The Effect of Factors promoting Advanced Manufacturing Technologies adoption in Operational performance

(An empirical Study on Electronic & Electrical companies in Egypt)

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Abstract

This research aims to identify the Effect of Factors promoting Advanced Manufacturing Technologies adaption and Human-ware based technologies in Operational performance, Explore The difference between perceived values for the employees of the Electronic and Electrical Companies Sector in Egypt for both Advanced Manufacturing Technologies and Operational Performance according to their demographic characteristics.
To do that, a Questionnaire was used as a tool to collect data needed with response (89%). The research hypotheses are the result of a pilot study and literature review and testing a number of assumptions and relationships which are connected to the Research problem.

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The results of statistical analysis identify that There is statistically significant effect at level $\alpha = 0.05$ of Factors promoting Advanced Manufacturing Technologies adaption and Human-ware based technologies on Operational Performance in the Electronic and Electrical Companies Sector in Egypt, finally, managerial implications and recommendations for further research were stated.

Keywords:
Advanced Manufacturing Technologies, Factors promoting AMT adaptation, Human-ware based technologies, Operational performance, Flexibility, Dependability, Speed of delivery.

تأثير العوامل المعززة لتكيف تقنيات التصنيع المتقدمة في الأداء التشغيلي
(دراسة ميدانية على قطاع الشركات الكهربائية والالكترونية في مصر)

الملخص

يهدف هذا البحث إلى التعرف على تأثير العوامل المعززة لتبني تقنيات التصنيع المتقدمة والتقنيات القائمة على الموارد البشرية على الأداء التشغيلي، واستكشاف الفرق بين القيم المدركة للعاملين في قطاع الشركات الإلكترونية والكهربائية في مصر لكل من تقنيات التصنيع المتقدمة والأداء التشغيلي وفقًا لخصائصهم الديموغرافية. ولتحقيق ذلك، تم استخدام استبيان كأداة لجمع البيانات المطلوبة مع استجابة (89٪). فرضيات البحث هي نتيجة لدراسة تجريبية ومراجعة الأدبيات واختبار عدد من الافتراضات والعلاقات المرتبطة بمشكلة البحث.

حددت نتائج التحليل الإحصائي أنه يوجد تأثير ذو دلالة إحصائية عند مستوى $\alpha = 0.05$ للعوامل المعززة لتبني تقنيات التصنيع المتقدمة والتقنيات القائمة على الإنسان على الأداء التشغيلي في قطاع الشركات الإلكترونية والكهربائية في مصر، وأخيرًا، تم ذكر الآثار الإدارية والتوصيات لمزيد من البحث.

الكلمات المفتاحية:

تقنيات التصنيع المتقدمة، العوامل التي تعزز التكيف مع تقنيات التصنيع المتقدمة، التقنيات القائمة على الموارد البشرية، الأداء التشغيلي، المرونة، الاعتمادية، سرعة التسليم.

1. Introduction

Nowadays organizations need to apply Advanced Manufacturing Technologies as it provide a competitive advantage in responding to customer demands quickly. Manufacturing has been changing due to changing needs and evolving technologies to address the customers' expectations of products and services at affordable prices with a shorter delivery period.

The wide range of AMT forces managers to carefully analyze their choices before deciding. Prior to implement AMT, it is important to know what types of improvements are necessary, how they are linked to the company's overall production strategy and to what extent both product design and manufacturing are either integrated or isolated from each other,

Studying the effect of Factors promoting AMT adaption and Human-ware based technologies on Operational performance enable organizations to achieve high dependability and flexibility of its products this means that it have high effectiveness ,also the organization ability to achieve high speed of delivery which mean high efficacy in its operations as a whole.

2. Previous studies

Researcher	***Research Title***	***Research results & conclusion***
Demeter, K. et al. 2024	Fourth industrial (r)evolution? Investigating the use of technology bundles and performance implications	Advanced manufacturing technologies build on traditional manufacturing technologies and do not constitute a separate direction that would point towards a fundamental digital transformation of companies. Performance effects are rather weak: out of the three technology bundles

		identified, only "automation and robotization" have a positive influence on cost efficiency, while "base technologies" and "data-enabled technologies" do not offer a competitive advantage, neither in terms of cost nor in terms of differentiation. Furthermore, while the business performance effect is positive, it is quite weak, suggesting that financial returns on technology investments might require longer time periods.
Wonga, D. et al. 2023	The effect of advanced manufacturing technology, sensing and analytics capabilities, and planning comprehensiveness on sustained competitive advantage: The moderating role of environmental uncertainty	The results of this study revealed that all four factors positively influenced SCA, and that environmental uncertainty positively moderated their effect, supporting our research model. We discuss the theoretical and practical implications of these findings. Digital manufacturing is vital to the manufacturing industry because it enables firms to produce increasingly customized, digitalized products of higher quality with a shorter lead time than can be produced without digital manufacturing.
Shahzad, F. et al. 2022	Decoupling the influence of eco-sustainability motivations in the adoption of the green industrial IoT and the effect of advanced manufacturing technologies (AMTs).	Empirical analysis shows that AMT mediates the relationship between GIIoT and GI. These outcomes expand and improve the current literature on the GIIoT and GI and (AMTs) requirements. Also, this study provide practitioners with valuable insights into Advanced Manufacturing Technologies (AMTs) that fulfill their environmental responsibilities and provide a competitive advantage in responding to customer demands quickly.

