THE EFFECT OF INTEGRATION BETWEEN THROUGHPUT ACCOUNTING AND LEAN ACCOUNTING ON COST REDUCTION (APPLIED STUDY IN SAUDI INDUSTRIAL SECTOR)

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ABSTRACT

This study aimed to investigate the impact of integration between throughput accounting and lean accounting on cost reduction in industrial companies by obtaining data from a sample of Saudi companies. A set of modern accounting systems have emerged that contribute to providing accurate information to management and help reduce unit cost while increasing production efficiency represented by both lean accounting and throughput accounting. A quantitative methodology was adopted for the purpose of achieving the research objectives, where a questionnaire with closed ended questions has been distributed online among a sample of (100) managers and accountants in Saudi industrial companies. The collected responses were analyzed by SPSS 23 and the results showed the importance of using throughput accounting and lean accounting in Saudi industrial companies, Moreover, the study concluded that there is a statistically significant, positive and strong correlation between the integration of lean accounting and throughput accounting and cost reduction in Saudi industrial companies, and that these two systems are complementary in their ability to reduce costs. The researcher recommends the necessity of using throughput accounting in conjunction with lean accounting in Saudi industrial companies in a way that leads to the optimal use of the establishment's resources and thus reducing costs

Keywords: Lean Accounting, Throughput Accounting, Cost Reduction

INTRODUCTION

The global crisis has contributed to the collapse of many financial institutions, banks and companies, and these collapses have negatively affected the level of economic achievements. Therefore, it was necessary to search for the causes that contributed to the emergence of these collapses and to take the necessary measures and procedures to address and deal with them (Hosban, 2019). Najm (2019) confirmed that recent decades have witnessed many developments in various industrial fields, and these developments included the orientation towards new methods in production that enhance the ability of organizations to succeed and overcome the routine and administrative methods that reduce the level of competition between organizations and reduce the level of customer satisfaction with the services provided.

FUADAH and others (2020) argued The managers use the management accounting systems to have information and use it for decision-making in this field, the accounting approach represented an important element that can enable industrial organizations to keep pace with various developments, and a set of modern accounting systems appeared that contribute to providing accurate information to management and help reduce unit cost while increasing production efficiency (Ogar et al., 2017). The better their business performance is, the more successful the

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business will be (SUMIATI.2020) Thus, there is a need to explore the possible antecedents of business performance. Both lean and throughput accounting are considered among the most prominent modern accounting systems, as Utiyama and Filho (2013) argued that these two systems have not been fully studied, and the researchers' efforts confirm that it is impossible to say that one of these methods is superior to the other, as the task of the company's management is to decide which of these systems is more appropriate for the company's work. Based on these concepts, many opinions emerged calling for the achievement of complementarity (integration) between these two systems as they are methods of management accounting (Najarian, 2004; Elsukova, 2015). Based on that, this research aims to investigate the effect of integration between throughput accounting and lean accounting on cost reduction.

Research Problem

The development of administrative systems had to be matched by an evolution in accounting systems as well, where Gračanin et al. (2019) argued that traditional accounting systems have become ineffective in meeting the management's needs in terms of providing appropriate information that serves the administration in its various functions in an environment characterized by intense competition. NGUYEN (2020) argued that the basic task of financial statements is to provide useful and appropriate information to the users in making economic decisions. As a result, many accounting systems emerged that helped provide accurate information to management and reduce production costs, including lean accounting and throughput accounting. Abdeen (2015) added that it is imperative to pay attention to modern management accounting tools and employ them to support the administration with important information that enables it to achieve its performance effectively. Based on that, this research seeks to investigate the extent to which the use of lean accounting, in combination with throughput accounting, can reduce costs. Thus, the problem of this research can be summarized in the following question:

- What is the effect of integration between throughput Accounting and lean accounting on cost reduction?

Research Importance

The importance of the research is highlighted by the importance of the two accounting systems, which seek to investigate the effect of integration between them on cost reduction. Throughput accounting is one of the new technologies that are compatible with the features of the modern era, and it is one of the modern philosophies and tools that are used in evaluating performance and providing a comprehensive view of the company as a whole (Elsukova, 2015). Throughput accounting represents an entry point for developing cost systems, and it seeks to provide management needs with administrative and cost information that is commensurate with the developments of the times and its complex environment (Stone, 2017). With regard to the lean accounting system, this system is considered one of the systems that work to reduce waste in resources and activities that do not add any value to the production process. It also contributes to improving the value of the product, enhancing its quality, improving the level of production, and reducing the cost.

