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The Role of Human Engineering Factors in Enabling Good Manufacturing Practices (GMP) Certification: Evidence from Jordanian Food Industry

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Abstract. The objective of this research was to analyse the influence of human engineering on the implementation of Good Manufacturing Practices (GMP) Certification within companies operating in the food industry of Jordan. The descriptive method was utilized to examine the relationship between the primary and secondary variables in five Jordanian food industry companies. A total of 283 questionnaires were collected for the study, of which 500 were distributed; all of the completed questionnaires were subjected to statistical analysis. The study's findings revealed a statistically significant effect on a moral level (0.05) of the human engineering dimensions (Design Factors, Environmental Factors, and Organizational Factors) on the implementation of Good Manufacturing Practices (GMP) in the Jordanian Food Industry.

The findings of this study contain a significant point regarding the establishment of a suitable workplace that considers the facets of human engineering. This is crucial for the growth of research organizations and will yield positive outcomes in the near future. Establishing an optimal working environment can be accomplished through the implementation of soundproofing measures in the offices, such as insulating the walls and windows. Additionally, mandating rest periods for employees during shift changes can help prevent physical and mental strain, accidents, and work-related injuries, all of which have the potential to adversely affect physical activity.

Keywords: Design Factors, Environmental Factors, and Organizational Factors, Good Manufacturing Practices (GMP), Jordanian food industry companies.

1. Introduction

Good Manufacturing Practises (GMP) is a comprehensive system that encompasses processes, procedures, and documentation. Its purpose is to ensure the consistent production and control of various items, such as food, cosmetics, and pharmaceutical goods, in accordance with established quality standards (Sucipto, Sumbayak, & Perdani, 2020). Implementing Good may significantly mitigate losses and waste, avert product recalls, seizures, financial fines, and legal ramifications such as jail. Overall, it provides protection for both the company and the consumer from any harmful food safety occurrences (Binsaddig, et, al, 2023).

In recent times, the world has experienced significant transformations, posing challenges for decision-makers in production factories to effectively compete with others. To secure success and maintain a competitive edge, it is imperative for these decision-makers to ensure that their products and services are of high quality, hygienic, and devoid of any flaws (Hasnan et al., 2022). Customers place great importance on finding items that align with their particular requirements and desires. In addition to seeking products that are reasonably priced and pose no risk of injury or disease, customers also prioritise safety. Factories must exert significant effort to attain and cultivate novel standards and procedures that will confer them a competitive advantage and guarantee client contentment by fulfilling their requirements. The factories are facing a difficult task in meeting these expectations, but they are approaching it with drive and ingenuity (Iancu & Kandalaft, 2020). The manufacturing industry has faced numerous challenges, particularly with the emergence of infectious diseases. However, a set of standards, such as the Good Manufacturing Practise (GMP) system, has been developed to address these challenges. The COVID-19 pandemic, which occurred about two years ago, further highlighted the importance of cleanliness in factories. As a result, ensuring the highest level of safety and cleanliness in factories has become a top priority worldwide.

The presence of (GMP) standards is highly significant as it aids in organising the thoughts of decision makers who can depend on a set of pre-established technologies and systems. These standards encompass various aspects, ranging from the receipt of raw materials at factories to the processing and distribution of products to consumers. These criteria are consistently implemented to maintain the quality of items. These standards have been implemented in the United States, the European Union, and Japan, and have received approval from the Food and Drug Administration and most industries, particularly the food industry (Kumar, Ramkishan, & Venkatesh, 2023). This standard pertains to an integrated system that effectively prevents mistakes and guarantees the implementation of Total Quality Management (Hayek, Oudat, Ali, Al-Alkawi, & El Haija, 2023; Salhab et al., 2023). It encompasses all facets of work, encompassing the human component inside manufacturing facilities. An immediate favourable outcome was observed following the acquisition of GMP certification and the implementation of these standards across all industries (Abumalih, 2023). Many organisations hastily implement GMP without adequately addressing the significance of human factors. This is especially apparent in counterfeit factories, where technology are utilised in a one-sided manner. Hence, it is imperative to uphold a profound comprehension of the significance of the human factor in the execution of Good Manufacturing Practise (GMP) (Kazemi & Lee, 2023). Ergonomics, also known as human engineering, is a highly beneficial tool for factories and companies. It offers advantages such as enhancing factory efficiency, reducing training expenses, promoting job security, fostering a sense of belonging among employees, and ensuring the health and safety of all individuals in the workplace, including visitors. Additionally, it effectively mitigates work injuries and accidents caused by equipment misuse, attains a flawless production process, enhances the workplace environment, minimises human exertion, and boosts overall performance.

The human engineering contribution has led to enhancements in the work environment, reduction in human effort, and overall improvement in performance. The collaboration between human engineering and good manufacturing practises has resulted in a significant improvement in product quality. The implementation of product quality principles, defect analysis, and statistical process control

techniques has effectively eliminated any defects in the product, thereby enhancing its overall quality. This study aims to investigate the relationship between human engineering aspects (design factors, environmental factors, and organisational factors) and the implementation of the GMP certificate in the food industry in Jordan.

The implementation of a commitment to good production practises yields numerous benefits as it serves as the foundation for establishing factories and companies that can generate added value for societies. This is accomplished by creating clean and secure products and services, from the manufacturing process to the delivery of goods to consumers. Achieving this requires increasing employees' awareness of production safety, producing products with greater precision and appropriateness under optimal conditions, and ensuring consumer satisfaction.

Implementing a commitment to good production practises can enhance the accurate understanding of the competitive position of factors. This is achieved by showcasing the capabilities of employees, identifying their strengths and challenges for decision-makers, promoting environmental awareness in the workplace, and creating favourable conditions for workers (Guastello, 2023). Statistics demonstrate that implementing novel strategies for organising and coordinating production activities in factories can result in gaining a competitive edge. Administrative, sales, and marketing factors account for 28% of this advantage (Heizer, Render, & Munson, 2020).