Stornelli, A. et al. 2021	Advanced manufacturing technologies (AMTs) adoption and innovation: A systematic literature review on barriers, enablers, and innovation types.	The findings of this review identify five main types of barriers and four main types of enablers to adoption. Also this study conceptualize three key stages of the AMT adoption process and classify the barriers and enablers on the basis of whether they apply to an individual stage, or whether their influence is pertinent across the whole process. This study reveal the relationship between categories of barriers and enablers associated to innovation types outcomes: product, process, service or business model innovations. The results of this study provide important implications for both managers and policy makers based on the evidence of the key barriers and enablers.
Singh, R, K.2021	Embracing advanced manufacturing technologies (AMTs) for performance improvement: an empirical study	Improvement in product quality and flexibility of operations are the motivation for (AMTs) implementation.Top management support and sound financial conditions are essential for implementing (AMTs). Successful implementation of (AMTs) helps in reducing the lead time and improving overall business performance.
Rupinderpreet, S. et al. 2021	Analyzing performance indicators of advanced manufacturing technology (AMT) implementation using Multi Criteria Decision Making (MCDM).	The results of this research illustrates that top management and education, training and incentives of employees are top rated performance indicators for successful implementation of (AMT) in a manufacturing industry. The present research could help the researchers and managers who are doing research in the domain of (AMT) implementation strategy

Savastano, M.et al.2021	The interplay between digital manufacturing (DM) and dynamic capabilities (DC) : an empirical examination of direct and indirect effects on firm performance.	Digital ecosystems created by the integration of cyber-physical systems into manufacturing operations, based on Industry 4.0 enabling technologies, can create the conditions for better performance in terms of productivity gains, flexibility, reductions of energy and material consumption as well as their cost, increase in business competitiveness and improvements in working conditions.
Kumar, R. et al, 2021	Embracing advanced manufacturing technologies (AMTs) for performance improvement: an empirical study	Improvement in product quality and flexibility of operations are the motivation for (AMTs) implementation.Top management support and sound financial conditions are essential for implementing (AMTs). Successful implementation of (AMTs) helps in reducing the lead time and improving overall business performance.
Roberto, J.et al, 2019	Design, process and commercial benefits gained from Advanced Manufacturing Technology (AMT).	Integrated systems are the most important (AMT) for maquiladoras and have the strongest impact on design, processes and commercial benefits.

3. Research Gap

After reviewing the literature review and conceptual framework, according to the results of the pilot study the researcher concluded that organizations need to develop competitive manufacturing techniques like AMT in their manufacturing processes for sustaining in a globally competitive market, so that the researcher could have identified the following **Three** research gaps:

-There is a need to empirically explore and understand factors promoting Advanced Manufacturing Technologies

implementation in Electronic and Electrical companies in Egypt.

-There is a need to identify and explore Human-ware based technologies in Electronic and Electrical companies in Egypt.

-Investigating perceived values for the employees of the Electronic and Electrical Companies Sector in Egypt for both Advanced Manufacturing Technologies and Operational Performance according to their demographic characteristics (Gender, Age, Qualification, Job Level, Years of work experience).

4. Research Questions

To reconcile the above mentioned gaps, the researcher developed Three Research Questions, they are:

1.What are factors promoting Advanced Manufacturing Technologies implementation in Electronic and Electrical companies in Egypt?

2.What are Human-ware based technologies in Electronic and Electrical companies in Egypt?

3.To what extent there is a difference between perceived values for the employees of the Electronic and Electrical Companies Sector in Egypt for both Advanced Manufacturing Technologies and Operational Performance according to their demographic characteristics (Gender, Age, Qualification, Job Level, Years of work experience)?

5. Research Objectives

To answer the previous mentioned questions, the research objectives are:

-Identify factors promoting Advanced Manufacturing Technologies should be installed in order to enable

manufacturing firms to achieve it's competitive operational performance objectives.

-Investigate the Human-ware based technologies in Electronic, and Electrical companies in Egypt.

-Explore The difference between perceived values for the employees of the Electronic and Electrical Companies Sector in Egypt for both Advanced Manufacturing Technologies and Operational Performance according to their demographic characteristics (Gender, Age, Qualification, Job Level, Years of work experience).

