The Impact of Nanotechnology and Lean Accounting on the Competitive Advantage of Jordanian Public Shareholding Industrial Companies

Associate Prof Jamal Hassan AL Afeef
Jerash University – Faculty of Business
Accounting Department -Jerash-Jordan.

Full Professor Osama Abdul-Munim Ali
Jerash University – Faculty of Business
Accounting Department -Jerash-Jordan.

Abstract

This study aimed to demonstrate the impact of nanotechnology and lean accounting on the competitive advantage of Jordanian public shareholding industrial companies. The study sample consisted of (34) public shareholding industrial companies, (3) questionnaires were distributed to each company, from which the researchers retrieved (87) questionnaires. After reviewing the retrieved questionnaires, it was found that there are (6) questionnaires that are not valid for statistical analysis. In order to identify the normal distribution of the data of the sample members, The (Kolmogorov-Smirnov Z) test was applied to all fields of the study and for each variable of the study (independent and dependent).The (VIF) test was also used to make sure that there is no problem of multiple linear relationships (multiple linear regression correlation),The study reached many results, the most important of which is the existence of a strong and statistically significant relationship between the application of nanotechnology, lean accounting and competitive advantage in Jordanian public shareholding industrial companies. The most important recommendations of the study centered on the necessity of focusing the Jordanian public shareholding industrial companies on the application of all tools of lean accounting and nanotechnologies, especially the two dimensions (value stream maps, performance measurement framework) for what these two dimensions have that could help in increasing the level of application of lean accounting, and their impact on reducing production costs.

Keywords: Nanotechnology: lean Accounting: Competitive advantage: Jordanian public shareholding industrial companies

Introduction:

In view of the intense competition market and the tremendous technological developments that were reflected in the adoption of the economic units of nanotechnology and the lean production system, accounting was not isolated from those changes, which called for the need to develop traditional methods of accounting, especially in cost accounting, that are no longer able to meet the requirements that Industrial companies need them to take decisions and knowing where resources are wasted and lost. This later on led to the innovation of a new method away from the traditional methods currently used, which the literature of cost and management accounting called the "lean accounting", that along with nanotechnology, was the leading indicator in achieving competitive advantage in industrial companies.

Study questions: The current study was built on the following questions:

First main question:
Is there an impact of nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

First sub-question:
Is there an impact of preparing a skilled, innovative and motivated workforce on the competitive advantage in the Jordanian public shareholding industrial companies.

Second sub-question:
Is there an impact on preparing leaders characterized by credibility and clear vision on the competitive advantage in the Jordanian public shareholding industrial companies.
Third sub-question:
Is there an impact of the dominance of the culture and convictions of knowledge and achievement on the competitive advantage in the Jordanian public shareholding industrial companies.

Fourth sub-question:

Is there an impact in the formation of organizations and institutions supporting Nano science and technology to raise the efficiency of the application of nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

Fifth sub-question:
Is there an impact of restructuring and engineering the existing companies to adopt nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

The second main question
Is there an impact of lean accounting on the competitive advantage in the Jordanian public shareholding industrial companies.
Sixth sub-question:

Is there an impact of value stream maps on competitive advantage in Jordanian public shareholding industrial companies.
Seventh sub-question:
Is there an impact of the performance measurement workflow on the competitive advantage in the Jordanian public shareholding industrial companies.
Eighth sub-question:

Is there an impact of the target cost on the competitive advantage in the Jordanian public shareholding industrial companies.

The ninth sub-question:
Is there an impact of continuous improvement (Kaizen) on the competitive advantage in the Jordanian public shareholding industrial companies.

The tenth sub-question:
Is there an impact of the box score on the competitive advantage in the Jordanian public shareholding industrial companies.

Study hypotheses: The current study was built on the following Hypotheses:
First main Hypothesis:
There is no impact of nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

First sub- Hypothesis:
There is no impact of preparing a skilled, innovative and motivated workforce on the competitive advantage in the Jordanian public shareholding industrial companies.