In a more details, the importance of research can be clarified through the following points:

1. This research examines the latest modern accounting tools that can be used in developing the cost systems used in the Saudi industrial sector.
2. This research provides the owners of administrative officials in industrial companies with cost and administrative information that helps these companies measure and evaluates the performance of improving

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the quality of services and reducing production costs. This would support the companies' ability to compete in the contemporary market in light of recent trends in management accounting.
3. This research will seek to develop the traditional costing methods used in the Saudi industrial sector.
4. This research provides results that could benefit industrial enterprises in applying modern costing methods that contribute to reducing costs and providing critical information to management.
5. This research is considered a prelude to conducting further future studies related to the subject of the study.

LITERATURE REVIEW

Lean Accounting

Lean accounting is one of the recent topics that have appeared recently, which expresses a system used to improve the ability of management to make decisions by relying on its tools. These tools contribute to determining levels of waste and overcoming everything that does not add value to work (Muhammad & Isah, 2020). The term Lean Accounting refers to John Kravick, a member of the research team at the International Automobile Program. This concept first appeared at the Toyota Factory, which is one of the largest and most profitable companies in the world (Mohsen, 2016). The Toyota Factory has adopted this concept as a revolutionary approach to production planning and inventory management (Mohsen, 2016).

The concept of lean accounting is based on the concept of rational thinking or loss-free production. Muhammad and Isah (2020) defined lean accounting as the system that contributes to eliminating the loss arising in production and operation processes and improving the quality of services in response to market requirements and customer needs. Mashkour and Sameer (2020) defined lean accounting as one of the most efficient methods of presenting the required information, through which traditional financial information and reports are mined in order to provide easy financial statements. Soleimani et al. (2019) pointed out that lean accounting consists of two basic, including:

1. The main goal of lean accounting is to eliminate waste, errors and clarify information.
2. Lean accounting seeks to bring about a radical change in accounting and control, and to conduct measurement processes to stimulate change and provide the required value to the customer.

Cesaroni and Sentuti (2014) pointed out that lean accounting aims to create customer value by identifying value flows to meet customer needs. Lean accounting focuses on reducing the waste of time and resources associated with production processes. This system expresses a way to organize, manage and develop production, processes and suppliers so that production processes are done at the lowest costs (Stone, 2017). Soleimani et al. (2019) emphasized that the types of waste or wastage include wastage in surplus production, waste in waiting time, and waste in transportation, waste in operations, wasted movement and wastage of defective products. Mashkour and Sameer (2020) added that getting rid of all types of losses and the related costs of activities that do not add value leads to reducing the cost and the time required to fulfill the client's desires and requests. Thus, this will contribute to achieving the success of the economic unit by providing a distinctive product at the right price and time (Maskell et al., 2011).

The principles on which lean accounting is based are necessarily derived from lean thinking, which includes determining the value of each product and eliminating unnecessary steps in the stages of the flow. In general, the principles on which lean accounting depend include the following (Cesaroni and Sentuti, 2014; Soleimani et al., 2019; Muhammad and Isah, 2020):

1. Lean and simple accounting work: It means applying lean accounting methods to accounting operations due to the types of waste and loss they contain. Waste are divided into two types; the first is the waste that cannot be eliminated in the short term, and the second is the waste that can be eliminated by using lean accounting methods appropriate for various operations.

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2. Accounting processes that support the transition to agility: It refers to a group of reports that support the transition to agility and support control of operations through visual metrics that help improve the level of financial performance.
3. Communicate information in a clear and timely manner.
4. Planning and budgeting from a lean perspective, depending on sales policy and financial and operational planning.
5. Strengthening internal accounting controls: where internal control is considered one of the most important processes that have attracted the attention of researchers and that cannot be ignored, as lean accounting sought to support and enhance them, and thus improve project performance.

Throughput Accounting

The throughput accounting concept appeared in the beginning of the seventies of the twentieth century in the writings of 'Goldratt' who worked on developing a computer program related to production scheduling (Parkhi et al., 2015). In order to face the administrative changes and the management needs of the information necessary to implement the concepts of continuous development adopted by the theory of constraints, throughput accounting has emerged as a method by which appropriate information can be provided to management in a way that helps it to set priorities and answer questions related to the achievement duration during a specific period (Islam, 2015).