6. Research Variables

After reviewing the literature, relying on pilot study results and in order to solve the research gap the researcher proposed two Variables of the research divided into two categories:

-Independent variable: Factors promoting Advanced Manufacturing Technologies adoption and Human-ware based technologies).
-Dependent variable: Operational Performance Dimensions (Dependability, Flexibility, Speed of delivery) as illustrated in figure (1)

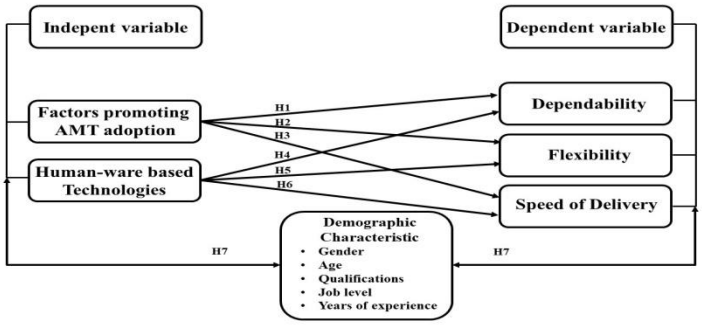

Figure (1) Research Variables

6.Research Hypotheses

Thus, the review of the literature suggested several researchable hypotheses to find out The Effect of Factors promoting AMT adoption in Operational performance, The following hypotheses were developed and tested:

H1.There is no statistically significant effect of Factors promoting Advanced Manufacturing Technologies adoption on Dependability in the Electronic and Electrical Companies Sector in Egypt

H2.There is no statistically significant effect of Factors promoting Advanced Manufacturing Technologies adoption on Flexibility in the Electronic and Electrical Companies Sector in Egypt.

H3.There is no statistically significant effect of Factors promoting Advanced Manufacturing Technologies adaption on Speed of Delivery in the Electronic and Electrical Companies Sector in Egypt

H4.There is no statistically significant effect of the Human-ware based technologies on Dependability in the Electronic and Electrical Companies Sector in Egypt

H5.There is no statistically significant effect of the Human-ware based technologies on Flexibility in the Electronic and Electrical Companies Sector in Egypt

H6.There is no statistically significant effect of the Human-ware based technologies on Speed of Delivery in the Electronic and Electrical Companies Sector in Egypt

H7.There is a statistically significant difference between perceived values for the employees of the Electronic and

Electrical Companies Sector in Egypt for both Advanced Manufacturing Technologies and Operational Performance according to their demographic characteristics (Gender, Age, Qualification, Job Level, Years of work experience).

8. Research Methodology

The construction of the questionnaire

The questionnaire was constructed based on five successful studies previously conducted in related fields of study, i,e, Samson and Swink, (2023) study. Rajesh Kumar Singh(2021) study, Bruno and D'Antonio (2018) study, Maghazei et al. (2022) study, Boyer and Pagell (2000) study. The modifications made to these studies were determined by the researcher's own knowledge of the Electronic and Electrical companies in Greater Cairo and the theoretical issues discussed previously.

Four hundred and eighty five questionnaires five questionnaires were sent to 97 selected Electronic and Electrical companies in greater cairo,

Table (1) Research Sample response rate

Sent Questionnaires	485
Total Response	450
Final usable Responses	435
Response Rate as percentage of sending Questionnaires	89%

In this research, Questionnaires constructed based on results of pilot study, literature review, previous studies there are two questionnaires, each questionnaire is designed as a five-point Likert Scale which is: (1= strongly disagree, 2= Disagree, 3=Neutral, 4=Agree and 5= Strongly agree).

Validity the of questionnaire

Having established an approximate schedule of questions relevant to the issues under investigation in the current study, i.e. Questionnaire on Demographic characteristics,

Questionnaire on Factors promoting AMT implementation and human ware based technologies, and Questionnaire on Operational performance Dimensions (Dependability, Flexibility, and Speed of delivery), a pilot study was conducted to confirm whether the theoretical and practical issues identified by the author were appropriate to Electronic and Electrical companies in Greater Cairo.

Questionnaires were provided in Arabic language since Arabic is the main language. The Arabic version was translated from English and then back-translated to ensure equivalency. The questionnaire was validated (face validity) by Three levels Employees (Top, Middle, and First line levels) in each company of 97 Electronic and Electrical Companies in Greater Cairo) selected.

Reliability of the questionnaire

The Chronbach's a coefficient was used to ensure the accuracy and the reliability of the questionnaire since the coefficient describes the degree to which scores on a measure represent something other than measurement error (Glass and Hopkins, 1996, p. 577). Chronbach's a for reliability indicated high consistency of the entire instrument (0.92), which confirmed the cohesiveness of items within the scale itself and the consistency of the conclusions to be drawn from the analysis.