Second sub- Hypothesis:
There is no impact on preparing leaders characterized by credibility and clear vision on the competitive advantage in the Jordanian public shareholding industrial companies.

Third sub- Hypothesis:
There is no impact of the dominance of the culture and convictions of knowledge and achievement on the competitive advantage in the Jordanian public shareholding industrial companies.

Fourth sub- Hypothesis:
There is no impact in the formation of organizations and institutions supporting Nano science and technology to raise the efficiency of the application of nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

Fifth sub- Hypothesis:
There is no impact of restructuring and engineering the existing companies to adopt nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

The second main Hypothesis
There is no impact of lean accounting on the competitive advantage in the Jordanian public shareholding industrial companies.

Sixth sub- Hypothesis:
There is no impact of value stream maps on competitive advantage in Jordanian public shareholding industrial companies.

Seventh sub- Hypothesis:
There is no impact of the performance measurement Workflow on the competitive advantage in the Jordanian public shareholding industrial companies.

Eighth sub- Hypothesis:
There is no impact of the target cost on the competitive advantage in the Jordanian public shareholding industrial companies.

The ninth sub- Hypothesis:
There is no impact of continuous improvement (Kaizen) on the competitive advantage in the Jordanian public shareholding industrial companies.

The tenth sub- Hypothesis:
There is no impact of the box score on the competitive advantage in the Jordanian public shareholding industrial companies.

The theoretical side:
Nanotechnology, a renewed intellectual concept:

Nanotechnology is the philosophical science that is concerned with the study of infinitesimal matter and its treatment in a molecular and physical manner, and working to innovate the latest advanced technologies and new methods whose dimensions may be measured by the so-called nanometer, which are very precise and very small dimensions compared to bacteria and the living cell.A nanometer is a unit of measurement that has been estimated as one-thousandth of a micrometer, which is one-thousandth of a millimeter, meaning that a nanometer is one-millionth of a millimeter. This technology is concerned with the properties of materials on a large scale, despite their different fields, from semiconductors to the invention of modern advanced methods that may depend on molecular assembly.

Therefore, nanotechnology is nothing but a scientific application that undertakes the production of things by assembling them on a small level from their basic components such as atoms and molecules, and as long as all materials consisting of atoms are aligned according to a specific composition, we can replace an element atom and align it with another atom and thus we can make something new and from almost anything, and sometimes these materials surprise us with new properties that we did not know before, which opens new areas for their use and harnessing for the benefit of humans at the lowest possible cost. (MHS Ahmeda et al., 2017)

The two researchers agree with (Satalkar et al., 2016) that there is no consensus on the definition of nanotechnology or nano, and this stems from the basic controversy about defining "nano." This indicates the intellectual leadership of this term at the local and global levels.

The ability of nanotechnology to improve the structure of materials used in manufacturing and production processes:

Nanotechnology has the ability to improve the structure and performance of the materials in which it is made. It is known in practice that everything that is small in size or measurement of anything has improved properties. Therefore, nanotechnology applications in the manufacturing process require three steps. The first step, which was used in the 1990s, was the ability to manipulate atoms, that is, to select them and keep them in the desired positions. This capability will allow items to be produced without scrap with nearly perfect efficiency and accuracy. The second step is to produce assembly devices that can be programmed to affect atoms and molecules. The assemblers will have a sub-micromechanical arm that is controlled by computer. This strategy will produce assemblies on the Nano level, which will be getting the atoms in their proper place. Finally, the third step will be the manufacture of sufficient complexes to produce consumer goods. This will be achieved through the use of replicas - assemblers that are programmed to create additional complexes. (Benelmekki, 2015).

Lean Accounting Concept:

A general term used to express changes in the lean business environment, as it is a set of principles and practices that reduce costs by eliminating all forms of waste, eliminating activities that do not add any value to the product, and simplifying all accounting operations while maintaining Finance control (Laura, 2010: 10).