The concept of human engineering aims to minimise human effort, prevent work accidents resulting from human mistakes, and enhance workers' satisfaction, which is crucial and cannot be overlooked. This is achieved by implementing comprehensive principles related to quality management of facilities and equipment, documentation, production control, quality complaints, and contract manufacturing, all verified through the application of the new manufacturing certificate. GMP also endeavours to investigate the potential use of individuals with special needs in companies by promoting more focus on human engineering, including ergonomics (ALShibly, 2021).

2. Literature Review and Hypothesis Development

Human engineering, or human factors engineering, is a broad and varied discipline that encompasses several disciplines and technologies. The term "ergonomics" is derived from the Greek terms "ergo" and "nomos," which pertain to the inherent principles of work. According to Karwowski (2005), ergonomics is a scientific field that encompasses all elements of human existence. Human engineering, as a multifaceted discipline, seeks to enhance the adaptability of labour and goods for all consumers (Guastello, 2023). Workplace adaptation encompasses modifying work environments, tools, equipment, and tasks to mitigate risks and minimise worker stress. This is achieved by enhancing job safety across various aspects of human engineering, such as health, design engineering, tissue and cell engineering, special needs engineering, safety engineering, and materials engineering. Each of these disciplines is dedicated to addressing all aspects of human well-being and will be elaborated upon as follows:

Human engineering is a field that aims to enhance human health and comfort by creating tools, medical equipment, and gadgets that are specifically tailored to the human body. The objective of design engineering is to enhance the design of artificial objects and materials via the use of contemporary technologies. Tissue and cell engineering is a field that examines the molecular makeup of cells and tissues in order to develop advanced medical therapies for people through the use of current technology. Special needs engineering is a field that specifically caters to those with disabilities, offering them specially developed gadgets, tools, and equipment to enhance their quality of life and provide aid in their everyday activities. Safety engineering is a discipline that concentrates on creating applications with the goal of enhancing public health and ensuring the safety of the environment and communities. Materials engineering primarily concerns the design and development of materials utilised in many sectors and products (Hussein, Ibrahem Eldesokey, Rashed, & Ahmed, 2023). Engineering is a foundational discipline that encompasses a collection of ideas and practical activities focused on the design of products, technologies, facilities, and environments. The goal of engineering is to fulfil and

address human needs, with a particular emphasis on enhancing human health, comfort, and safety (Karwowski, 2005). The use of engineering principles is extensively employed in the design of diverse products, including furniture, textiles, and food products, with the aim of optimising human comfort, safety, and productivity (Guastello, 2023). In addition, houses, buildings, and cities are specifically engineered to enhance the standard of living and offer pleasant, hygienic, and secure surroundings for human beings. Biomedical items and medical materials are specifically engineered to enhance both the well-being and comfort of individuals. Software and technologies are developed to optimise their effective and suitable utilisation by people, while apparel and uniforms in factories are meant to ensure a pleasant and secure working environment for individuals.

Hasnan et al. (2022) examined the most common instances of nonconformance in small food processing according to the GMP. Their goal was to identify the main factors that contribute to these nonconformance issues. The review was conducted using twenty peer-reviewed papers published between 2012 and 2021. These publications gathered data pertaining to Good Manufacturing Practises (GMP) and small-scale processors. The most common aspect of noncompliance with good manufacturing practises (GMP) was found to be insufficient sanitary design and facilities, accounting for 85% of all publications. This was followed by poor personal hygiene (55%), inadequate or absent documentation (55%), subpar cleaning and maintenance programmes (50%), lack of operational control (50%), insufficient training (35%), inadequate product information (15%), and inadequate health control for workers (15%). These nonconformances were discovered to cause instances of foodborne illnesses, undesirable microbiological proliferation in goods and surrounding environments, deterioration in quality, and the presence of unclean substances. The nonconformance can be attributed to several factors, including inadequate on-site monitoring, financial limitations, insufficient expertise, lack of management backing, lax enforcement by authorities, and hostility from workers towards food safety practises.

Sucipto, Sumbayak, and Perdani, (2020). assessed the adoption of (GMP) and Sanitation Standard Operating Procedure (SSOP) in the bread manufacturing process of small and medium-sized enterprises (SMEs). This study included observational techniques, interviews, and surveys. The participants in this study consist of managers and staff from "X" Bakery. The findings of this study revealed that the application of Good Manufacturing Practises (GMP) resulted in a 58.3% achievement, while the Sanitation Standard Operating Procedures (SSOP) achieved 52.3%. These results suggest that the industry in question fell short of the minimal requirement of 60%. This industry had inadequate compliance with Good Manufacturing Practises (GMP) and Sanitation Standard Operating Procedures (SSOP). The fulfilment of five parts of GMP is required, specifically the site and environment, manufacturing equipment, process control, food labelling, and product recall. However, there are nine aspects that have not been fulfilled, namely pertaining to structures and facilities, water supply, sanitation facilities and activities, pest control, staff health, storage, supervision by the responsible person, employee documentation, and training. Additionally, three components of SSOP have been fulfilled, including the avoidance of cross-contamination, safeguarding of food, and labelling. Five aspects fail to meet the SSOP standards, including water security, surface hygiene, sanitation facilities, staff health control, and insect prevention. The most vulnerable aspect of GMP implementation is the lack of adequate supervision, whereas the weakest aspect of SSOP implementation is the insufficient control over staff health. Hence, it was imperative to enhance the employees' expertise, augment the auxiliary infrastructure, and intensify production oversight to enhance the execution of GMP, SSOP, and sustainable production.

