Tourism Corporation is also using artificial intelligence powered chatbot known as DISHA. The Full form of DISHA is Digital Interaction to seek help anytime. The DISHA chatbots helps to resolve travel queries and services offered by IRCTC. Thus leads to minimize waiting time for query answering. It helps to strengthen customer satisfaction.

Utrip is basically travel planning platform which provides individual customized itineraries based on customer preferences and budget. Avvio is company which has product Allora, has ability to analyze current and past data of user preferences. Ultimately this helps managers to take better decisions.

VII. FINDINGS

1) Technology and systems are changing rapidly. Intelligent systems are replacing labor and technology is replacing automated routine cognitive work.

2) Industry 4.0 is transmuting manufacturing and service industries and their processes and functions.

3) Smart products and services will be the future of the business, which will fulfill customers' expectations beyond their requirements.

4) The technologies like Chatbots and robots will streamline interaction and improves stakeholder's engagement

5) Strategic decisions and solutions can be done earlier with predictive analysis

VIII. CONCLUSION

Intelligent systems and BI are changing the business world. Intelligent systems give quicker responses to businessrelated queries and produce important business metrics reports. They present valuable insights related to customer behavior and their preferences. They also measure customer lifetime value. The strength of intelligent systems is that businesses gain better understanding of the past, present and future of business. Businesses as we have known them and as they are today are dramatically different. We can say that a paradigm shift has happened in businesses.

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