Many definitions were given to throughput accounting, as it was defined as an accounting approach to assessing the company's ability to maximize the effectiveness of the completion rate of its activities through the use of financial measures in the best exploitation of potential opportunities (Mohammadi and Hamed, 2011). This will lead to reach the target units within a certain unit of time. It has also been defined as an administrative accounting system that targets the ways in which to achieve the maximum return for a restricted activity unit. Draziclutilsky et al. (2016) emphasized that the extent of throughput accounting depends on evaluating the company's ability to achieve effectiveness in the performance of its activities in order to reach the units of the final goal in generating revenues. Islam (2015) argued that throughput accounting is not considered a system for measuring and allocating cost, but rather it represents a measure of the added value from internal flows of the company in the form of revenue or sales. This confirms the importance of this approach in the continuous improvement to maximize the completion rate in exchange for reducing costs (Islam, 2015).

Throughput accounting is characterized by a set of advantages, as it contributes to improving the competitive position by enhancing the company's market share in the competitive market (Mohammadi & Hamed, 2011). It also reduces inventory and associated costs and streamlining production flow. Throughput accounting helps in evaluating the operating performance of companies by focusing on weaknesses in the systems and reducing the time required for completion, in addition to increasing sales volume, reducing inventory levels to the lowest possible extent and reducing operating costs (Parkhi et al., 2015; Draziclutilsky et al., 2016).

Cost Reduction Concept

Cost reduction means moving from the current level of costs to a lower level. This is done by taking measures that lead to changing working conditions so that the facility can produce the same product but at a lower cost (Okutmus, 2015). Kocamiş (2015) emphasized that the goal of reducing the cost of production is the optimal use of resources in a way that reduces the areas of misuse. Also, reducing costs contributes to increasing the competitiveness of companies and organizations, and helps the organization to achieve consumer satisfaction with regard to the quality of services provided and within the appropriate price. Draziclutilsky et al. (2016) stressed that

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reducing cost does not mean reducing the level of quality; rather, cost reduction converges with maintaining product quality and within specified standards.

With regard to the impact of lean accounting on cost reduction; several studies have confirmed that the application of lean accounting contributes to reducing costs by eliminating waste. Lean accounting reduces the need for reporting and analysis metrics, and reduces waste in resources and activities that do not have any added value to production processes. Andersch (2014) argued that since the primary goal of lean accounting is the elimination of waste, this means that it is the best way to reduce costs. Awadallah and Al-Siddiq (2018) study confirmed that the application of a lean accounting system contributes to the accurate allocation of costs and their paths, which leads to lowering the unit cost. Kocamiş (2015) concluded that lean accounting helps eliminate waste and thus reduces costs.

With regard to the impact of throughput accounting on cost reduction, this aspect has not been examined in depth in previous literature. Abdeen (2015) concluded that throughput accounting contributes to reducing costs and providing appropriate information for planning, control and performance evaluation purposes. Draziclutilsky et al. (2016) emphasized that throuhput accounting is considered an appropriate tool in making decisions and controlling the cost of production and manufacturing. However, although each type of accounting system has been studied for its effect on cost reduction, the study of the integration between these two systems and its impact on cost reduction has not yet been studied, and this is what the current research seeks to investigate.

RESEARCH METHODOLOGY

Research Design and Tool

In this study, the research problem focuses on revealing the effect of integration between throughput accounting and lean accounting on cost reduction. The quantitative approach is considered as the most appropriate utilised approach to cover the research problem in a clearer way. This approach essentially integrates data, analyses and uses them to investigate relative hypotheses of subjects (Apuke, 2017). Apuke (2017) outlined the benefits of quantitative research design as its importance, as the data collected could not be obtained using other techniques. It also has an objective representation of the target population and a structured assessment, as all participants share the same data.

The primary data was collected from across sectional survey. This survey (questionnaire) was designed based on previous relevant studies and literature. The questionnaire consists of four different parts with a set of closed statements directed towards collecting data on the different study variables. The first part of the questionnaire consists of questions covering the sociodemographic information of the selected sample participating in this study. The second section includes a group of (7) statements asking about the first independent variable in the study which is throughput accounting, while the third section inquiries about the second independent variable represented by lean accounting, which consists of (8) close-ended statements and the last fourth section consisted from another (7) statements asking about the dependent variable of this study which is the reduction of costs. The fifth Likert Scale was utilized to gather the responses of the study sample.