Andaregie and Astatkie (2022) examined the obstacles and factors that influence the adoption of Good Manufacturing Practises (GMP) in medium- and large-scale manufacturing enterprises located in northern Ethiopia. In order to accomplish the goals, primary data was gathered from 131 manufacturing enterprises of medium and large size through interviews. The study issues were addressed using exploratory factor analysis and multiple linear regression modelling. Several unique features of a firm,

including as the expertise of its managers, the number of employees, the size of the company, the age of the organisation, and the presence of an environmental management department, have a considerable impact on the adoption of GMP. The main obstacles to the implementation of GMP (Good Manufacturing Practises) were a lack of environmental awareness, impediments connected to the business environment, societal impact, technological limitations, financial constraints, organisational challenges, and legal or government restrictions. The identification of industry-specific features and adoption hurdles as drivers of Good Manufacturing Practises (GMP) can assist medium- and large-scale manufacturing firms in modifying their manufacturing practises to align with GMP standards. Moreover, the results of this investigation can be used to advance ecological durability in manufacturing.

Lestari et al., (2023) assessed the comprehensive framework of Halal (GMP) in small and medium-sized companies (SMEs) and examine its impact on performance within the food industry. This study included focus group discussions in two locations, including eight experts and 73 small and medium-sized enterprises (SMEs) in the food industry. The discussions were held at two Indonesian Government agencies. The analysis revealed the presence of 6 variables and 40 indicators related to HGMP and its implementation in each agency. The research classified two agencies as poor, highlighting the necessity to enhance the application of HGMP. The SMEs' business process policies shown substantial variations in the areas of infrastructure, workforce, inventory, and upkeep.

Venugopal and Saleeshya (2019) proposed a methodology that constructs and evaluates the sustainability of the manufacturing system by integrating lean and agile principles. The Analytical Hierarchy Process (AHP) and Analytical Network Process (ANP) have been recognised as appropriate approaches for analysing the model. The model is verified in an Ayurveda Pharmaceutical company to determine the key factors of lean and agile production that construct and facilitate the dimensions of sustainability, including Economic, Environmental, Social, Technological, and Ethical aspects. The findings indicate that the sector prioritises the economic components of sustainability, followed by the social, environmental, ethical, and technological features of sustainability, particularly from a lean viewpoint. From an agile standpoint, the social component carries the most importance, followed by moral, economic, technological, and environmental elements of sustainability.

In his study, Abdullah (2020) examined the influence of human engineering factors on the attainment of workplace satisfaction among employed persons and their supervisors at the Jaber Bin Hayyan business in Mosul. The research seeks to assess the individual impact of various components of human engineering, including the physical environment, senior management commitment, and health monitoring, on the attainment of workplace happiness, as measured by dimensions such as job satisfaction, work association, and emotional well-being. The study utilised a descriptive analytical method. The questionnaire was utilised as the primary instrument for gathering data from the research organisation. This approach was aligned with the study aims and hypotheses, which encompassed a total of 163 participants. The findings demonstrated that the active involvement of senior management had the most significant influence on attaining many aspects of workplace well-being. Consequently, the researchers advised enhancing it by establishing a nurturing organisational culture for employees and implementing contemporary administrative techniques to manage them. Additionally, efforts should be made to empower and include them as decision-making partners. This fosters a stronger sense of belonging and boosts job satisfaction, ultimately establishing a strong connection between employees and their work, resulting in improved well-being and pleasure.

The Good Manufacturing Practises (GMP) certificate is an internationally recognised standard that establishes the criteria for guaranteeing the quality and safety of pharmaceutical, food, and medical goods. Manufacturing companies must adhere to a set of dependable and efficient operating protocols and processes to guarantee that their goods satisfy the necessary criteria in terms of purity, quality, and safety (Kumar, Ramkishan, & Venkatesh, 2023).

Good manufacturing practises encompass various elements such as manufacturing procedures,

quality assurance, storage, transportation, packaging specifications, equipment and facility maintenance, cleaning, sterilisation, and quality control of raw materials, active ingredients, and finished products (Jain & Jain, 2021).

The certification requirements are established by esteemed organisations such as the World Health Organisation, the European Union, and the US Food and Drug Administration. Regular evaluation of companies that have acquired these certifications is regarded as a commendable practise. Obtaining the Good Manufacturing Practise (GMP) certification is of utmost importance for companies engaged in the production of these products worldwide (Hussein et al., 2023). The certification encompasses several domains like workforce, organisational framework, duties, and worker qualifications. The GMP certification encompasses facilities that are designed to assure the safety of both goods and workers, prohibit all types of pollution, and safeguard against any potential harm that may impact them. Additionally, the equipment utilised in production must be meticulously developed and strategically positioned to provide optimal functionality for location-based operations. This encompasses the implementation of accurate numbering and regular upkeep to guarantee a well-organized system that facilitates effortless retrieval. It is important to establish and enforce standards for weighing and measuring. Additionally, it is crucial to allocate a dedicated location just for this task, distinct from the manufacturing lines. Manufacturing procedures and work techniques should be meticulously designed with regulated standards to guarantee the appropriateness and precision of materials and measurements. Prior to commencing work, it is imperative to develop and label the factory, packaging code, and numbering system. Additionally, it is essential to assess the packaging lines.

Ensuring quality control is crucial, which involves scrutinising raw materials, storage, transportation, and packing items to verify their compliance with standards. It is advisable to contemplate the implementation of a water purification system. It is essential to thoroughly analyse and document any deviations and complaints in order to maintain a comprehensive record for future reference. This process should be carried out internally, through a systematic evaluation and documentation of the factory's operations, starting from the moment raw materials are received until the final product is completed, as well as any other relevant activities.