The sample

The population is Electronic and Electrical companies in Egypt, and the sample consists of 97 Electronic and Electrical companies in Greater Cairo (56 Electronic companies + 41 Electrical companies) in greater Cairo,

The sample was collected at the base of the largest companies in Investments and returns and sales of the Electronic and Electrical companies in greater Cairo and this confirms on the

necessity of collecting data through Scanning the holding and leading companies in the Electronic and Electrical companies.as illustrated in table (2)

Table (2) performance Indicators for Electronic and Electrical companies in Greater Cairo *Source:(ida) Industrial Development Authority-2023*

	No of Enterprises	Investment costs (in pounds)	Number of employees	Salaries (in pounds)
Electronic	56	3613081175	8762	2850000
Electrical	41	2008458000	14354	444760000

9. Statistical analysis

the researcher will calculate stability of data collection tool using Cronbach's Alpha method to calculate all constructs of the questionnaire, then demonstrate the evaluation of the employees of the Electronic and Electrical Companies Sector in Egypt for the study variables independent variable Advanced manufacturing Technologies (Factors promoting Advanced Manufacturing Technologies adaption, and Human-ware based technologies), and the dependent variable (Operational Performance)(Dependability, Flexibility, and Speed of Delivery), and after evaluation of employees perception for study variables, the researcher test the two main hypothesis of the study and the six sub-hypotheses emanating from it through check the relationship between (Advanced Manufacturing Technologies)and(Operational Performance) through calculation of Pearson correlation coefficient between them, then test the impact of the dimensions of independent variable on the dimensions of dependent variable through using simple and multiple regression models between them.

Evaluation of Factors promoting AMT adaption

Table (3) shows the answers of the employee's perception for the first dimension which has five statements numbered (1-5) in the survey, and it is clear that it has mean equal (3.995) which is a moderate value, against standard deviation equal (0.827) and Coefficient of variation equal (20.71%). Also, the mean for these five statements ranges between (3.809, 4.121), standard deviation ranges between (0.902, 1.017), and Coefficient of variation ranges between (21.96%, 26.70%) and these results indicate employee's perception for the first dimension is moderate.

Table (3) Employees' perception for Factors promoting AMT adoption

Ser.	Factors promoting AMT adoption	Mean	Std Dev.	CovVar %
1	The company can gain a competitive advantage.	**4.108**	**0.902**	**21.96%**
2	The company can obtain a financial benefit.	**3.945**	**0.936**	**23.72%**
3	The company can face competitive threats.	**3.809**	**1.017**	**26.70%**
4	The company is able to cope with the skills shortage.	**3.992**	**0.986**	**24.70%**
5	Enhancing the company's image.	**4.121**	**0.993**	**24.09%**
Mean and Std Dev.		**3.995**	**0.827**	**20.71%**

To confirm the significance of the previous results in the population (1 sample t) test was performed between the employee's perception for the first dimension and expected value (3) and the results of this test are shown in Table (4):

Table (4) (1-Sample T) Factors promoting AMT adoption

(Factors promoting AMT adoption)	Mean	Stdev	Std error	P value
	3.995	**0.827**	**0.042**	**0.000**

It is clear from Table (4) that there is a significant difference between employee's perception values for the first dimension which greater than the expected value (3) proposed by researcher and that proved through (P value = 0.000) which is less than (0.05) and this means reject Null hypothesis, and accept alternative hypothesis which validate that there is a significant difference for employee's perceived value for this dimension of independent variable that greater than the expected value.

Evaluation of Human-ware based technologies

Table (5) shows the answers of the employee's perception for the second dimension Human-ware based technologies which has five statements numbered (6-10) in the survey, and it is clear that it has mean equal (4.019) which is a moderate value, against standard deviation equal (0.829) and Coefficient of variation equal (20.63%). Also, the mean for these five statements ranges between (3.869, 4.151), standard deviation ranges between (0.914, 1.005), and Coefficient of variation ranges between (22.02%, 24.35%) and these results indicate employee's perception for the second dimension Human-ware based technologies is moderate.

Table (5) Employees' perception for Human-ware based technologies

Ser.	Human-ware of (AMTs)	Mean	Std Dev.	CovVar %
6	The company needs experience in developing processes for implementing advanced manufacturing techniques.	**4.151**	**0.914**	**22.02%**
7	The company engages in activities necessary to develop processes for implementing advanced manufacturing technologies.	**3.869**	**0.936**	**24.20%**

8	The company seeks to provide practical knowledge such as databases, models, etc.	**3.889**	**0.999**	**25.68%**
9	The company seeks to develop the capabilities available to employees in terms of skills and knowledge.	**4.058**	**0.964**	**23.75%**
10	The company undertakes training and education to reduce implementation resistance against the implementation of advanced manufacturing techniques.	**4.126**	**1.005**	**24.35%**
Mean and Std Dev.		**4.019**	**0.829**	**20.63%**

To confirm the significance of the previous results in the population (1 sample t) test was performed between the employee's perception for the second dimension and expected value (3) and the results of this test are shown in Table (6):

Table (6) (1-Sample T) for Human-ware based technologies

Human-ware baswed technologies	**Mean**	**Stdev**	**Std error**	**P value**
	4.019	**0.829**	**0.042**	**0.000**

It is clear from Table (6) that there is a significant difference between employee's perception values for the second dimension which greater than the expected value (3) proposed by researcher and that proved through (P value = 0.000) which is less than (0.05) and this means reject Null hypothesis, and accept alternative hypothesis which validate that there is a significant difference for employee's perceived value for this dimension that greater than the expected value.