As both (Issa and Mohsen, 2015: 121) see that lean accounting is a new designed concept which works better for financial performance in companies that adopt the concepts and principles of lean thinking as one of their business strategies, and that requires a change in the accounting, measurement and control systems in a way that serves and reflects correctly the results of applying the principles of lean thinking in all the company's activities.

Lean Accounting Benefits:

(Chopra, 2013: 80-p81) indicated that there are several benefits to lean accounting, which are as follows:
1- Supporting a lean culture by stimulating investment, providing relevant and actionable information, and encouraging continuous improvement at every level of the company with regard to the preparation of internal and external reports.
2- Lean accounting requirements are consistent with generally accepted accounting principles (GAAP).
3- Using lean accounting tools to eliminate all types of waste in accounting operations while maintaining adequate financial control.
4- lean accounting provides accurate, understandable and timely information to all levels of the company through the use of critical information and metrics for leanness. Financial information and performance measurement are organized throughout value streams. lean performance metrics are the cornerstone of management for controlling lean production cells and value streams.
5- lean accounting saves money and reduces costs by eliminating all accounting operations that are not needed, as most companies do not have any idea about reducing costs due to their preoccupation with the depth of operations and the lack of qualified cost accountants in the company, and by using lean accounting These processes can be controlled and all processes that do not add any value will be deleted.
6- lean accounting increases the value of sales because it provides the best information for decision-making. That's why when using standard cost information related to pricing, profitability, purchasing and capital investment, they are often wrong decisions. And for that ,lean companies have good tools such as value stream costing for making lean decisions.
7- In lean accounting, the financial impact is clearly defined. Most companies use traditional costing methods to assess the benefits of improving leanness, and many companies look at reducing short-term costs as a proportion of lean change.
Principles and Practices of lean Accounting:
(Maskell &Baggaley, 2006: 36-38) indicated that the most important principles and practices of lean accounting can be summarized as follows:

1- Lean and simple accounting work
2- Accounting processes that support the shift towards leanness
3- Communicate information clearly and in a timely manner
4- Strengthening the internal control of accounting
5- Planning from a lean perspective

Lean Accounting Tools and Practices
The following is a brief presentation of some of the lean accounting tools that will be focused on:-
Value stream maps:
Value stream maps are one of the basic tools in lean accounting. Value streams of products in lean companies constitute an advanced stage in the transition to lean management, as manufacturing cells within value streams are designed to make a group of products or parts that require the manufacturing chain itself, it is a model of a tool Cost that provides accurate and cost-relevant information to decision makers and managers at all levels of the company that they need to do their job effectively by value stream costs. (Xueping, et al, 2012: 33-48).
Performance Measurement Framework:
Performance metrics are divided into two types, cell performance metrics and value stream performance metrics, as follows:

1- Metrics of cell performance:-
(Bahadir, 2011: 25-30) indicated that through the implementation of lean principles on accounting practices, there must be new performance measures to support manufacturing and lean processes, to provide appropriate information to decision makers with oversight of processes within lean cells. These metrics are collected and used by individuals within the cell that display the first stepswhich was taken in time. Therefore, measures of cell performance are commensurate with lean culture. There are four measures of cell performance:

A- Operational Equipment Effectiveness (OEE):

B- Quality report from the first time (First _ Time _ Trough) (FTT):
C- The daily report in hours (Day _ By_ The_ Hour) (DBH):
D- Report of production under actual operation to production in process of standard operation WIP_TO_SWIP**:**
2- Value Stream Performance Metrics:

Cell performance measures are to support and assist individuals working in lean cells in decision-making and control, and cell performance measures are for continuous improvement in the value stream and provide the means to serve customers. But the goal of measuring the performance of the value stream is to push one or more teams (CI) to continuously improve the processes in the value stream. Unnecessary processes are also excluded in the accounting processes by studying the measurement of the performance of the value stream every week to make the steps go in the right direction.
Target cost:

Both (Ofleanu & Topor, 2014: 348) pointed out that target costs focus on customer value and achieving perfection, and the aim of it is to extract cost estimation from the value stream in order to start improving projects and reduce costs to make the value stream costs on the same line with the target costs and ensure levels High customer values and interview level. And the result is a series of improvement initiatives related to: sales, marketing, and product design.
Kaizen method (continuous improvement):

Kaizen method has been defined as critical tools in confirming continuous improvement activities, and it supports a cost-reducing process in the production path. If it is employed with target costs, it helps to reduce cost in the complete product design, development and production cycle.
Score box:

(Maskell & Kenddy, 2007: 59-73) pointed out that the Box score is a report that appears on a weekly basis through the performance of the value stream that is used to evaluate the financial impact and take decisions to improve leanness, and the box score tool was used for reporting requirements and other decision-making. (Al-Mousawi and Al-Gharabawi, 2015: 14) indicated that the main purpose of the weekly box score report is to focus the attention of the value stream team on areas that can benefit from continuous improvement efforts, and the improvement of the results of the weekly value stream can be tracked as an indicator of the effectiveness of continuous improvement efforts.

The researchers believe that a pioneering cost-technology integration between nanotechnology and lean accounting tools will lead to a rapid improvement in the production process. By reducing the unit cost of the product through the most effective use of the inputs of the manufacturing processes of industrial companies stemming from the effects of nanotechnology on the value chain of industrial products, that will eventually lead to the production of high-quality products at a very low cost, which occurs through the adoption of lean accounting to lean methods that reduce In-store production volume, reduce production cycle time and improve product quality. Thus, achieve a competitive advantage for Jordanian industrial companies at the local and global levels.

Practical side :

The study sample:
The study sample consisted of (34) public shareholding industrial companies, (3) questionnaires were distributed to each company, from which the researchers retrieved (87) questionnaires. And (81) questionnaire were valid for analysis .
The characteristics of the study sample:
Table No. (1) shows the Description of the demographic variables for the study sample.

Table (1): Description of the demographic variables for the study sample

variable	Level	Recurrence	Percentage
Qualification	diploma	9	11.1
	Bachelor	45	55.6
	Master's	21	25.9
	PhD	6	7.4
	Total	81	100.0
Academic specialization	Accounting	30	37.5
	Business Administration	15	18.5
	Economic	3	3.7
	Finance and Banking	18	22.2
	other (engineering)	15	18.5
	Total	81	100.0
The administration you belong to	cost management	39	48.1
	production management	6	7.4
	Marketing Management	18	22.2
	Engineered designs Management	9	11.1
	purchase management	9	11.1
	Total	81	100.0
Obtaining any professionalcertification?	Yes	12	14.8
	No	69	85.2
	Total	81	100.0
Number of years of work experience	Less than 5 years old	9	11.1
	5-10 years	39	48.1
	10-15 years	18	22.2
	more than 15 years	15	18.5
	Total	81	100.0

It appears from Table No. (1) that the study sample is qualified to answer the items of the questionnaire and rely on it, and thus it is reflected in their answers with confidence and dependence, which enhances and strengthens the results of this study.

Validity and reliability of the study instrument:

The validity of the content of the instrument used in the study was confirmed by presenting it to a group of experienced and competent faculty members and administrations in companies, to express their opinion in each field of the study and the formulation of paragraphs and the extent to which each paragraph relates to its field, as some questions were modified and others were deleted and the addition of new questions was done to comply with the proposals and observations of the arbitrators, and thus the study instrument (the questionnaire) became in its final form, consisting of (94) paragraphs distributed over (3) fields of study.

It is clear from the results of data analysis in Table No. (2) that the result of the stability of the study paragraphs is high.

