



The Role of Artificial Intelligence Technologies in Improving Production Process Performance: A Case Study of the Al-Mansour/Bejji Plant of the General Food Products Company in Salah al-Din Governorate

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Abstract: This study aims to identify the role of artificial intelligence (AI) technologies in improving the performance of production processes through an applied study at the Al-Mansour/Bejji factory, which is affiliated with the General Company for Food Products in Salah al-Din Governorate. The study was based on the main hypothesis that artificial intelligence technologies have a statistically significant impact on production process performance, in addition to testing the impact of each of the following technologies: machine learning, expert systems, intelligent forecasting and data analysis, computer vision, and intelligent automation. The study used a descriptive-analytical design, with a sample of 100 factory workers of different job level and specialization. A questionnaire was used to collect the data. In order to analyze the data and test the research hypotheses, the various types of statistical methods were applied, among which correlation coefficient, Cronbach alpha, descriptive statistics, linear regression analysis were used. The results indicated that the implementation of artificial intelligence (AI) technologies in the factory was relatively high with the arithmetic mean of 3.83 and relative importance of 76.60%, and the performance of the production processes in the factory was 3.8 with a relative importance of 76.00%. The regression results also indicated that there is an influence of the use of AI technologies on the performance of production processes, as can be seen by the correlation value R of 0.746 and R^2 of 0.557, which means that AI technologies can explain about 55.7% of the variation of the performance of production processes. All five dimensions of artificial intelligence studied also had a significant effect, with intelligent automation showing the greatest effect, followed by intelligent forecasting and data analysis, machine learning, expert systems, and computer vision.

Keywords: Artificial intelligence technologies, production process performance, Al-Mansour Factory.

Introduction

The manufacturing process has undergone many rapid changes in recent years thanks to advances in artificial intelligence technologies, which have now become modern tools that help improve production processes and increase their efficiency in resource utilization [1], [2]. The use of these technologies has significantly contributed to enhancing the ability to analyze data, forecast demand, monitor product quality, detect malfunctions, and support decision-making, thereby helping organizations respond effectively to the changing conditions and variables of the production process. The food industry places great importance on the use of artificial intelligence technologies, as production processes must be highly efficient in terms of quality control, problem detection, waste reduction, and maximizing resource utilization. In this regard, the use of these technologies has become a modern trend that helps improve the performance and efficiency of the production process. From this perspective, the main objective of the present study is to explore the role of artificial intelligence technologies in improving production process performance through a case study of the Al-Mansour/Baji factory, which is affiliated with the General Food Products Company in Salah al-Din Governorate.

A. Research Problem

Industries and companies—particularly food production plants—face growing challenges ranging from rising production costs, fluctuating demand levels, product quality, waste reduction, and better utilization of resources. Amid these challenges, artificial intelligence (AI) technologies have emerged as one of the contemporary tools that can be applied to data analysis, production demand forecasting, quality control, fault detection, and decision-making related to production activities. These technologies have enormous scope for making an ideal production environment, but vary in use and effectiveness among companies. Thus, it is yet to be known whether these technologies will be able to address production challenges and enhance production efficiency in the local industry. The research problem is concerned with the degree of use of the technology used in the application of artificial intelligence and its role in enhancing the productivity of the Mansour/Baji plant affiliated with General Food Products Company (GFPC) in Salah al-Din Governorate. Thus, the research aims of this study are to determine the degree of use of these technologies, the relationship between these technologies and production activities, and the contribution of these technologies to increase the efficiency of production activities and product quality.

Based on this, the research problem can be defined through the following main question:

To what extent do artificial intelligence (AI) technologies help improve the performance of production operations at the Mansour/Big factory, which is affiliated with the General Food Products Company in Salah al-Din Governorate? This main question gives rise to a number of sub-questions, the most important of which are:

1. To what extent are artificial intelligence technologies available and implemented at the plant?
2. What is the performance of production operations at the plant?
3. Is there a statistical relationship between artificial intelligence technologies and production process performance?
4. Do artificial intelligence technologies have a statistical impact on improving production process performance?
5. What are the aspects of artificial intelligence technologies that contribute most to

improving production process performance?

B. Significance of the Research

The significance of this research stems from the growing interest in artificial intelligence (AI) technology, which can be considered one of the contemporary tools that may help improve production processes and increase the operational efficiency of industrial organizations. There are following aspects by which the significance of this research can be justified:

First: Scientific significance.