Evaluation of Operational Performance

Table (7) shows the answers of the employee's perception for the dependent Variable Operational Performance in the survey, and it is clear that it has mean equal (3.987) which is a moderate value, against standard deviation equal (0.808) and

Coefficient of variation equal (20.27%). and these results indicate employee's perception for independent variable is moderate in sample.

Table (7) Employees' perception for Operational Performance

Dependent Variable	Mean	Std Dev.	Coefficient of variation %
Operational Performance	3.982	0.779	19.57%

To confirm the significance of the previous results in the population (1 sample t) test was performed between the employee's perception and expected values for the study and the results of this test are shown in Table (8)

Table (8) (1-Sample T) for Operational Performance

Dependent Variable	Mean	Stdev	Std error	P value
	3.982	0.779	0.039	0.000

It is clear from Table (8) that there is a significant difference between the dependent variable Operational Performance which greater than the expected value (3) proposed by researcher and that proved through (P value = 0.000) which is less than (0.05) and this means reject Null hypothesis, and accept alternative hypothesis which validate that there is a significant difference for employee's perceived value for the dependent variable Operational performance that greater than the expected value, and to validate these results the study prove this for its dimensions (Dependability, Flexibility, Speed of Delivery) as presented in following sections:

Evaluation of Dependability

Table (9) shows the answers of the employee's perception for Dependability which has three statements numbered (1-3) in the survey, and it is clear that it has mean equal (3.970) which is a moderate value, against standard deviation equal (0.859) and Coefficient of variation equal (21.64%). Also, the mean for these four statements ranges between (3.786, 4.113), standard deviation ranges between (0.097, 1.027), and Coefficient of variation ranges between (24.55%, 24.97%) and these results indicate employee's perception for the first dimension Dependability is moderate.

Table (9) Employees' perception for Dependability

Ser.	Dependability of Operational Performance	Mean	Std. Dev.	Cov. Var %
1	The company calculates the percentage of delay in delivering orders to customers.	4.121	0.964	23.40%
2	The company is studying the reasons for deviation from the specified delivery dates.	4.040	0.942	23.31%
3	The company adheres to set production schedules.	3.907	0.926 0	23.70%
Mean and Std Dev.		4.023	0.832	20.67%

To confirm the significance of the previous results in the population (1 sample t) test was performed between the employee's perception for the first dimension (Dependability) and expected value (3) and the results of this test are shown in Table (10):

Table (10) (1-Sample T) for first dimension Dependability

Dependability of Operational Performance	Mean	Stdev	Std error	P value
	4.023	0.832	**0.042**	**0.000**

It is clear from Table (10) that there is a significant difference between employee's perception values for Dependability which greater than the expected value (3) proposed by researcher and

that proved through (P value = 0.000) which is less than (0.05) and this means reject Null hypothesis, and accept alternative hypothesis which validate that there is a significant difference for employee's perceived value for this dimension of dependent variable that greater than the expected value.

Evaluation of Flexibility

Table (11) shows the answers of the employee's perception for Flexibility which has four statements numbered (4-7) in the survey, and it is clear that it has mean equal (3.934) which is a moderate value, against standard deviation equal (0.796) and Coefficient of variation equal (20.22%). Also, the mean for these four statements ranges between (3.869, 4.015), standard deviation ranges between (0.834, 1.009), and Coefficient of variation ranges between (21.04%, 26.08%) and these results indicate employee's perception for Flexibility is moderate.

Table (11) Employees' perception for Flexibility

Ser.	Flexibility of Operational Performance	Mean	Std Dev.	CovVar %
4	The company calculates the time needed to develop a new product or service.	**3.965**	**0.834**	**21.04%**
5	The company has the ability to change the assortment of products offered.	**3.887**	**0.943**	**24.25%**
6	The company has the ability to operate at its maximum capacity.	**3.869**	**1.009**	**26.08%**
7	The company has the ability to modify and develop production schedules.	**4.015**	**1.007**	**25.09%**
Mean and Std Dev.		**3.934**	**0.796**	**20.22%**

To confirm the significance of the previous results in the population (1 sample t) test was performed between the employee's perception for Flexibility and expected value (3) and the results of this test are shown in Table (12):

Table (12) (1-Sample T) for second dimension Flexibility

Flexibility of Operational Performance	Mean	Stdev	Std error	P value
	3.934	0.796	0.040	0.000

It is clear from Table (12) that there is a significant difference between employee's perception values for Flexibility which greater than the expected value (3) proposed by researcher and that proved through (P value = 0.000) which is less than (0.05) and this means reject Null hypothesis, and accept alternative hypothesis which validate that there is a significant difference for employee's perceived value for this dimension of dependent variable that greater than the expected value.

Evaluation of Speed of Delivery

Table (13) shows the answers of the employee's perception for Speed of Delivery which has three statements numbered (8-10) in the survey, and it is clear that it has mean equal (3.934) which is a moderate value, against standard deviation equal (0.796) and Coefficient of variation equal (20.22%). Also, the mean for these four statements ranges between (3.869, 4.015), standard deviation ranges between (0.834, 1.009), and Coefficient of variation ranges between (21.04%, 26.08%) and these results indicate employee's perception for speed of delivery is moderate.