Table No. (2): Internal stability coefficients (Cronbach's alpha) for each field of the study instrument and for the instrument as a whole

Field	Paragraph	# of Paragraphs	Cronbach's alpha
Nanotechnology	Preparing a skilled, innovative and motivated workforce	**8**	**0.720**
	Preparing leaders characterized by credibility and a clear vision	**5**	**0.727**
	The Dominance of culture and convictions of knowledge and achievement	**7**	**0.800**
	Forming organizations and institutions supporting nanoscience and technology to raise The efficiency of nanotechnology application in companies	**7**	**0.702**
	Restructuring and engineering existing companies to adopt nanotechnology	**7**	**0.714**
Lean Accounting	Value stream maps	**7**	**0.845**
	Performance Measurement Workflow	**7**	**0.735**
	Target Cost	**7**	**0.719**
	Continuous Improvement (Kaizen)	**7**	**0.706**
	Box Score	**7**	**0.800**
Competitive advantage		**25**	**0.725**
Instrument as a whole		**94**	**0.916**

It appears from Table No. (2) that all values of Cronbach's alpha coefficients were high, and the stability of the study paragraphs as a whole was high, reaching (0.916), which indicates that the study instrument is highly credible.

Normal Distribution:

In order to identify the normal distribution of the data of the sample members, the test (Kolmogorov-Smirnov Z) was applied to all fields of the study and for each of the independent and dependent variables of the study. :

Table (3)
The results of applying the test (Kolmogorov-Smirnov Z) to all fields of study

Field	Paragraph	Kolmogorov-Smirnov Z	Statistical significance
Nanotechnology	Preparing a skilled, innovative and motivated workforce	**1.131**	**0.154**
	Preparing leaders characterized by credibility and a clear vision	**1.341**	**0.055**
	The Dominance of culture and convictions of knowledge and achievement	**1.348**	**0.053**
	Forming organizations and institutions supporting nanoscience and technology to raise the efficiency of nanotechnology application in companies	**1.161**	**0.135**
	Restructuring and engineering existing companies to adopt nanotechnology	**1.201**	**0.112**
Lean Accounting	Value stream maps	**1.293**	**0.071**
	Performance Measurement Workflow	**1.045**	**0.224**
	Target Cost	**1.345**	**0.054**
	Continuous Improvement (Kaizen)	**1.150**	**0.142**
	Box Score	**1.351**	**0.052**
Competitive advantage		**1.268**	**0.080**
Instrument as a whole		**0.960**	**0.316**

It appears from Table No. (3) that the value of the test (Kolmogorov-Smirnov Z) for the study fields ranged between (1.045-1.348), which are acceptable values at the level of significance (0.05), as it turns out that the probability ratios for all answers were greater than (0.05).

Which is the level adopted in Statistical treatment of this study, thus making sure that the distribution is a normal distribution for all fields.

The interactions (correlation) test between the independent variables

Table No. (4)Shows the value of VIF and Tolerance

The first main hypothesis

The (VIF) test was relied upon to ensure that there is no problem of multiple linear relationships (multiple correlation), because it is considered a problem as one of the problems facing the statistical estimation of regression coefficients, and Table No. (4) shows the test results for VIF:

Field	VIF	Tolerance
Preparing a skilled, innovative and motivated workforce	1.07**3**	0.932
Preparing leaders characterized by credibility and a clear vision	1.100	0.909
The Dominance of culture and convictions of knowledge and achievement	1.125	0.889
Forming organizations and institutions supporting nanoscience and technology to raise the efficiency of nanotechnology application in companies	1.258	0.795
Restructuring and engineering existing companies to adopt nanotechnology	1.192	0.839

The table above shows that there is no multiple correlation problem between the independent variables as it is less than 5, and therefore the level of variance in each of the independent variables is accepted.

The second main hypothesis

The (VIF) test was relied upon to ensure that there is no problem of multiple linear relationships (multiple correlation), because it is considered a problem as one of the problems facing the statistical estimation of regression coefficients, and Table No. (5) shows the test results for VIF:

Field	VIF	Tolerance
Value stream maps	**1.166**	**0.858**
Performance Measurement Workflow	**1.549**	**0.645**
Target Cost	**1.290**	**0.775**
Continuous Improvement (Kaizen)	**1.160**	**0.862**
Box Score	**1.260**	**0.794**

The table above shows that there is no multiple correlation problem between the independent variables as it is less than 5, and therefore the level of variance in each of the independent variables is accepted.