The purpose of this research is to gain insights into the nature of the relationship between the application of smart technologies and the enhancement of production performance, as well as to create a framework that can be applied in future research on technological transformation in industry.

Second: Practical Significance.

The importance of this study in practice is to evaluate the level of adoption of the smart technologies in the factory Manour/Begi and the role of these technologies in improving the performance of the production process. In addition, the research results could be used by the factory management to determine where these technologies could be implemented to boost productivity and product quality, cut waste and expenses, and make better use of existing resources.

Third: Managerial Significance.

The results of this research may provide indicators that will help management make effective decisions regarding the adoption of smart technologies and the development of production processes, as well as stimulate a shift toward creating a production environment capable of responding to changing market demands.

C. Theoretical Background

Artificial Intelligence is one of the most noticeable technological advancements of the era and has brought along a sea change in business and manufacturing. This is because the capabilities of this technology regarding data analysis, forecasting, automation and decision making in operations. The use of this technology has been a way for industrial organisations to improve the efficiency of what they do and to be better prepared to tackle production issues. The theoretical part of this study is devoted to the definition of such concepts as artificial intelligence (AI) technologies, the main types of such technologies, and the application of AI technologies in the industrial sector, along with the definition of production performance, its components and indicators, as well as explanation of the nature of the relationship between the use of AI technologies and the improvement of production performance.

D. The Concept of Artificial Intelligence Technologies

Artificial intelligence is a scientific field concerned with the development of computer applications capable of simulating the workings of the human mind in processes such as learning, data analysis, prediction, reasoning, problem-solving, and decision-making [3]. These applications rely on specialized algorithms and models that enable the system to process large volumes of data and extract knowledge and information from it to achieve better results. In an industrial setting, artificial intelligence is the technology that enables the development of demand forecasts [4], improved production scheduling, quality management, fault detection, maintenance, and resource optimization. Therefore, in the current context, artificial intelligence has become not only an automation technology but also a technology for aiding decision-making and improving production processes. Thus, from a procedural

standpoint in this study, artificial intelligence can be defined as follows: a set of intelligent computer technologies and systems that use data and algorithms to simulate human capabilities in learning, analysis, prediction, and decision-making in order to assist and improve production processes. Therefore, in the context of this study, artificial intelligence is a group of technologies and intelligent computer systems that uses data and algorithms to simulate some of the human capabilities, such as learning, analyzing, predicting and making decisions, to support production processes and contribute to their efficiency and performance. Artificial Intelligence Technologies:

E. The Importance of Artificial Intelligence Technologies

Artificial Intelligence technologies play an important role in supporting the development of work methods, as well as in contributing to the efficiency of production processes in industrial organisations. The impact of these technologies is not just on the automation industry, but also on data analysis, decision-making, and anticipating issues before they arise. The impact of the artificial intelligence technology can be summarized as follows: [5]

Increasing the Efficiency of Production Operations: These technologies help to optimize the use of resources and shorten the time needed to perform a work operation, which boosts the efficiency of production operations.

1. **Supporting decision making:** These technologies carry out a detailed analysis of data and information related to the production process, thus enabling management to take decisions swiftly and accurately based on the available data.
2. **Enhancing product quality:** Artificial Intelligence technologies can be used to monitor the production process and identify defects or deviations in advance to improve product quality and reduce defective products.

Waste minimization: Smart technologies can be used to pinpoint waste, and to make the more effective utilization of materials, energy and human resources, to reduce production costs.

F. Dimensions of Artificial Intelligence Technologies

There are different AI technologies that can be used for business and manufacturing purposes. Use of these technologies will depend on the process of industry involved and the data at hand. Some of the technologies that are relevant to manufacturing processes include machine learning, expert systems, data analysis, computer vision, and intelligent operations [6].

1. **Machine Learning:** This is one of the most important AI technologies, involving the use of algorithms to enable a system to learn and discover patterns in data without needing to be programmed for each individual case. It can be applied in production environments to forecast demand, analyze performance, and predict deviations and malfunctions [7], [8].
2. **Expert System:** An expert system uses the techniques used by an expert to solve and make decisions on problems through a knowledge base and inferencing. It is applicable in diagnosing production-related problems, making technical decisions, and establishing the root cause of deviation or malfunction.
3. **Data Analysis & Intelligent Forecasting:** The technology makes use of big data analysis in extracting information to assist managers in forecasting the future trends. It can be used in the production process to make demand forecasts and to estimate the need for raw materials..
4. **Computer Vision:** This technology uses image and video processing and

analysis methods to detect objects, patterns, defects, and problems. It has become increasingly popular in the food industry, where it can be used to inspect products, detect defects, and verify their quality against standards [9].