Table (13) Employees' perception for Speed of Delivery

Ser.	Speed of Delivery of Operational Performance	Mean	Std Dev.	CovVar %
8	The company calculates the waiting time for customers to receive their orders.	4.030	0.929	23.05%
9	The company compares the established production schedules with what was actually achieved.	3.867	0.916	23.68%
10	The company calculates the time required to complete the production cycle.	4.076	0.966	23.71%

Mean and Std Dev.	**3.991**	**0.812**	**20.34%**

To confirm the significance of the previous results in the population (1 sample t) test was performed between the employee's perception for Speed of Delivery and expected value (3) and the results of this test are shown in Table (14):

Table (14) (1-Sample T) for Speed of Delivery

Speed of Delivery of Operational Performance	**Mean**	**Stdev**	**Std error**	**P value**
	3.991	**0.812**	**0.041**	**0.000**

It is clear from Table (14) that there is a significant difference between employee's perception values for Speed of Delivery which greater than the expected value (3) proposed by researcher and that proved through (P value = 0.000) which is less than (0.05) and this means reject Null hypothesis, and accept alternative hypothesis which validate that there is a significant difference for employee's perceived value for this dimension of dependent variable that greater than the expected value.

Regression Models between dimensions of AMT and dimensions of OP

To confirm and validate the correctness of the hypotheses, the researcher tests the six hypotheses between dimensions of AMT and dimensions of OP using six simple regression models between them:

Hypothesis one

Table (15) shows the result of applying regression model between (Factors promoting AMT adoption) and (Dependability), it is clear that the model is significant through (P value = 0.000) which less than (0.05) and confirmed by (F

Calculated = 859.38) which greater than (F Tabulated = 3.865), and the impact is evaluated through coefficient of determination $\mathbf{R^2 = 0.685}$ that means (68.5%) of the changes in the (Dependability) of dependent variable returned to changes in (Factors promoting AMT adoption) of independent variable and its Regression equation is:

Dependability = 0.842 + 0.801 x Factors promoting AMT adoption

Table (15) First Regression Model between (Factors promoting AMT adoption) and (Dependability)

Variable	Source	DF	SS	MS	F Calculated	P value
Factors promoting AMT adoption	Treatment	1	187.655	187.655	859.38	0.000
	Error	395	86.255	0.218		
	Total	396	273.910			

Hypothesis two

Table (16) shows the result of applying regression model between (Factors promoting AMT adaption) and (Flexibility), it is clear that the model is significant through (P value = 0.000) which less than (0.05) and confirmed by (F Calculated = 770.22) which greater than (F Tabulated = 3.865), and the impact is evaluated through coefficient of determination $\mathbf{R^2 = 0.661}$ that means (66.1%) of the changes in the (Flexibility) of dependent variable returned to changes in (**Factors promoting Advanced Manufacturing Technologies adoption**) of independent variable and its Regression equation is:

Flexibility = 0.945 + 0.753 x Factors promoting AMT adaption

Table (18) Second Regression Model between (Factors promoting AMT adaption) and (Flexibility)

Variable	Source	DF	SS	MS	F Calculated	P value
Factors promoting Advanced Manufacturing Technologies adaption	Treatment	1	165.633	165.633	770.22	0.000
	Error	395	84.947	0.215		
	Total	396	250.580			

Hypothesis three

Table (17) shows the result of applying regression model between (Factors promoting AMT adaption) and (Speed of Delivery), it is clear that the model is significant through (P value = 0.000) which less than (0.05) and confirmed by (F Calculated = 784.35) which greater than (F Tabulated = 3.865), and the impact is evaluated through coefficient of determination $\mathbf{R^2 = 0.665}$ that means (66.5%) of the changes in the (Speed of Delivery) of dependent variable returned to changes in (Factors promoting AMT adaption) of independent variable and its Regression equation is:

Speed of Delivery = 0.932 + 0.771 x Factors promoting AMT adaption

Table (17) Third Regression Model between (Factors promoting AMT adaption) and (Speed of Delivery)

Variable	Source	DF	SS	MS	F Calculated	P value
Factors promoting Advanced	Treatment	1	173.560	173.560	784.35	0.000
	Error	395	87.410	0.221		

Manufacturing Technologies adaption	**Total**	**396**	**260.970**			

Hypothesis four

Table (18) shows the result of applying regression model between (Human-ware based technologies) and (Dependability), it is clear that the model is significant through (P value = 0.000) which less than (0.05) and confirmed by (F Calculated = 770.13) which greater than (F Tabulated = 3.865), and the impact is evaluated through coefficient of determination $\mathbf{R^2 = 0.661}$ that means (66.1%) of the changes in the (Dependability) of dependent variable returned to changes in (Human-ware based technologies) of independent variable and its Regression equation is:

Dependability = 0.802 + 0.813 x Human-ware based technologies

Table (18) Fourth Regression Model between (Humnan-ware based technologies) and (Dependability)

