Introduction to Industrial Management

Associate Professor Dr. Eng. Osama Mohammed Elmardi Suleiman Khayal, Department of Mechanical Engineering, College of Engineering and

Technology, Nile Valley University - Atbara – Sudan

Email address: osamamm64@gmail.com

Google scholar citation link: https://scholar.google.com/citations?user=-k9zOxAAAAAJ&hl=ar

mobile phone number: Sudan, Atbara | 00249919305570

Abstract

Effective industrial management is important as it helps organizations meet challenges, accomplish goals, reduce costs, utilize resources optimally, and establish sound organizations, thereby benefiting both businesses and society.

Studying industrial management offers numerous benefits for individuals aiming for a career in this field. Firstly, it equips them with the necessary knowledge and skills to effectively manage men, money, and machines in industrial settings, contributing to industrial growth and economic development. Additionally, management research tailored to specific industry needs helps in addressing practical management issues and improving decision-making processes, leading to better risk management and global competitiveness in industries. Understanding the principles of good work design and manual labor is crucial in the context of Industry, where human, machine and computer interactions are crucial in highlighting the importance of sound industrial engineering knowledge. Moreover, mastering industrial security management ensures a comprehensive understanding of security functions within corporate operations, emphasizing management techniques over hardware aspects.

Keywords: Artificial Intelligence; Data Science; Machine Learning; Study programs; Specialization; Data Center Monitoring.

1. Introduction

Industrial management is a branch of engineering that facilitates the establishment of a management system and integrates diverse engineering processes. Industrial management deals with industrial design, construction, management and application of science and engineering principles to improve the entire industrial infrastructure and industrial processes. Industrial management focuses on managing industrial processes. It can be said that industrial managers are responsible for the appropriate and most efficient interaction of man, material, machine and method that every organization needs.

Industrial management also involves the study of the performance of machines as well as people. Specialists are employed to keep the machines in good working order and to ensure the quality of their production. The flow of materials through the factory is supervised to ensure that workers or machines do not stop working. Continuous inspection is carried out to keep production as per standards.

As part of engineering, especially in relation to the manufacturing engineering industry, it studies the structure and organization of industrial companies. It includes areas of industrial issues essential to the success of companies in the manufacturing sector.

Who is an industry manager? The industrial manager integrates the principles of manufacturing system, logistics, supply chain management, materials management, and entrepreneurship, among others. Industrial managers plan how to use resources efficiently and economically in a business including labor, materials, machinery, time, capital, energy and information. The industrial

manager also has to deal with creating new systems to solve problems related to waste and inefficiency associated with a business/industrial process. This field always needs competent personnel who are able to apply logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to such problems. The Master's degree in Industrial Management provides students with broad knowledge and skills required to meet industrial needs [1] – [6].

2. Coursework or Course Study

Study programs in industrial management are very popular in economies with a high value of industrial production, such as the United States and Germany. German research universities in particular integrate a large number of advanced engineering courses into their graduate program in industrial management, and are therefore similar to M. Eng programs. Degree programs are also offered under the title Industrial Management [1] and [3] – [6].

3. Specialization in Industrial Management

The major or the specialization in Industrial Management is designed to address and solve real-life problems related to industrial installations. Collaborating with relevant industries and financial institutions is its modus operandi. This major is one of the very few majors aimed at mid-career professionals who wish to move into senior management within industrial and manufacturing organizations. It is designed to provide essential business expertise to all senior managers by integrating specific engineering topics with technology management and manufacturing systems. The major also studies the latest business ideas and provides specialized knowledge in engineering and technology issues and theories. Topics such as finance, marketing and management strategy are integrated with modern industrial issues such as project management and quality [1].

4. Artificial Intelligence

4.1 Explaining Artificial Intelligence (AI)

In the simplest terms, the term AI refers to systems or devices that simulate or mimic human intelligence to perform tasks and that can improve themselves based on the information they collect. Artificial intelligence manifests itself in a number of forms. Some of these examples:

Chatbots or chat robots are used in artificial intelligence to understand customer problems faster and provide more efficient answers.

Artificial intelligence is used to analyze important information from a large set of text data to improve scheduling.

Recommendation engines can provide automated recommendations for TV shows based on users' viewing habits.