5. Smart Operations: This involves a combination of automation and artificial intelligence technologies to make certain processes and operations more autonomous and flexible.

G. Production Performance

Production performance is one of the key concepts in production and operations management. It is a measure of the efficiency and effectiveness of the processes through which an organization transforms inputs—including raw materials, labor, energy, and equipment—into outputs, which are products or goods that meet customer needs and expectations. Production process performance depends on the extent to which an organization succeeds in achieving its production goals by making the most efficient use of available resources through appropriate productivity, product quality, cost reduction, elimination of waste, adherence to required production lead times, and the ability to adapt to changing conditions [10]. In an industrial context, the evaluation of production operations' performance goes beyond production volume; there are other criteria that assess the efficiency and effectiveness of the production process, including productivity, product quality, cost reduction, waste elimination, production speed, and flexibility.

Hence, the researcher concludes that, according to this study, operational performance is defined as: the extent to which the production process at the Mansour/Begi factory is efficient and effective through the optimal utilization of its resources to produce high-quality products at higher output levels without incurring excessive costs, wasting resources, or wasting unnecessary time.

H. The Relationship Between Artificial Intelligence Technologies and Production Process Performance

The relationship between artificial intelligence technologies and the efficiency of production processes has become increasingly important due to the rapid technological innovations witnessed in the industrial sector. Artificial intelligence technologies have provided industries with the ability to use data to improve planning, forecasting, control, and decision-making—all of which can have positive effects on the efficiency and effectiveness of production processes. Machine learning and data analysis technologies play an important role in analyzing historical and operational data and discovering patterns that enable management to forecast demand and determine production requirements [11]. Expert systems can be used in aiding decision making for production problems diagnosis and the selection of appropriate alternatives, and computer vision can be used for product defect detection and product quality assurance. Additionally, intelligent automation can help to make certain operations more efficient and effective, minimizing human error and ensuring smooth operations. Another example of how AI technologies can apply to predictive maintenance is to identify potential equipment or production line malfunctions, reducing production downtime and optimizing equipment and resource use [12]. In this regard, the link between AI technologies and the performance of production can be considered synergistic: the right use of smart technologies can contribute to improving productivity and quality, lower costs and waste, save time and increase flexibility in production. Consequently, the extent to which a factory benefits from these technologies depends on the availability of technological

infrastructure, the competence of the workforce, the quality of data, and management's ability to integrate AI into production activities and decisions[13].

I. Research Objectives

The study aimed to achieve the overall goal of identifying the role of artificial intelligence (AI) technologies in improving the performance of production activities in Mansour/Biji factory affiliated to the General Food Products Company in Salah al-Din Governorate. Other goals of the research are:

1. To identify how much AI technologies are available and used at Mansour/Biji factory.
2. To understand how production activities are performing at the plant from the viewpoint of the people in the research sample.
3. To comprehend how AI technologies relate to the production activities' performance.
4. To measure the impact of artificial intelligence technologies on improving the performance of production activities at the plant.
5. To determine the extent to which various aspects of artificial intelligence technologies contribute to improving production performance indicators.
6. To present a number of practical suggestions and recommendations that factory management can use to enhance their use of artificial intelligence technologies and improve production performance.

J. Research Hypotheses

Based on the research problem and objectives, the main hypothesis and sub-hypotheses can be formulated as follows:

Main Hypothesis: There is a statistically significant relationship (at a significance level of less than 0.05) between artificial intelligence techniques and the improvement of production process performance at the Al-Mansour/Begi factory. Several sub-hypotheses stem from this, including

1. First Sub-Hypothesis: There is a statistically significant relationship (at a significance level of less than 0.05) between machine learning and the improvement of production process performance.

2. Second sub-hypothesis: There is a statistically significant relationship with a significance level of less than 0.05 between expert systems and the improvement of production process performance.

3. Third Sub-Hypothesis: There is a statistically significant relationship, with a significance level of less than 0.05, between intelligent forecasting and data analysis and the improvement of production process performance.