Variable	Source	DF	SS	MS	F Calculated	P value
Human-ware based technologies	**Treatment**	**1**	**181.047**	**181.047**	**770.13**	**0.000**
	Error	**395**	**92.863**	**0.235**		
	Total	**396**	**273.910**			

Hypothesis five

Table (19) shows the result of applying regression model between (Human-ware based technologies) and (Flexibility), it is clear that the model is significant through (P value = 0.000)

which less than (0.05) and confirmed by (F Calculated = 608.90) which greater than (F Tabulated = 3.865), and the impact is evaluated through coefficient of determination $\mathbf{R^2 = 0.607}$ that means (60.7%) of the changes in the (Flexibility) of dependent variable returned to changes in (Human-ware based technologies) of independent variable and its Regression equation is:

Flexibility = 0.983 + 0.745 x Human-ware based technologies

Table (19) Fifth Regression Model between (Human-ware based technologies) and (Flexibility)

Variable	Source	DF	SS	MS	F Calculated	P value
Human-ware based technologies	Treatment	1	151.983	151.983	608.90	0.000
	Error	395	98.597	0.250		
	Total	396	250.580			

Hypothesis six

Table (20) shows the result of applying regression model between (Human-ware based technologies) and (Speed of Delivery), it is clear that the model is significant through (P value = 0.000) which less than (0.05) and confirmed by (F Calculated = 755.76) which greater than (F Tabulated = 3.865), and the impact is evaluated through coefficient of determination $\mathbf{R^2 = 0.657}$ that means (65.7%) of the changes in the (Speed of Delivery) of dependent variable returned to changes in (Human-ware based technologies) of independent variable and its Regression equation is:

Speed of Delivery = 0.857 + 0.791 x Human-ware based technologies

Table (20) Sixth Regression Model between (Human-ware based technologies) and (Speed of Delivery)

Variable	Source	DF	SS	MS	F Calculated	P value
Human-ware based technologies	Treatment	1	171.389	171.389	755.76	0.000
	Error	395	89.581	0.227		
	Total	396	260.970			

Hypothesis seven

Testing this hypothesis done by applying the following two steps as follows:

-First Step: Perform descriptive analysis of employees' personal data according to their demographic characteristics (Gender, Age, Qualification, Job Level, Years of work experience), by calculating frequency and percentage and conducting the corresponding graphs.

-Second Step: Comparing Employees' Perceived Values for (AMT, OP) according to their demographic characteristics (Gender, Age, Qualification, Job Level, Years of work experience), by performing two (2 Sample T) Test for gender and eight (ANOVA) tests for characteristics (Age, Qualification, Job Level, Years of work experience).

Descriptive Analysis of Employees' Personal data According to Gender

Table (21) shows the distribution of employee sample of the Electronic and electrical Companies Sector in Egypt according to gender, it is clear that the number of (male) equal (354) with

highest percentage that equal (89.17%), while the number of (female) equal (43) with percentage that equal (10.83%) as shown in Figure (2).

Table (21) Distribution of employees according to gender

Gender variable	Frequency	Percentage%
Male	**354**	**89.17%**
Female	**43**	**10.83%**
All	**397**	**100%**

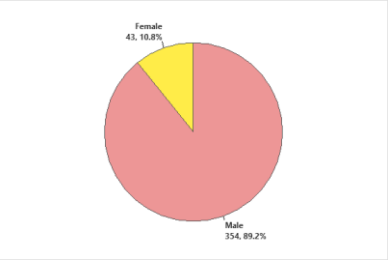

Figure (2) Distribution of employee according to gender

Descriptive Analysis of Employees' Personal data According to Age

Table (22) shows the distribution of employee sample of the Electronic and electrical Companies Sector in Egypt according to age, it is clear that the number of employees with age (From 30 to 50 years) equal (215) with highest percentage that equal (54.16%), while the number of with age (Less than 30 years old) equal (100) with percentage that equal (25.19%), and the number of employee with age (More than 50 years) equal (82) with percentage that equal (20.65%), as shown in Figure (3).

Table (22) Distribution of employees according to Age

Age variable	Frequency	Percentage%
Less than 30 years old	**100**	**25.19%**
From 30 to 50 years	**215**	**54.16%**
More than 50 years	**82**	**20.65%**
All	**397**	**100%**

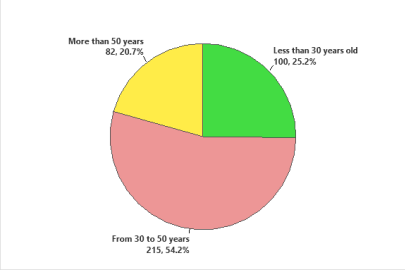

Figure (3) Distribution of employees according to age

Descriptive Analysis of Employees' Personal data According to Qualification

Table (23) shows the distribution of employee sample of the Electronic and electrical Companies Sector in Egypt according qualification, it is clear that the number of employees with qualification (Bachelor's degree) equal (236) with highest percentage that equal (59.45%), while the number of with qualification (Master's degree) equal (139) with percentage that equal (35.01%), and the number of employee with qualification (PHD) equal (22) with percentage that equal (5.54%), as shown in Figure (4).