Artificial intelligence is more about the ability to think superiorly and analyze data than it is about a specific form or function. Although AI presents images of high-performance, human-like robots taking over the world, it does not aim to replace humans. It aims to significantly enhance human capabilities and contributions. Which makes it a very valuable business asset.

Ontology (the branch of metaphysics that deals with the nature of existence) represents knowledge as a set of concepts within a domain and the relationships between those concepts. Figure 1 below shows this.
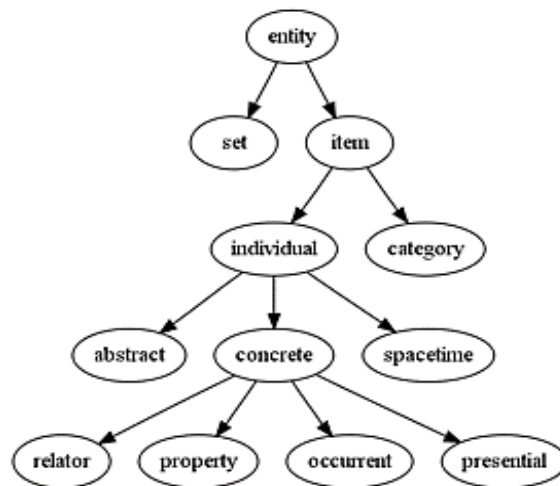
Figure 1 Representing Ontology Semantics with Description Logic

4.2 Artificial Intelligence Terminology

AI has become an umbrella term for applications that perform complex tasks that in the past required human input, such as communicating with customers online or playing a game of chess. This term is often used interchangeably with its subfields, which include machine learning and deep learning. However, there are differences. For example, machine learning focuses on creating systems that learn or improve their performance based on the data they consume. It is important to note that although all machine learning is AI, not all AI is machine learning.

To get the full value from AI, many companies are making significant investments in data science teams. Data science, an interdisciplinary field that uses scientific methods and other methods to extract value from data, combines skills drawn from fields such as statistics and computer science with scientific knowledge to analyze data collected from multiple sources.

4.3 Artificial Intelligence and Developers

Developers use AI to more efficiently perform manually performed tasks, communicate with customers, identify patterns, and solve problems. To start using AI, developers must have a background in mathematics and feel comfortable with algorithms.

When starting out using AI to create an application, it helps to start small. By building a relatively simple project, like tic-tac-toe, for example, you will learn the basics of artificial intelligence. Learning by doing is a great way to improve any skill, and AI is no different. Once you have successfully completed one or more small projects, there are no limits to where AI can take you.

4.3.1 How can Artificial Intelligence (AI) Technology help organizations?

The main principle of AI is to mimic or simulate and go beyond the way humans perceive and interact with the world around us. Which has quickly become the cornerstone of innovation. Equipped with several forms of machine learning that recognize patterns in data to make predictions, AI can add value to your business by:

Providing a more comprehensive understanding of the wealth of data available.

Relying on predictions to automate highly complex tasks as well as mundane tasks.

In manufacturing, AI can provide the most value in planning and production processes. According to the BCG report, the most important use cases of AI in the manufacturing industry are:

Intelligent, self-improving machines that automate production processes.

Anticipate efficiency losses for better planning.

Detect quality defects to facilitate predictive maintenance.

We will explore the most notable use cases from each category mentioned above in the following sections. However, before continuing, let us understand how AI will change manufacturing.

4IR technologies will begin to emerge in the era of intelligent manufacturing with digital factories. According to the IFR (International Federation of Robotics), there were already 2.7 million industrial robots working in factories around the world in 2020. This was a 12% increase compared to 2019, and with digitalization initiatives increasing exponentially, the trend is expected to grow further. .

Manufacturers will continue to invest in technologies such as artificial intelligence and machine learning to further reduce production costs and improve time to market. In the wake of a global pandemic, manufacturers will strive to make their businesses more resilient by adopting technologies that automate tasks, anticipate disruptions, and facilitate full control of all operations.

4.3.2 Artificial Intelligence in Institutions

AI technology improves organizations' performance and productivity by automating processes or tasks that previously required human power. AI can also understand data on a scale that no human can achieve. This ability can bring significant benefits to the business. For example, Netflix uses machine learning to provide a level of personalization that helped the company grow its customer base by more than 25 percent in 2017.