4. Fourth Sub-Hypothesis: There is a statistically significant relationship (at a significance level of less than 0.05) between computer vision and the improvement of production process performance.

5. Fifth Sub-Hypothesis: There is a statistically significant relationship with a significance level of less than 0.05 between smart automation and the improvement of production process performance.

K. Conceptual Framework of the Research Variables

Figure 1 presents the conceptual framework. Independent variable: Artificial intelligence (AI) technologies and the five dimensions of AI technologies: machine learning, expert systems, forecasting and analysis, computer vision, intelligent automation.

- Dependent variable is the performance of the production process, where the five dimensions of artificial intelligence are hypothesized to affect the production

process. The main hypothesis and five sub-hypotheses are followed .It is in keeping with the structure of the main hypothesis and five sub-hypotheses.

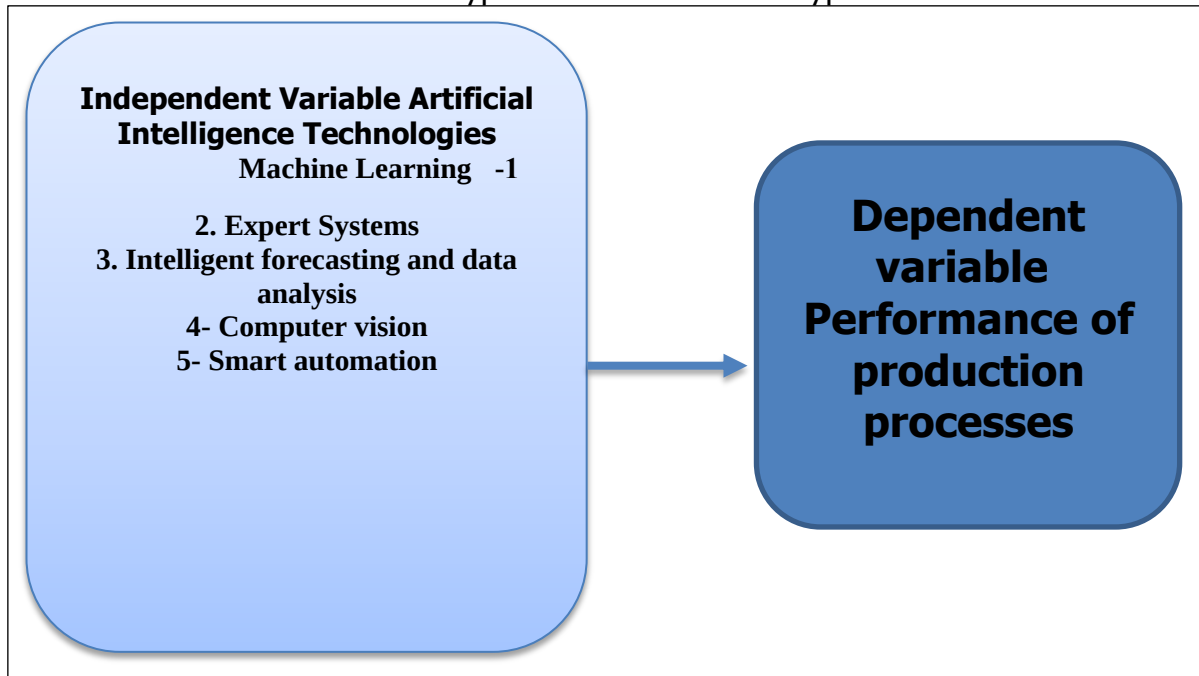


Figure 1. Conceptual diagram of the research variables

Methods

A. Research Design and Scope

A descriptive-analytical design was adopted to describe the study variables and to analyze the relationship and impact between AI technologies and production process performance, using a cross-sectional questionnaire survey conducted in 2026.

The scope of the present work will be:

1. It is limited to examining the impact of Artificial Intelligence (AI) technologies on the performance of production process with the scope of the research being the effect of the independent variable (AI technologies) on the dependent variable (production process performance), and the aim is to clarify the nature of the effect and the impact between the variables.
2. **Spatial Restrictions:** The field study will be conducted at the Mansour/Baji factory in the General Food Products Company in Salah al-Din Governorate, as a spatial limitation.
3. **Human scope:** The scope of the research will be restricted to factory workers, employees and managers who are engaged in production, administrative and technical activities at the Mansour/Baji factory and can contribute with relevant information in regard to the use of AI technologies, as well as the performance of the production process.
4. **Temporal Limits:** The study will be conducted in 2026 as the timeframe during which field data will be collected and analyzed.
5. **Methodological Scope:** The scope of the research will be limited to a descriptive-analytical approach used to describe the study variables and analyze the relationship and impact between AI technologies and production process performance based on data collected from individuals in the study sample.