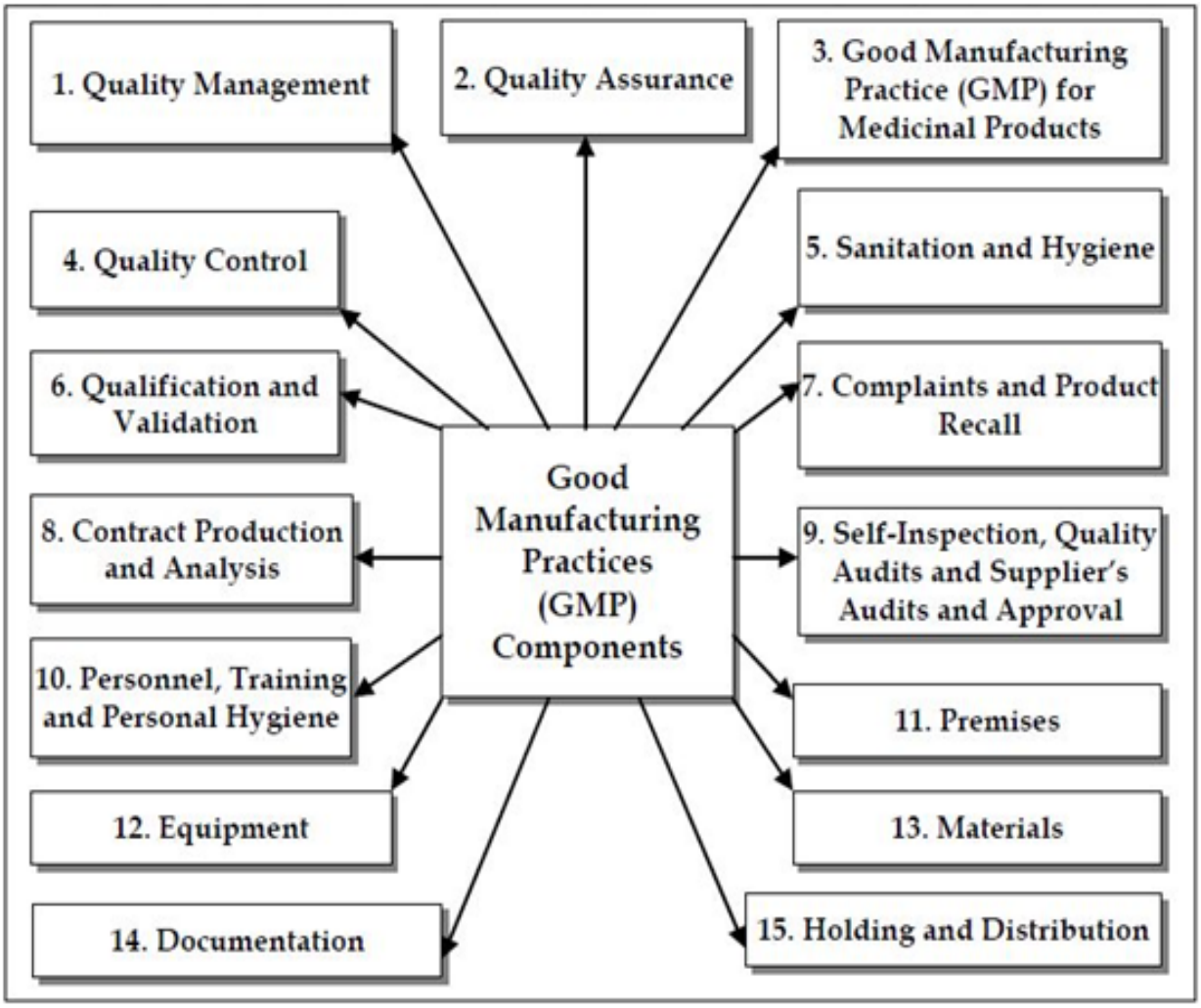

Fig.1: displays the consolidated components of Good Manufacturing Practises as outlined by Chaudhari, Yadav, Verma, and Singh in 2014.

Based on the above discussion, the researchers believe that the following dimensions might impact the dimension of Human Engineering in Jordanian factories when it comes to the implementation of (GMP) certification. These dimensions include a wide range of factors such as:

1. Design factors: These are factors that are special to workers and relate to the issuance and decision-making centre, as well as the communication of its kind. The factors that contribute to vigilance include daily exposure to repetitive situations, where workers are able to engage in cognitive and behavioural responses towards others. These responses can include assessing the effects of ageing, determining appropriate seating and standing arrangements, monitoring industrial work, designing facilities, and organising equipment locations.

2 - Environmental factors include the magnitude of the influence of noise, radiation, heat, humidity, odours, and the unique conditions present in the manufacturing environment.

3- Organisational factors: - Work patrols and worker methods for addressing accidents and ensuring security protection. The influence of solidarity and stability, as well as the inspiration provided by individuals and their own drive. A study has proved that the work environment has a direct impact on the improvement of communication and relationships, resulting in increased productivity indicators and overall performance (Peter, 2023).

From the above argument, previous studies and literary gap, the current study seeks to examine the Role of Human Engineering Factors (Design Factors. Environmental Factors. Organizational Factors)

in Enabling Good Manufacturing Practices (GMP) Certification. Researcher built the following model in order to highlight the relationship between variables and identify the possible hypothesis:

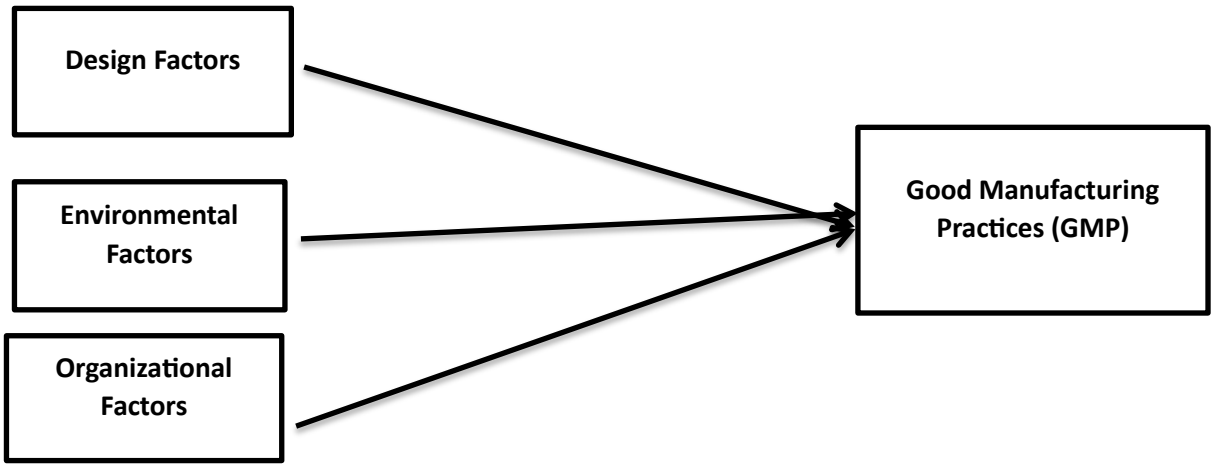

Fig.2: Study Model

The source was prepared based on previous studies by the researcher

Main Hypothesis: There is statistically significant effect at a moral level (a≤0.05) of human engineering in its dimensions (design factors, environmental factors, and organizational factors) on the application of the GMP certificate in the Jordanian food industry sector

HO.1.1: There is no statistically significant effect at a moral level (a≤0.05) of the design factors on the application of the GMP certification in the Jordanian food industry sector.

HO.1.2: There is no statistically significant effect at a moral level (a≤0.05) of the environmental factors on the application of the GMP certification in the Jordanian food industry sector.

HO.1.3: There is no statistically significant effect at a moral level (a≤0.05) of the organizational factors on the application of the GMP certification in the Jordanian food industry sector

3. Research Methodology

This study utilised a descriptive-analytical technique to offer a thorough and precise depiction of the topic matter. The main objective was to evaluate the influence of several aspects of human engineering on the application of Good Manufacturing Practises (GMP) certification in companies in Jordan. The research involved gathering data and doing analysis to evaluate design factors, environmental factors, and organisational factors, as well as to examine the implementation of GMP certification at these plants.

Methodology refers to a scientific process that is used to provide a systematic strategy for tackling a specific problem. The technique comprises a diverse array of stages and methods that provide guidance to researchers in order to get precise and dependable findings (Anderson & Poole, 2019).

This study utilised descriptive and inferential methodologies to assess the influence of human engineering on the implementation of the GMP certificate in Jordanian food sector enterprises.

The descriptive-inferential approach is based on accurately documenting the description of phenomena, situations, and details. Its goal is to describe the phenomenon and concepts related to the studied phenomenon. This approach involves utilising various tools and methods to collect and analyse data in a practical manner. The Descriptive-Heuristic Approach, as defined by Bougie and Sekaran (2020), is distinguished by its emphasis on accuracy, detail, and reliance on factual data derived from scientific experiences and direct observations. It enables the attainment of precise and dependable results through theoretical and scientific analysis of collected data, employing various tools and

methods.

3.1. Population and Sampling

The study was done and applied to the supervisory and authoritative roles in the key enterprises of the Jordanian food sector. The aforementioned firms include Emirates of the Future, Zaloom Group, Al Kasih Factories Group, Nabil Food Products Group, and Siniora Food Industries Company.

These organisations have a workforce of over 8000 individuals. According to Human Resources Management statistics, there were an estimated 639 employees in managerial and authoritative positions in these companies.

The size of the research sample was estimated by utilising a sample table established by Bougie and Sekaran (2020). The table suggests that a population of (639) persons would require a minimum of (240) predicted replies in order to get an adequate sample size. digital electronic questionnaire was created using Google Forms, targeting individuals holding supervisory and authoritative positions. A total of 283 digital questionnaires were collected and all of them were included in the following statistical analysis.

The study utilised a combination of secondary and primary data sources. The secondary data sources included books, literature, scientific journals, specialised publications, and electronic resources from the internet and various databases. In addition to the secondary data, primary data was collected through the use of a questionnaire. This questionnaire was meticulously crafted to collect factors and dimensions that are relevant to the investigation.

3.2. Data analysis

The stability of the research tool was assessed by computing Cronbach's Alpha coefficient, a metric that quantifies the internal consistency of the study items. The findings of this investigation are displayed in Table 1.

Table 1: results of the stability test of the study instrument:

Variables	Dependent	Independent				Total Indicator
	Good Manufacturing (GMP) Practices	Human Engineering	Organizational Factors	Environmental Factors	Design Factors	
Cronbach Alpha	0.818	0.889	0.789	0.815	0.836	0.908
No. of paragraphs	6	16	6	5	5	22

Table 1 displays the Cronbach's Alpha values for the scale paragraphs, which varied from (78.9%) to (88.9%). The total stability coefficient for all scale items was (90.8%). According to De Vellis (2017), the threshold for adequate stability of the Cronbach's Alpha coefficient is 0.70. Thus, all the internal consistency coefficients provided in the table above serve as reliable indicators of the study's stability in statistical analysis.

3.3. Normal Distribution Test

The kurtosis and skewness coefficients have been computed to assess whether the data adheres to a normal distribution. The degree of overexertion of the data from the average value is indicated by the coefficient of skewness. If the overexertion value does not exceed ±1.96, the distribution can be considered normal. The coefficient of skewness measures how much the data values deviate from the

average in a specific direction, either to the right or to the left. If the value falls outside the range of ±1, it indicates a significant skewness in the distribution (Hair et al., 2018).

Table 2: Kurtosis & Skewness Test Results

Variables	Human Engineering	Organizational Factors	Environmental Factors	Design Factors	Good Manufacturing (GMP) Practices
Kurtosis	1.226	1.514	0.629	0.357	0.342
Skewness	-0.777	-0.956	-0.651	-0.610	-0.381

Based on the data shown in Table (2), it is evident that the data distribution is normal. The Kurtosis value did not exceed (±1.96), and the Skewness values remained within the range of (±1).

3.4. Multiple linear correlation testing (Multicollinearity)

Table 3 shows that the coefficient of permissible variation for the independent dimensions was between (0.2) and (1), indicating a low level of variation. Additionally, the coefficient of contrast inflation was below (5), suggesting a lack of strong correlation between the independent variables. These findings support the suitability of the values for conducting multiple linear regression analysis (Hair Jr et al., 2021).