Most companies have made data science a priority and are still investing heavily in it. According to a Gartner survey of more than 3,000 CIOs, respondents ranked analytics and business intelligence as the top differentiating technologies for their organizations. The CEOs surveyed believe that these technologies are the most strategic for their companies and, therefore, attract the newest investments.

AI provides value to most jobs, businesses, and industries. It includes general applications for specific fields, such as:

Using transactional and demographic data to predict how much specific customers will spend over the course of their relationship with the company (or customer lifetime value).

Optimize prices based on customer behavior and preferences.

Using image recognition to analyze X-ray images for signs of cancer.

4.3.3 How do Companies Use Artificial Intelligence

According to Harvard Business Review, companies primarily use AI to:

Detect and deter security intrusions (44 percent).

Solve technical problems for users (41 percent).

Reducing production management work (34 percent).

Measure internal compliance when using approved suppliers (34 percent).

4.3.4 What are the Driving Factors for the Adoption of Artificial Intelligence?

There are three factors driving the development of AI across industries:

Delivers high-performance computing easily and affordably. The abundance of business computing power in the cloud has enabled easy access to affordable, high-performance computing power. Before this development, the only computing environments available for AI were non-cloud-based and expensive.

Having large amounts of data available for learning. AI needs to learn from a lot of data to make correct predictions. The emergence of different tools for collecting labeled data, as well as the ability for organizations to easily and affordably store and process this data, whether structured or unstructured, has led to more organizations being able to create and train AI algorithms.

Applied AI technology provides a competitive advantage. Companies are increasingly realizing the competitive advantage of applying AI insights to business goals and making it a business-wide priority. For example, targeted recommendations provided by AI technology can help you make better decisions faster. Many AI features and capabilities can reduce costs, reduce risk, speed up time to market, and much more.

4.3.5 Five Common Myths about AI for Organizations

While many companies have successfully embraced AI technology, there is a lot of misinformation about AI and what it can and cannot do. We will discover five common myths or legends about artificial intelligence below:

The First Myth: Artificial Intelligence Requires You to Follow a Style that you Designed Yourself

Fact: Most companies are adopting AI through a combination of both in-house and non-traditional solutions. Developing in-house AI allows companies to customize unique business needs; Pre-built AI solutions enable you to simplify implementation with a ready-to-use solution for the most common business problems.

The Second Myth: Artificial Intelligence Delivers Magical Results Instantly

Fact: The path to AI success takes time, thoughtful planning, and a clear idea of the results you want to achieve. You need a strategic framework and an iterative approach to avoid delivering a random set of disconnected AI solutions.

The Third Myth: Artificial Intelligence (AI) Does not Require People to Operate it

Fact: AI is not about controlling robots. The value of AI is that it augments human capabilities and eases the burden on your employees to devote themselves to more strategic tasks. Furthermore, AI relies on people to provide it with the right data and work with it in the right way.

The Fourth Myth: The More Data, the Better Results

Fact: Enterprise AI needs smart data. To get the most effective business insights derived from AI, your data must be high-quality, up-to-date, relevant, and rich.

The Fifth Myth: Enterprise Artificial Intelligence (AI) Only Needs Data and Models to Succeed

Fact: Data, algorithms, and models are the beginning. But the AI solution must be scalable to meet changing business needs. To date, most enterprise AI solutions have been designed by data scientists. These solutions require extensive manual setup and maintenance and are not scalable. To successfully implement AI projects, you need AI solutions that are scalable to meet needs as you move forward with AI technology.

4.4 Benefits and Challenges of Enabling Artificial Intelligence

There are many success stories that prove the value of AI. Companies that add machine learning and cognitive interaction to traditional business processes and applications can dramatically improve user experience and boost productivity.

However, there are some obstacles. Few companies have deployed AI on a large scale, for several reasons. For example, if they do not use cloud computing, AI projects are often very expensive. They are also complex to construct and require expertise, which is in high demand with supplies in short supply. Knowing when and where to integrate AI, as well as when to turn to third parties, will help reduce these difficulties.

4.4.1 Artificial Intelligence Success Stories

AI is the driving factor behind some important success stories:

According to the Harvard Business Review, the Associated Press produced 12 times more stories by training its AI software to write short earnings stories. This effort freed the agency's journalists to write more in-depth articles.