B. Research Population and Sample

The research population consists of workers, employees, managers, and technicians working at the Mansour/Begi factory who are familiar with the artificial intelligence techniques used at the factory. A suitable sample was selected from this population to administer the research questionnaire, taking into account their various roles in the production process.

The sample consisted of 100 respondents of different job levels and specializations; its distribution by demographic and occupational variables is presented in Table 3.

C. Research Instrument

The study relied on a questionnaire as the primary tool for collecting field data, and its items were formulated based on the literature and previous studies related to artificial intelligence technologies and production process performance. The questionnaire has three sections:

Part One: Demographic and occupational information on the sample participants: (Gender, Age, Educational qualification, Years of service, Job title).

Part Two: Artificial intelligence technologies: Five dimensions, (Machine learning, Expert systems, Intelligent forecasting and data analysis, Computer vision and Intelligent automation).

D. Part Three: Production Process Performance.

1. Validity of the Instrument

Face and content validity were conducted to ensure that the research instrument is valid and suitable to measure the research variables. In this regard, the preliminary version of the questionnaire was presented to the committee of reviewers who specialize in management, statistics and related sciences, so as to ensure that the items of the questionnaire were appropriate for the research variables and their dimensions, clearly worded and relevant to the field of the research. Based on those suggestions and the revision of some items the final version of the questionnaire was adopted to make the instrument more suitable to measure the artificial intelligence techniques and the performance of production processes at Al-Mansour/Begi factory. The internal consistency was also examined by calculating the correlation coefficients between the items and the dimension they belong to. The results indicated that the correlation coefficients were positive and statistically significant, higher than the accepted limits and there was an adequate internal consistency among the instrument items and dimensions.

Table 1. Internal Consistency Reliability of the Research Instrument

Variable	Dimension	Number of paragraphs	Lowest correlation coefficient	Highest correlation coefficient
Artificial Intelligence Technologies	Machine Learning	5	0.621	0.814
	Expert Systems	5	0.587	0.796
	Intelligent Forecasting and Data Analysis	5	0.603	0.827
	Computer Vision	5	0.615	0.839
	Intelligent automation	5	0.641	0.852
Production Process Performance		10	0.572	0.831

Source: Compiled by the researcher using the SPSS statistical software

As can be seen in the table, the correlation values between the items of the questionnaires and the dimensions ranged from 0.572 to 0.852. These are the acceptable values of correlation coefficient showing good consistency among the items and dimensions, which helps in the validity of the instrument for field use.

2. Reliability of the Instrument

The reliability of the research instrument was tested by Cronbach's alpha [14], which is one of the most widely-used techniques to assess the internal consistency of the items in the questionnaire. A high score for this coefficient means that the items are very similar and are measuring the same thing. The alpha coefficient was computed for each dimension of the artificial intelligence technologies and for the variable "performance of productive operations" and the overall alpha coefficient for the instrument was also computed.

Table 2. Reliability Coefficients of the Research Instrument Using Cronbach's Alpha

Variable	Dimension	Number of paragraphs	Cronbach's alpha coefficient
Artificial Intelligence Technologies	Machine Learning	5	0.884
	Expert Systems	5	0.871
	Intelligent Forecasting and Data Analysis	5	0.892
	Computer Vision	5	0.879
	Intelligent automation	5	0.901
Production Process Performance		10	0.918
The Survey as a Whole	All Dimensions	35	0.947

Source: Compiled by the researcher using the SPSS statistical software

The results have revealed that Cronbach's alpha coefficients were between 0.871 and 0.918 at the dimension level while the reliability coefficient for the whole questionnaire was 0.947. These figures are relatively high and are above the statistically acceptable level [15], implying that the tool under analysis is reliable and consistent, which makes it appropriate for field studies and the verification of research hypotheses. In addition, the figures indicate the appropriate homogeneity of the tool's questions and prove their ability to adequately assess the intended dimensions in a consistent way. Therefore, it can be used in its final version, thus allowing for further statistical analysis.