Results :

Discussing the results of the study:
The first main hypothesis:

There is no impact of nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

To test this hypothesis, multiple regression analysis was used to identify the relationship between the application of nanotechnology, represented by (preparing the workforce, preparing leaders, culture and knowledge, forming supporting organizations, restructuring) on the competitive advantage of Jordanian public shareholding industrial companies, and Table No. (6) shows That relationship:

Independent Variable	Value β	Value*t*	Statistical significance
Constant	0.804	2.006	0.048
Preparing a skilled, innovative and motivated workforce	0.223	3.242	0.002
Preparing leaders characterized by credibility and a clear vision	0.189	3.662	0.000
The Dominance of culture and convictions of knowledge and achievement	0.148	2.702	0.009
Forming organizations and institutions supporting nanoscience and technology to raise the efficiency of nanotechnology application in companies	0.125	2.041	0.045
Restructuring and engineering existing companies to adopt nanotechnology	0.137	2.356	0.021
Value*F*	**14.902**	*F* Statistical significance	**0.000**
Adj. R^2	**%46.5**	R^2	**%49.8**
Durbin-Watson	**1.051**	# of Views	**81**

The table shows a strong and statistically significant relationship between the application of nanotechnology and the competitive advantage in the Jordanian public shareholding industrial companies represented by (preparing the workforce, preparing leaders, culture and knowledge, forming support organizations, restructuring) where the value of F reached (14,902) and with a statistical significance (0.000) as Adj. R2

reached (46.5%), which represents the strength of the influence of the independent variable (nanotechnology) on the dependent variable (competitive advantage), and thus we reject the first main null hypothesis, and accept the alternative hypothesis.

Results related to the first sub-hypothesis:

There is no impact of preparing a skilled, innovative and motivated workforce on the competitive advantage in the Jordanian public shareholding industrial companies.
The result of the multiple regression test showed that there is a direct relationship between the preparation of skilled, innovative and motivated workforce and the competitive advantage ,and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.223) units, and thus we reject the null hypothesis and accept the alternative hypothesis .
The results related to the second sub-hypothesis:

There is no impact on preparing leaders characterized by credibility and clear vision on the competitive advantage in the Jordanian public shareholding industrial companies.

The result of the multiple regression test showed that there is a direct relationship between the preparation of leaders characterized by credibility, clear vision on the competitive advantage, and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.189) units, and thus we reject the null hypothesis and accept the alternative hypothesis.
Results related to the third sub-hypothesis:

There is no impact of the dominance of the culture and convictions of knowledge and achievement on the competitive advantage in the Jordanian public shareholding industrial companies.
The result of the multiple regression showed that there is a direct relationship between the dominance of the culture and convictions of knowledge and achievementand competitive advantage, and it is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.148) units, and thus we reject the null hypothesis and accept the alternative hypothesis.

Results related to the fourth sub-hypothesis:

There is no impact in the formation of organizations and institutions supporting Nano science and technology to raise the efficiency of the application of nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

The result of the multiple regression showed that there is a direct relationship between the formation of organizations and institutions supporting Nano science and technology to raise the efficiency of the application of nanotechnology and the competitive advantage, and it is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.125) units, and thus we reject The null hypothesis and we accept the alternative hypothesis.
Results related to the fifth sub-hypothesis:
There is no impact of restructuring and engineering the existing companies to adopt nanotechnology on the competitive advantage in the Jordanian public shareholding industrial companies.

The result of the multiple regression showed that there is a direct relationship between the restructuring and engineering the existing companies to adopt nanotechnologyand competitive advantage, and it is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.137) units, and thus we reject the null hypothesis and accept the hypothesis alternative.

The second main hypothesis

There is no impact of lean accounting on the competitive advantage in the Jordanian public shareholding industrial companies.