Deep Patient, an AI-based tool developed by the Icahn School of Medicine at Mount Sinai, allows doctors to identify high-risk patients before diagnosing diseases. The tool analyzes a patient's medical history to predict nearly 80 diseases one year before their onset.

4.4.2 Ready-to-go AI Makes Activating AI Easier

The emergence of AI-driven solutions and tools means that more companies can benefit from AI at a lower cost and in less time. Off-the-shelf AI refers to solutions, tools, and software that either have built-in AI capabilities or automate algorithmic decision-making.

Off-the-shelf AI can be anything from autonomous databases, which self-repair using machine learning, to pre-built models that can be applied to a variety of datasets to solve challenges such as image recognition and text analysis. It can help companies realize value faster, increase productivity, reduce costs, and improve customer relationships.

4.4.3 How to get Started with Artificial Intelligence

1/ Communicate with Customers through Chatbots:

Chatbots use natural language processing to understand customers and allow them to ask questions and obtain information. These bots can also learn over time so they can add more value to customer interactions.

2/ Data Center Monitoring:

IT operations teams can save huge amounts of time and energy on system monitoring by putting all web data, application data, database performance, user experience, and log data into a single cloud-based data platform that automatically monitors thresholds and detects anomalies.

3/ Conduct Business Analysis without the Need for Experts:

Analytical tools with a visual user interface allow non-technical people to easily look into the system and get understandable answers.

4.4.4 Discovering Obstacles to Realizing the Full Potential of Artificial Intelligence

Despite the promise of AI, some companies do not realize the full potential of machine learning and other AI functions. Why? Ironically, it turns out that the problem lies, in large part, with the people. Inefficient workflows may also prevent companies from getting the full value of their AI implementations.

For example, data scientists may face challenges in obtaining the resources and data they need to create machine learning models. They may have trouble cooperating with their teammates. They have many open-source tools to manage, while application developers sometimes need to go through an extensive recoding process of the models that data scientists develop before, they can include them in their applications.

With a growing list of open-source AI tools, IT administrators are finding they can spend more time supporting data science teams by constantly updating their work environments. This problem is exacerbated by limited standardization in how data science teams want to work.

Finally, senior executives may not be able to envision the full potential of their companies' investments in AI. Therefore, they do not provide enough care and resources to create the collaborative and integrated ecosystem necessary for the success of AI technology.

4.4.5 Create the Right Culture

Getting the most out of AI, and avoiding issues that prevent successful implementations, means creating an overall culture among teams that fully supports the AI ecosystem. In this type of environment:

Business analysts work with data scientists to define problems and goals:

Data engineers manage the data and the data platform so that it is fully operational for analytics.

Data scientists prepare, explore, visualize, and model data on a data science platform.

IT engineers manage the underlying infrastructure needed to support data science at scale, both on-premises and in the cloud. Application developers deploy models in applications to create data-driven products from artificial intelligence to adaptive intelligence.

As AI capabilities reach core enterprise processes, a new term has emerged: adaptive intelligence. Adaptive intelligence applications help companies make better business decisions by combining the power of real-time internal and external data with decision science and high-level computing infrastructure.

These applications basically make your business smarter. This, in turn, enables you to provide your customers with better products, recommendations, and services, all of which leads to better business results.

4.4.6 Artificial Intelligence as an Imperative and Competitive Strategic Advantage

AI is an imperative strategic technology that drives greater efficiency, new revenue opportunities, and enhanced customer loyalty. It is also quickly becoming a competitive advantage for many organizations. With AI, companies can get more done in less time, create personalized and engaging customer experiences, and predict business outcomes to increase profitability.

But artificial intelligence is still a new and complex technology. To get the most out of it, you need experience in how to build and manage AI solutions at scale. An AI project requires more than just hiring a data scientist. Companies must implement tools, processes, and management strategies to ensure the success of AI technology.

4.4.7 Best Practices for Getting the Most out of Artificial Intelligence (AI)

The Harvard Business Review made the following recommendations for getting started working with AI:

Apply AI capabilities to activities that have the greatest and most immediate impact on revenue and costs.

Use AI to boost productivity with the same number of people, rather than getting rid of or adding more employees.

Start implementing AI technology in the back office, not the front office (you will benefit greatly from applying it to IT and accounting).