3. Statistical Analysis

The data were analyzed with SPSS. Pearson correlation coefficients were used to examine internal consistency, Cronbach's alpha to assess reliability, and descriptive statistics (arithmetic mean, standard deviation, coefficient of variation and relative importance) to describe the variables and their dimensions. The hypotheses were tested with linear regression analysis at a significance level of 0.05.

Results

A. Demographic Characteristics of the Sample

Table 3. Distribution of the Research Sample According to Demographic and Functional Variables

Variable	Category	Repetition	Percentage %
Gender	Male	72	72.0
	Female	28	28.0
	Total	100	100.0
Age	Under 30 years	14	14.0
	30–39 years	31	31.0
	40–49 years	34	34.0
	50 years and above	21	21.0
	Total	100	100.0
Educational Qualification	Preparatory and Below	18	18.0
	Diploma	17	17.0
	Bachelor	45	45.0
	Postgraduate studies	20	20.0
	Total	100	100.0
Years of Service	Less than 5 years	13	13.0
	5–10 years	24	24.0
	11–15 years	27	27.0
	16–20 years	21	21.0
	More than 20 years	15	15.0
	Total	100	100.0
Job Title	Administrative	18	18.0
	Engineer	16	16.0
	Technician	31	31.0
	Employee	20	20.0
	Production Supervisor	15	15.0
	Total	100	100.0

Source: Prepared by the researcher using the SPSS statistical software

As shown in Table 3, most respondents were male (72.0%). The largest age group was 40–49 years (34.0%), and bachelor's degree holders formed the largest educational group (45.0%). The most frequent length of service was 11–15 years (27.0%), and technicians were the largest job category (31.0%).

B. Descriptive Analysis of the Research Variables

Table 4. Descriptive Analysis of the Research Variables and Dimensions

Variable	Dimensions	Arithmetic Average	Standard deviation	Variance Coefficient %	Relative Importance %	Ranking
Artificial Intelligence Technologies	Machine Learning	3.86	0.71	18.39	77.20	3
	Expert Systems	3.74	0.76	20.32	74.80	4
	Intelligent Forecasting and Data Analysis	3.92	0.68	17.35	78.40	2
	Computer Vision	3.61	0.81	22.44	72.20	5
	Intelligent automation	4.01	0.65	16.21	80.20	1
Overall	Artificial	3.83	0.72	18.80	76.60	—

average	Intelligence Technologies					
Overall average	Production Process Performance	3.80	0.73	19.17	76.00	—

Source: Generated by the researcher with the help of SPSS software package

From the above table, it can be observed that the adoption of AI technologies at the factory is quite high with an arithmetic average score of 3.83 and relative importance of 76.60%, whereas the average score of production process performance has been estimated at 3.80 and its relative importance is 76.00%. Thus, from the above table, it can be concluded that AI technologies are applied to a considerable extent and that production process performance is rated positively. Moreover, intelligent automation carries the highest arithmetic mean among the AI dimensions (4.01), followed by intelligent forecasting and data analysis (3.92).

C. Hypothesis Testing

1. Main hypothesis

Main Hypothesis: There is a statistically significant relationship, at a significance level of less than (0.05), between artificial intelligence technologies and the improvement of production process performance at the Al-Mansour/Bejji factory.

Table 5. The Impact of Artificial Intelligence Technologies on Improving Production Process Performance

Independent variable	R	R ²	Modified R ²	F value	Sig.
Artificial Intelligence Technologies	0.746	0.557	0.552	123.145	0.000

Source: Produced by the researcher using SPSS software

It is evident from the table above that there is a statistically significant effect of artificial intelligence (AI) technologies on the performance of production process since the correlation coefficient is $R = 0.746$ and the coefficient of determination is $R^2 = 0.557$. This means that AI technologies explain about 55.7% of the variance in the performance of production process performance, while the rest 44.3% variance is explained by other factors that are not part of the model under discussion. In addition, the value of F-statistic of 123.145 at the level of significance of 0.000 ($p < 0.05$) validates the significance of the regression model..