Table (23) Distribution of employees according to qualification

Academic qualification variable	Frequency	Percentage%
PHD	22	5.54%
Master's degree	139	35.01%
Bachelor's degree	236	59.45%
All	397	100%

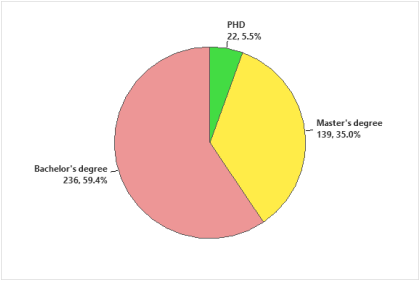

Figure (4) Distribution of employees according to qualification

Descriptive Analysis of Employees' personal data According to Job level

Table (24) shows the distribution of employee sample of the Electronic and electrical Companies Sector in Egypt according Job level, it is clear that the number of employees with Job level (Middle management) equal (171) with highest percentage that equal (43.08%), while the number of with Job level (Supervisory management) equal (140) with percentage that equal (35.26%), and the number of employee with Job level (Senior management) equal (86) with percentage that equal (21.66%), as shown in Figure (5).

Table (24) Distribution of employees according to Job level

Job level variable	Frequency	Percentage%
Senior management	86	21.66%

Middle management	**171**	**43.08%**
Supervisory management	**140**	**35.26%**
All	**397**	**100%**

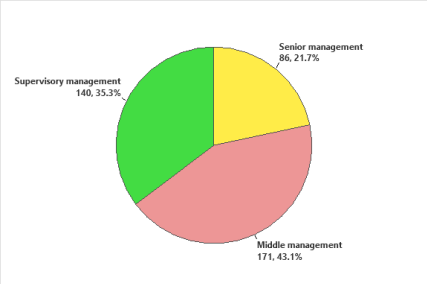

Figure (5) Distribution of employees according to Job level

Descriptive Analysis of Employees' personal data According to Experience

Table (25) shows the distribution of employee sample of the Electronic and electrical Companies Sector in Egypt according to experience, it is clear that the number of employees with experience (From 5 to 10 years) equal (181) with highest percentage that equal (45.59%), while the number of with experience (More than 10 years) equal (116) with percentage that equal (29.22%), and the number of employee with experience (Less than 5 years) equal (100) with percentage that equal (25.19%), as shown in Figure (6).

Table (25) Distribution of employees according to experience

experience variable	Frequency	Percentage%
Less than 5 years	**100**	**25.19%**
From 5 to 10 years	**181**	**45.59%**
More than 10 years	**116**	**29.22%**

All	**397**	**100%**

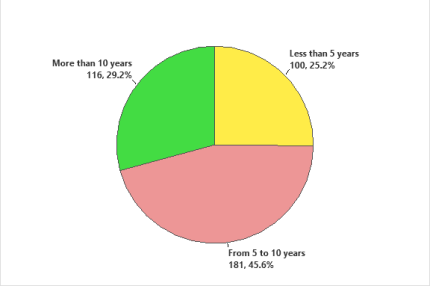

Figure (6) Distribution of employees according to experience

10. The Managerial Implications and recommendations for future research.

Based on the findings and results of the analyzed data. The following managerial implications will be introduced to the Electronic and Electrical companies in Egypt:

1- Electronic and Electrical companies in Egypt should build strong IT infrastructure in order to facilitate the information sharing internal and external the firms especially, with suppliers.
2- Electronic and Electrical companies in Egypt should change their culture in order to cope with new production systems.
3- Electronic and Electrical companies in Egypt should educate and train their employees in Advanced Manufacturing Technologies techniques.
4- Electronic and Electrical companies in Egypt should Recruit qualified individuals which help the company to reach their business objectives.
5- Manufacturers need an equally strong company wide commitment to continuous improvement.

6- Electronic and Electrical companies in Egypt should continuously improve their performance and acquire new competitive advantages.
7- Electronic and Electrical companies in Egypt should listen to customers by identifying their needs.
8- Electronic and Electrical companies in Egypt should use Operations performance Indicators always to measure their performance.

11.Recommendations for future research

This study focuses on the impact of factors promoting Advanced Manufacturing Technologies adaption and Human-ware based technologies in improving Operations performance (an applied study on Electronic, and Electrical companies in Egypt), This study also focuses on Advanced Manufacturing Technologies Dimensions (Factors promoting Advanced Manufacturing Technologies adoption, and Human-ware based technologies) and Operational performance Dimensions (Dependability, Flexibility, and Speed of Delivery)

Therefore, other researchers can study the following fields:

1- Case studies inside companies that have applied Advanced Manufacturing Technologies system.

2- A framework roadmap for implementing Advanced Manufacturing Technologies in local governmental entities.

5- An analysis and discussion of the Advanced Manufacturing Technologies Dimensions (Factors promoting Advanced Manufacturing Technologies adoption, and Human-ware based technologies).

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