To test this hypothesis, multiple regression analysis was used to identify the relationship between the application of lean accounting represented by (value stream maps, performance measurement, target cost, kaizen, Score Box) on the competitive advantage of Jordanian public shareholding industrial companies, and

Table No. (7) shows that relationship

Independent Variable	Value β	Value *t*	Statistical significance
Constant	1.215	3.878	**0.000**
Value stream maps	0.084	2.440	0.017
Performance Measurement Workflow	0.282	5.119	0.000
Target Cost	0.117	2.318	0.023
Continuous Improvement (Kaizen)	0.132	2.235	0.028
Box Score	0.106	2.084	0.041
Value*F*	**23.734**	*F* Statistical significance	**0.000**
Adj. R^2	**%58.7**	R^2	**%61.3**
Durbin-Watson	**1.645**	# of views	**81**

The table shows a strong and statistically significant relationship between the application of lean accounting and the competitive advantage in the Jordanian public shareholding industrial companies represented by (value stream maps, performance measurement workflow, target cost, kaizen, Score box), where the value of F reached (23,734) and a statistical significance of (0.000) where the adj. R2 reached (58.7%), which represents the strength of the influence of the independent variable (lean accounting) on the dependent variable (competitive advantage), and thus we reject the second main null hypothesis, and accept the alternative hypothesis.

Results related to the sixth sub-hypothesis:

There is no impact of value stream maps on competitive advantage in Jordanian public shareholding industrial companies.

The result of the multiple regression showed that there is a direct relationship between the value stream maps and the competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.084) units, and thus we reject the null hypothesis and accept the alternative hypothesis.

Results related to the seventh sub-hypothesis:

There is no impact of the performance measurement Workflow on the competitive advantage in the Jordanian public shareholding industrial companies.

The result of the multiple regression showed that there is a direct relationship between the performance measurement workflow and the competitive advantage and is statistically significant, as the result indicates that the increase of the independent variable by 1% leads to an increase of the dependent variable by (0.282) units, and thus we reject the null hypothesis and accept the alternative hypothesis.

Results related to the eighth sub-hypothesis:

There is no impact of the target cost on the competitive advantage in the Jordanian public shareholding industrial companies.

The result of the multiple regression showed that there is a direct relationship between the target cost and the competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.117) units, and thus we reject the null hypothesis and accept the alternative hypothesis.

Results related to the ninth sub-hypothesis:

There is no impact of continuous improvement (Kaizen) on the competitive advantage in the Jordanian public shareholding industrial companies.

The result of the multiple regression showed that there is a direct relationship between continuous improvement (Kaizen) and competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.132) units, and thus we reject the null hypothesis and accept the alternative hypothesis.

Results related to the tenth sub-hypothesis:

There is no impact of the box score on the competitive advantage in the Jordanian public shareholding industrial companies.

The result of the multiple regression showed that there is a direct relationship between the Score box and the competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.106) units, and thus we reject the null hypothesis and accept the alternative hypothesis.

Results:

1- There is a strong and statistically significant relationship between the application of nanotechnology and the competitive advantage in the Jordanian public shareholding industrial companies represented by (preparing the workforce, preparing leaders, culture and knowledge, forming support organizations, restructuring)
2- There is a direct relationship between the preparation of skilled, innovative and motivated workforce and the competitive advantage ,and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.223) units
3- There is a direct relationship between the preparation of leaders characterized by credibility, clear vision on the competitive advantage, and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.189) units
4- There is a direct relationship between the dominance of the culture and convictions of knowledge and achievement and competitive advantage, and it is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.148) units.
5- There is a direct relationship between the formation of organizations and institutions supporting Nano science and technology to raise the efficiency of the application of nanotechnology and the competitive advantage, and it is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.125) units
6- There is a direct relationship between the restructuring and engineering the existing companies to adopt nanotechnology and competitive advantage, and it is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.137) units
7- There is a strong and statistically significant relationship between the application of lean accounting and the competitive advantage in the Jordanian public shareholding industrial companies represented by (value stream maps, performance measurement workflow, target cost, kaizen, Score box)
8- There is a direct relationship between the value stream maps and the competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.084) units
9- There is a direct relationship between the performance measurement workflow and the competitive advantage and is statistically significant, as the result indicates that the increase of the independent variable by 1% leads to an increase of the dependent variable by (0.282) units
10- There is a direct relationship between the target cost and the competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.117) units
11- There is a direct relationship between continuous improvement (Kaizen) and competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.132) units
12- There is a direct relationship between the Score box and the competitive advantage and is statistically significant, as the result indicates that an increase in the independent variable by 1% leads to an increase in the dependent variable by (0.106) units