Table 3: Multicollinearity Results

Variables	Environmental Factors	Design Factors	Organizational Factors
VIF	1.745	1.641	1.410
Tolerance	0.573	0.609	0.709

Table 4 shows the results of using Pearson correlation coefficients to check for strong multicollinearity among the ergonomics aspects, which validates and supports the prior findings.

Table 4: The Pearson correlation matrix among the dimensions of independent variable

Human Engineering	Design Factors	Environmental Factors	Organizational Factors
Design Factors	1		
Environmental Factors	0.600	1	
Organizational Factors	0.455	0.504	1

Table 4 indicated that the ergonomics dimensions had a significant link, with the greatest correlation coefficient being 0.60. Gujarati et al. (2017) state that a correlation value below 80% suggests the lack of multicollinearity.

Table 5: description of the personal and functional characteristics of the study sample

Variable	Categories	Repetition	Percentage Ratio
Gender	Male	220	77.7%
	Female	63	22.3%
	Total	**283**	**100%**
Educational Qualification	Diploma	38	13.4 %
	Bachelor's	166	58.7%
	Postgraduate Studies	79	27.9 %
	Total	**283**	**100 %**
Job Title	Director	25	8.8 %
	Head of Department	46	16.3 %
	Supervisor	49	17.3 %
	Administrative employees	67	23.7 %
	Technical employees	96	33.9 %
	Total	**283**	**100 %**
Years of Experience	5 years or less	8	2.8 %
	6-10 years	80	28.3 %
	11-15 years	102	36 %
	More than 15 years	93	32.9 %
	Total	**283**	**100 %**

Table (5) displays the majority of the sample which represents (77.7%) of males, (220) individuals, while females are (22.3%) of the sample, with 63 individuals. This lead us that the nature of employment in Jordanian food industry companies may be more suited to males, because of the demanding nature of the work that involves effort for long hours.

Showing us the educational qualifications, which represent the highest percentage of the sample and it contains (58.7%) of employees who hold bachelor's degrees, with a total of 166 respondents, while 13.4% of employees hold intermediate diploma degrees, amounting to 38 individuals. This lead us knowing that most of the respondents to the sample of the questionnaires hold university degrees, reflecting their capability to provide accurate responses to the questionnaire's content.

Moving to the job titles within the food industry companies' studies which has showed us that the technical employees make up the largest group by formulating (33.9%) over a 96 employees, while managers made up the smallest group formulated with 8.8%, with 25 individuals. This led us to know that supervisory and oversight bodies in these companies mainly focus on technical roles, followed by administrative positions and then supervisors, department heads, and managers.

Regarding to work experience, the sample had showed us that 36% of employees have experience between 10 and 11 years, among of 102 individuals, while 2.8% have 5 years of experience or less, among of 8 individuals, all of these findings align with logical expectations as individuals with relatively extensive experience are well-represented in the study sample.

3.5 Descriptive statistics for the variables and dimensions of the study tool:

The study encompassed the computation of arithmetic means, standard deviations, ranks, relative weights, and degrees of application for the variables and dimensions under investigation. The degree of relative relevance was computed using the following equation: The category length is determined by subtracting the lower limit of the alternative from the higher limit of the alternative, and then dividing the result by the number of levels. In this case, the calculation is 5 - 1 ÷ 3, which equals 1.33.

If the arithmetic mean is within the range of 1 to 2.33, it is categorised as being at the level of cities. If it falls within the range of 2.34 to 3.66, it is considered to be at an average level. If it exceeds 3.66, it is classified as being at a high level (Subedi, 2016). The descriptive analysis of the study variables yielded the following results:

Table 6: Results of descriptive statistics on research variables and dimensions

Variable Type	Variable / Dimension		arithmetic mean	standard deviation	relative weight	degree of importance
independent	1	Design Factors	3.78	0.718	75.6	High
	2	Environmental Factors	3.86	0.639	77.3	High
	3	Organizational Factors	4.01	0.550	80.2	High
	Human Engineering		**3.89**	**0.520**	**77.8**	**High**
Dependent	**The application of Good Manufacturing Practices (GMP)**		**3.63**	**0.649**	**72.5**	**High**

Table (6) presents the statistical data for the independent variable, human engineering, in the Jordanian food industry companies. The arithmetic mean for this variable is 3.89, indicating a moderate level of achievement. It carries a relative weight of 77.8%, suggesting a significant influence on the employees in supervisory and supervisory authorities. The standard deviation is 0.520, indicating a relatively low level of variability. In comparison, organisational factors rank first in terms of importance, with an arithmetic mean of 4.01 and a relative weight of 80.2%. This variable exhibits a high degree of significance and has a standard deviation of 0.550. Environmental factors come in second place, with an arithmetic mean of 3.86 and a relative weight of 77.3%. They also hold a high degree of importance and have a standard deviation of 0.639. It has the lowest rank among the design factors, with an arithmetic mean of 3.78 and a relative weight of 75.6%. It is considered highly important, with a standard deviation of 0.718. The dependent variable, which measures the application of the certificate of good manufacturing practises, had an arithmetic mean of 3.63. It carried a relative weight of 72.5% and was considered to be of average importance by employees in supervisory and regulatory roles in Jordanian food industry companies. The standard deviation for this variable was 0.649.

It is noteworthy that the standard deviations of the variables and dimensions are similar, as shown in table (6). This suggests that there is little variation in the responses of the study sample regarding the dimensions of design factors, environmental factors, and organisational factors. However, the average level of GMP Good Manufacturing Practises application is present.

4. Results

This component of the study will include an analysis of the results obtained from the hypothesis testing. The primary hypotheses were analysed using multiple regression analysis, while other hypotheses were derived from the main hypothesis using simple regression analysis. The subsequent outcomes have been presented as follows:

4.1. The results of the main hypothesis test

There is no statistically significant effect at a moral level (a≤0.05) of human engineering in its dimensions (design, environmental, organizational factors) on the application of the GMP certificate in the food sector in Jordan.