2. Sub-hypotheses

Table 6. Results of Testing the Sub-Hypotheses on the Effect of the Dimensions of Artificial Intelligence Technologies on Production Process Performance

Hypothesis	Independent Dimension	R	R ²	Modified R ²	F	Sig. F	Beta β	T	Sig.	Decision
H1	Machine Learning	0.648	0.420	0.414	70.986	0.000	0.214	3.286	0.001	Acceptance
H2	Expert Systems	0.594	0.353	0.347	53.475	0.000	0.176	2.714	0.008	Acceptance
H3	Intelligent Forecasting and Data Analysis	0.681	0.464	0.458	84.834	0.000	0.241	3.692	0.000	Acceptance
H4	Computer Vision	0.529	0.279	0.272	37.951	0.000	0.129	2.031	0.045	Acceptance
H5	Intelligent automation	0.713	0.508	0.503	101.157	0.000	0.287	4.381	0.000	Acceptance

Source: Prepared by the researcher using SPSS statistical software

From the table above, it is clear that all artificial intelligence technology

dimensions significantly affect production process performance as their significance (Sig. F) is less than 0.05 for all models. The values of R (correlation coefficient) are between 0.528 and 0.713 whereas R^2 values vary between 0.279 and 0.508. It shows the varying ability of these dimensions in explaining variations in production process performance. All beta coefficients are positive with intelligent automation technology being the one with the greatest influence ($\beta = 0.287$) followed by intelligent forecasting and data analysis ($\beta = 0.241$), machine learning ($\beta = 0.214$), expert systems ($\beta = 0.176$), and computer vision ($\beta = 0.129$).

Discussion

The results show that AI technologies are applied at a relatively high level in the factory (mean = 3.83; relative importance = 76.60%) and that production process performance is also rated positively (mean = 3.80; relative importance = 76.00%). The closeness of the two means is consistent with the view that smart technologies contribute to productivity, quality and cost reduction when they are integrated into production activities.

The regression results support the main hypothesis: AI technologies explained 55.7% of the variance in production process performance ($R = 0.746$, $R^2 = 0.557$, $F = 123.145$, $p < 0.001$). The significant effect of machine learning and of intelligent forecasting and data analysis agrees with the role that data-driven learning methods are described as playing in demand forecasting, process monitoring and fault detection in manufacturing.

Intelligent automation had the strongest effect ($\beta = 0.287$), followed by intelligent forecasting and data analysis ($\beta = 0.241$), machine learning ($\beta = 0.214$), expert systems ($\beta = 0.176$) and computer vision ($\beta = 0.129$). The prominence of automation is plausible in a production environment where speed, accuracy and continuity of operations are decisive. Computer vision, although widely recommended for the inspection and grading of food products, had the smallest effect and the lowest mean (3.61). This may indicate that its use at the factory is less developed than that of the other technologies, an interpretation that should be tested in further research.

Because 44.3% of the variance in production process performance remains unexplained, other factors evidently also matter. The literature points to technological infrastructure, workforce competence, data quality and management's ability to integrate AI into production decisions; these were not measured in the present model.

Several limitations should be considered. The study covers a single factory and a sample of 100 respondents, the data are based on perceptions collected through a questionnaire, and the cross-sectional design supports conclusions about association rather than strict causality. In addition, each dimension was examined in a separate model, so the overlapping effects of the dimensions were not controlled. Future studies could use multiple plants, objective performance indicators and multiple regression or structural equation models.

Conclusion

This study examined the role of artificial intelligence technologies in improving production process performance at the Al-Mansour/Beiji factory on the basis of a questionnaire completed by 100 employees. AI technologies were found to be applied at a relatively high level (mean = 3.83) and production process performance

was rated satisfactory (mean = 3.80); AI technologies had a significant positive effect, explaining 55.7% of the variance in performance ($R = 0.746$), and all five dimensions were significant, with intelligent automation the strongest ($\beta = 0.287$), followed by intelligent forecasting and data analysis ($\beta = 0.241$), machine learning ($\beta = 0.214$), expert systems ($\beta = 0.176$) and computer vision ($\beta = 0.129$). Accordingly, factory management is advised to expand the use of AI across production stages, giving priority to smart automation and to data analysis and forecasting systems; to apply machine learning for predictive maintenance, expert systems for diagnosing production problems and computer vision for continuous quality inspection; to train workers and technicians; and to improve IT infrastructure and data quality. Since 44.3% of the variance remains unexplained, future research should examine other factors such as smart manufacturing, total quality management, total productive maintenance, workers' digital literacy and technological infrastructure.

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