Recommendations

1- The necessity for Jordanian public shareholding industrial companies to focus on applying all tools of lean accounting and nano technologies, especially the two dimensions (value stream maps, performance measurement workflow) for how these two dimensions helps in achieving an increase in the level of application of lean accounting, and their impact on reducing production costs.
2- The necessity of relying on value stream maps as a main tool in Lean Manufacturing along with nanotechnology. And activating its impact on the development of the production process.
3- Increasing the level of dependence on the target cost and nanotechnology, as a tool for cost control, and directing the target cost towards design and production planning in a way that ensures achieving the target profit, and thus achieving the competitive advantage.
4- The company should include expected future improvements during the budget period and include them in the budget figures, due to its contribution in reducing costs and achieving quality in its products.
5- The need for the company to rely on the score box in adopting the company's future plans along with nano technologies, and to prepare improvement programs and make gradual improvements that affect the financial and operational results.

References

Ahmeda, M. H. S.,Ahmida,N. H. S., &Ahmeida,A. A.(2017).Introduction nanotechnology: definition, terms, occurrence and applications in environment", 2(1), 12-

Al-Gharabawi, Sajjad Mahdi Abbas and Al-Mousawi, Abbas Nawar Kahit (2015), Using lean accounting tools in supporting lean production systems and evaluating the performance of economic units, Al-Kout Journal of Economic and Administrative Sciences, No. 17, Iraq.

Bahadir, Ayca (2011), The Role Of Management Accounting Systems In Implementing Lean Business Strategies, Master Thesis Accounting, Erasmus University Rotterdam, The Netherlands.

Benelmekki,M.(2015)."An introduction to nanoparticles and nanotechnology", Designing Hybrid Nanoparticles , chapter 1,page 1-14.

Chopra, Abha (2013), Lean Accounting-An Emerging Concept, International JouranlOf Marketing, Vol. 2, No. 8, PP. 79-84, India.

Issa, Sirwan Karim and Mohsen, Muhammad Abdulaziz (2015), Lean Accounting, Application of a Proposed Value Stream Model in Family Food Production Company, Journal of Kirkuk University for Administrative and Economic Sciences, Vol. 5, No. 1, pp. 112-138, Iraq.

Laura, Cretu (2010), Lean Accounting Anew Global Approach, The Journal Ovidius University Annals Economy, Romania

Maskell, Brian H & Kennedy, Frances A (2007), Why Do We Need Lean Accounting And How Does It Work?, Journal Of Corporate Accounting And Finance, Vol.18, No.3.

Maskell, Biran&Baggaley, Bruce (2006), Whats Lean Accounting All About?, Inaugural Lean Accounting Summit, PP. 35-43, WWW.Leanaccountingsummit.com

Ofileanu, Dimi &Topor, Dan Loan (2014), Lean Accounting- An Ingenious Solution For Cost Optimization, International Journal Of Academic Research In Business And Social Sciences, Vol. 4, No. 4, PP. 342-352, Romania.

Satalkar,P., Elger,B. S., Shaw,D. M. (2016)."Defining Nano,Nanotechnology and Nanomedicine: Why Should It Matter?" *Sci Eng Ethics. 2016 Oct;22*(5), 1255-1276. https://doi.org/10.1007/s11948-015-9705-6

Xueping, Li &Sawhny, Rapinder & Aendt, Eric John (2012), A Comparative Analysis Of Management Accounting System Impact On Lean Implementation, International Journal Of Technology Management, Vol. 57, PP. 33-48.