Table 7: presents the results of the multiple regression model evaluating the impact of ergonomics and its various dimensions on the application of Good Manufacturing Practices (GMP) certification

T. Sig	*T* calculated	*Beta*	*Std. Error*	*B*	Human Engineering	Dependent	*F. Sig*	*F* calculated	*DF*	*Adj* R^2	R^2	*R*
*0.014	2.474	0.150	0.055	0.136	**Design factors**	***GMP***	*0.00	54.956	279/3	0.365	0.371	0.609
*0.00	3.778	0.237	0.064	0.240	**Environmental factors**							
*0.00	6.141	0.346	0.066	0.408	**organizational factors**							
Constant= 0.548						***Morale is at the level of (0.05)**						
Minimum Tabular DW (1.738) value=					**Upper Tabular DW value (1.799) DU=**					**Durbin–Watson = (2.082)**		

Table 7 demonstrates that the test value (D.W) has exceeded (2.082), surpassing its upper Tabular value (du) of (1.799). This suggests that there is no autocorrelation issue and that the test is appropriate for utilization in the regression model. The correlation coefficient R was shown to be 60.9%, indicating a significant association between human engineering and the implementation of the certificate of good manufacturing standards in Jordanian food industry enterprises. The coefficient of determination (R2 = 0.371) indicates that human engineering, along with its dimensions, accounts for 37.1% of the variation in the application of the certificate of good manufacturing practices in Jordanian food industry companies. This suggests a statistically significant impact of human engineering on the application of the certificate, as indicated by the value of F.Sig (0.00) being less than 0.05. Furthermore, all dimensions of human engineering have contributed to the influence and application of the certificate, as indicated by T.Sig being less than 0.05. By analyzing the beta value, we observe that regulatory factors have the greatest impact on the application of the certificate of good manufacturing practices in Jordanian food sector enterprises. Environmental factors come next in terms of impact, followed by design elements. Hence, we confirm the alternative hypothesis which states that there is a statistically significant influence, at a significant level (α≤0.05), of the dimensions of human engineering (design factors, environmental factors, organizational factors) on the implementation of the GMP certificate in the food industry sector in Jordan.

4.2. The results of the 1st sub-hypothesis test:

HO.1.1: There is no statistically significant effect at a moral level (a≤0.05) of design factors on the application of the GMP certification in the Jordanian food industry

Table 8**:** The results of the simple regression model of the impact of design factors in the application of the GMP certificate

T. Sig	*T* calculate	*Beta*	*Std. Error*	*B*	Human Engineering	Dependent	*F. Sig*	*F* calculated	*DF*	*Adj* R^2	R^2	*R*
*0.00	8.477	0.450	0.048	0.407	**Design factors**	***GMP***	*0.00	71.353	282	0.200	0.203	0.450
Constant= 2.089						***Morale is at the level of (0.05)**						
Minimum Tabular (1.758) DW value=					**Upper Tabular DW (1.799) value DU=**			**Durbin–Watson = (2.000)**				

Table (8) demonstrates that the Test (D.W) value has exceeded (2), surpassing its top Tabular value (du) of (1.779). This suggests the lack of autocorrelation issue and confirms its appropriateness for use in the regression model. The correlation coefficient R was determined to be 45%, indicating a moderate association between the design criteria and the implementation of the certificate of good manufacturing standards in Jordanian food industry enterprises. The coefficient of determination (R2) value of 0.203 indicates that design factors account for 20.3% of the variation in the application of the certificate of good manufacturing practices in Jordanian food industry companies. This suggests that design factors have a statistically significant impact on the application of the certificate, as indicated by the value of the test statistic (T.Sgt.) being 0.00, which is less than the significance level of 0.05. Therefore, we conclude that the alternative hypothesis is valid, indicating a statistically significant impact of design variables on the use of the GMP certificate in the food business sector in Jordan, with a significance level of $\alpha \leq 0.05$.

4.3. The results of the 2nd sub-hypothesis test

HO.1.2: There is no statistically significant effect at a moral level ($a \leq 0.05$) of environmental factors on the application of the GMP certification in the Jordanian food industry sector.

Table 9: The results of the simple regression model of the impact of environmental factors in the application of the GMP certificate

T. Sig	***T* calculate**	***Beta***	***Std. Error***	***B***	**Human Engineering**	**Dependent**	***F. Sig***	***F* calculated**	***DF***	***Adj R^2***	***R^2***	***R***
0.00*	9.722	0.502	0.052	0.509	**Environmental Factors**	***GMP***	0.00*	94.517	282	0.249	0.252	0.502
Constant= 1.659							***Morale is at the level of (0.05)**					
Minimum (1.758) Tabular DW value =					**Upper Tabular (1.799) DW value DU=**			**Durbin–Watson = (2.054)**				

Table (9) demonstrates that the Test (D.W) value has exceeded (2.054), surpassing its top Tabular value (du) of (1.779). This suggests the lack of autocorrelation issues and confirms its appropriateness for use in the regression model. The correlation coefficient R was determined to be 50.2%, indicating a moderate association between environmental conditions and the implementation of the certificate of good manufacturing standards in Jordanian food industry enterprises. The coefficient of determination (R2 = 0.252) suggests that environmental factors account for 25.2% of the variation in the application of the certificate of good manufacturing practices in Jordanian food industry companies. This indicates a statistically significant impact of environmental factors on the application of the certificate, as evidenced by the value of T.Sig (0.00), which is lower than the threshold of 0.05. Hence, we validate the alternative hypothesis which asserts that there is a statistically significant influence, at a significant level ($\alpha \leq 0.05$), of environmental factors on the implementation of the GMP certificate in the food business sector in Jordan.