4.4.8 Get Help with your Experience with Artificial Intelligence

There is no opt-out of transitioning to AI. To remain competitive, every company must eventually embrace AI and create an AI ecosystem. It is natural for companies that fail to adopt AI in some capacity over the next ten years to remain behind.

Although your company may be an exception to this rule, most companies do not have the in-house skills and expertise to develop the type of ecosystem and solutions that can leverage AI capabilities.

If you need help developing the right strategy and accessing the right tools to succeed on your AI transformation journey, you should look for an innovative partner with comprehensive business experience and a comprehensive AI portfolio.

4.4.9 Artificial Intelligence Learning Library

1/ What is Data Science?

Companies are actively combining statistics with computer science concepts such as machine learning and artificial intelligence, to extract insights from big data in order to foster innovation and transform decision-making.

2/ What is Machine Learning?

Machine learning is a subset of artificial intelligence (AI) which focuses on creating systems that learn from data with the goal of automating and accelerating decision-making and reducing the time needed to achieve value.

3/ News and Opinions on Artificial Intelligence

Artificial intelligence, machine learning, and data science are changing the way companies address complex problems to transform the course of their industries. If you are searching for additional information, you should refer to the latest articles to understand how the industry and your peers are approaching these technologies [1] – [9].

5. Conclusions

First of all, industrial management is important because it allows efforts, skills, and resources to be directed towards productivity and efficiency. Industrial management is composed of a wide set of techniques that seek to minimize time, costs and losses, in order to increase the value of production.

The main Objectives of Industrial Management are: Achieving Maximum results with minimum efforts; Increasing the Efficiency of factors of Production; Maximum Prosperity for Employer & Employees; Human betterment & Social Justice; Obtain harmony in group action.

The five points of importance of management are achieving organization goals, achieving individual goals, creating a dynamic environment, developing society, and improving efficiency. Management refers to the process of performing tasks efficiently and effectively while achieving personal and organizational goals.

Studying industrial management offers benefits like solving industry problems, enhancing industrial growth, improving industrial relations, and fostering innovation in managing resources effectively for career advancement.

The Major applications of Industrial Management could be summarized in the following points: Preproduction Planning; Production Planning and Control; Plant Location; Capacity Planning; Selection of Machinery and Equipment; Plant Layout; Material Handling Planning; Routing, Scheduling, Dispatching, controlling; Inventory Management & Store Keeping; Total Quality Management.

References

1. Osama Mohammed Elmardi Suleiman Khayal (Author), Industrial Maintenance First Edition, Paperback – 11 April 2024, Language: English, Paperback: 108 pages, ISBN-10 : 620748553X, ISBN-13: 978-6207485536.

2. Peter Kuhlang, Perspektiven zur Gestaltung menschlicher Arbeit im Industrial Engineering, 01 Jan 2016.

3. Harvey Burstein and et al., Industrial security management, 01 Jan 1977.

4. Marius Gabriel Petrescu and et al., Management of Industrial Technologies, 01 Jan 2022.

5. Sunil Joshi, Benefits of Management Research to Industries, 01 Mar 2011.

6. D.R. Chawda, Benefits of Management Research to Industries, A Critical View, 01 Mar 2011

7. Lisseth Quevedo (Author), Format: Kindle Edition, Fundamentals of Industrial Maintenance, ASIN : B0C9FK77Y9, Publication date : June 25, 2023, Language: English.

8. Joji Parambath (Author), Maintenance, Troubleshooting, and Safety in Hydraulic Systems (Industrial Hydraulic Book Series (Advanced Level)) Paperback – June 18, 2020, ASIN : B08BDSDDFS, Publisher : Independently published (June 18, 2020), Language : English Paperback : 83 pages, ISBN-13: 979-8653941719.

9. Gilberth Bolaños F (Author), The Age of Green Maintenance: Transforming Commerce, Services and Industry, Preserving the Planet Kindle Edition, ASIN: B0D3BSCXDH, Publication date : May 11, 2024, Language : English.

Dr. Osama Mohammed Elmardi Suleiman Khayal was born in Atbara, Sudan in 1966. He received a bachelor degree in mechanical engineering from Sudan University of science and technology in 1998, and a master degree in solid mechanics from Nile valley university (Atbara, Sudan) in 2003; He also received his PhD degree in mechanics of materials in 2017.