4.4. The results of the 3rd sub-hypothesis test

HO.1.3: There is no statistically significant effect at a moral level ($a \leq 0.05$) of organizational factors on the application of the GMP certification in the Jordanian food industry sector.

Table 10: The results of the simple regression model of the impact of organizational factors in the application of the GMP certificate

T. Sig	*T* calculate	*Beta*	*Std. Error*	*B*	Human Engineering	Dependent	*F. Sig*	*F* calculated	*DF*	*Adj R²*	*R²*	*R*
0.00*	10.591	0.534	0.059	0.630	Organizational Factors	***GMP***	0.00*	112.166	282	0.283	0.285	0.534
Constant= 1.103								***Morale is at the level of (0.05)**				
Minimum (1.758) Tabular DW value =					**Upper Tabular (1.799) DW value DU=**			**Durbin–Watson = (1.984)**				

Table 10 demonstrates that the Test (D.W) value has exceeded (1.984), surpassing its top Tabular value (du) of (1.779). This suggests the absence of autocorrelation issues and confirms its appropriateness for use in the regression model. The correlation coefficient R was determined to be 53.4%, indicating a moderate association between regulatory parameters and the implementation of the certificate of good manufacturing standards in Jordanian food industry enterprises. The coefficient of determination (R2) value of 0.285 indicates that regulatory factors account for 28.5% of the variation in the application of the certificate of good manufacturing practices in Jordanian food industry companies. This suggests that regulatory factors have a statistically significant impact on the application of the certificate, as indicated by the Sig value of 0.00, which is less than 0.05. We confirm the alternative hypothesis that asserts the presence of a statistically significant impact, at a moral level ($\alpha \leq 0.05$), of regulatory variables on the implementation of the GMP certificate in the food business sector in Jordan.

5. Conclusions

The study's findings led to the following conclusions:

Jordanian food industry firms acknowledge the importance of using the Good Manufacturing Practices (GMP) certification in their sector. They hold the belief that ongoing enhancement in these activities boosts efficiency and aids in the attainment of their future aims.

The independent variable, 'human engineering,' had an arithmetic mean of 3.89 with a relative weight of 77.8%. The variable was deemed crucial by individuals in supervisory and controlling positions inside enterprises in the Jordanian food industry.

The initial crucial element is 'organizational factors,' which obtained an average value of (4.01) and a relative importance of (80.2%). This factor encompasses elements such as allocating job tasks among employees according to their capabilities, implementing measures to address accidents and security concerns, promoting unity and stability, and enhancing individual motivation. The study conducted by Peter in 2023 confirms that the work environment has a significant impact on the improvement of communication and relationships, resulting in higher productivity and overall performance. Furthermore, the second notable element is 'environmental factors,' which has an average value of 3.86 and a relative weight of 77.3%. This dimension comprises several elements such as noise, radiation, heat, humidity, and odors, and their influence on the working environment of the factory (Greig, et al., 2023).

The dimension of 'design factors' obtained an arithmetic mean of 3.78, with a relative weight of 75.6% and a significant level of relevance. This highlights the significance of decision-makers involved in factory design possessing practical insights obtained from the experiences of workers and supervisors, rather than just relying on generic manuals and instructions. The dependent variable, 'application of the

Good Manufacturing Practices Certificate,' had an arithmetic mean of 3.63, weighted at 72.5%. From the viewpoint of employees in management and controlling positions within Jordanian food sector enterprises, this signifies a moderate degree of significance.

To summarize, Jordanian food industry businesses have a robust dedication to implementing human engineering features, encompassing design, environmental, and organizational concerns. Nevertheless, the implementation of (GMP) demonstrates a reasonable level of applicability.

Decision makers need better insights into dealing with the concept of ergonomics because most of it is based on their economic point of view or previous experiences (Guastello, 2023), but the concept GMP requires specialized scientific techniques and tools that prevent accidents and work injuries according to the data of the place. Motivating employees is a very important element in reducing stress and instilling enthusiasm for employees (Webster & Haut, 2024)

Based on the findings on our study, we have the following recommendations for the practitioners:

- Maintaining a focus on an important issue by providing a suitable work environment that promotes the implementation of Good Manufacturing Practices (GMP) certification as a fundamental aspect of employees' daily routines, which will lead to include regularly updating guidelines and specific instructions to that sector.

- Establishing a single training center should be the focus of efforts by partnering with Jordanian food industry unions and federations, and these centers will conduct courses and conferences focusing on the most recent worldwide expertise and experiences.

- The significance of psychological ownership and employee ambitions as drives should be acknowledged in order to focus on improving creativity, innovation, and loyalty within Jordanian food sector enterprises.

- Encouraging workers to submit recommendations to focus and work on revising the worldwide standards for GMP certification, with the goal of promoting the synergy principle and encouraging collaboration among stakeholders.

- A suggestion and complaint box can be created within these businesses to help with the prompt discovery of essential adjustments.

- Improving sophisticated mechanisms and technology in manufacturing, with a focus on using renewable energy sources, may be accomplished by integrating computerized, automated processes and procedures.

- The researchers urge that comparable studies be conducted in other areas where resources are available to support human capital development and sustainable development in Jordan's Hashemite Kingdom.

- The current study advises Jordanian food industry companies to conduct comprehensive waste analyses and waste management practices, focusing specifically on identifying areas where waste treatment does not add value and trying to find a suitable solution for them and implementing it because it is critical.

- According to the present study, Jordanian food sector businesses should analyze the activities that support production processes, such as handling, distributing, packing, and logistics services. This evaluation will seek to reduce various types of waste while aiming for zero faults.

However, there are some rooms for future studies in the area which include:

1- The influence of Human Engineering on the implementation of the income arrangement decision and the easement facility locations in Jordanian food industry enterprises.

2- The influence of Green Human Engineering Practices on performance evaluation metrics in Jordanian food sector firms.

3- Working on analyzing the influence of Good Manufacturing Practices (GMP) certification on facility redesign in Jordanian food sector enterprises.

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