However, it is necessary to verify the reliability and validity of the study tool. The validity of the questionnaire was achieved as long as its statements were taken from questionnaires published in peer-reviewed and reliable previous studies and papers. However, for the reliability of the questionnaire, it was verified by conducting a pilot study on a sample of (30) managers and accountant working in a selected sample of Saudi industrial companies. The reliability of the tool and its components was determined by SPSS' Alpha Cronbach test before distributing the tool to

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the original study sample members and conducting the real study. Table 1 below shows the Cronbach alpha values for the overall questionnaire and its different parts.

Table 1
THE RESULTS OF CRONBACH' ALPHA RELIABILITY TEST

No.	Variable	Number of Items	Cronbach's alpha value
1	The application and implementation of throughput accounting tools	7	0.908
2	The application and implementation of lean accounting tools	8	0.887
3	The extent of the reduction in production costs	7	0.888
Overall Tool's Items		22	0.905

As shown in Table 1, Cronbach's alpha was determined to be (0.908) for elements of the first scale, (0.887) for elements of the second scale and (0.888) for elements of the third scale. Moreover, it was (0.905) for the overall instrument elements, which means that the reliability of the tool is acceptable, and that the results that will be obtained from this questionnaire are valid and will be the same if the questionnaire is redistributed to another random sample, as long as Cronbach's Alpha value is higher than (0.7) (Graham, 2006).

Research Sample

The study population in the current study consisted from all managers and accountants working in industrial companies in Saudi Arabia. Due to the impossibility of covering the entire study population, a random representative sample of the study population consisting of (100) accountants and managers working in five Saudi industrial companies was selected, and the questionnaire was sent to them electronically via e-mail.

The following Table 2 shows the socio-demographic description of the members of the study sample according to (age, job position, qualification, and years of experience):

Table 2
THE SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY SAMPLE

Variable	Categories	Frequency	Percentages
Age	Below 30 years	44	44.0%
	30- 40 years	33	33.0%
	41- 50 years	20	20.0%
	More than 50 years	3	3.0%
Job position	Manager	45	45.0%
	Accountant	55	55.0%
Qualifications	Bachelor’s degree	74	74.0%
	Master’s degree	20	20.0%
	PhD	6	6.0%
Years of Experience	Less than 3 years	10	10.0%
	3 years - 5 years	12	12.0%
	5 years - 10 years	57	57.0%
	More than 10 years	17	17.0%
Overall		100	100%

The descriptive statistics of the socio-demographic data of the study sample shows that the sample consists of two categories of employees of industrial companies in Saudi Arabia, which are accountants by percentage of (55%) and managers by percentage of (45%). However, the most

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participated age category in this survey was below 30 years old with a percentage of (44%), followed by (33%) individuals of 30-40 years old, (20%) individuals of 41-50 years old and lastly (3%) individuals whose age are older than 50 years as shown in Table 2 above. Most of the study sample members were well educated having Bachelor's degree at least (74%), Master's degree with a ratio of (20%) or PhD with a ratio of (4%). According to years of experience, Table 2 also shows that accountants and managers with less than 3 years of experience are few, representing only (10%) of the sample followed by employees with 3-5 years of experience with a percentage of (12%). On the other hand, the vast majority of the study sample possesses 5-10 years of experience with a percentage of (57%) and more than 10 years of experience with a percentage of (17%), which indicates that the study sample is composed from highly qualified people who have knowledge in the field of the study, and this shows their ability to answer the research questions with credibility and high efficiency.

The researcher utilized SPSS (23) software program to analyze the primary collected data from the questionnaires, and then presenting the results and conclusions raised from this study.

ANALYSIS AND RESULTS

In this part, the data of the questionnaires that were collected from a sample of managers and accountants working in industrial Saudi companies were analyzed, using means and standard deviations to obtain the level and ranks of the items related to the study, as well as the Pearson correlation and multiple linear regression test to predict the relationship between the integrated throughput accounting and lean accounting and cost reduction in industrial companies.

Results Related to the Implementation of Throughput Accounting Tools in Saudi Industrial Companies

In order to identify the extent and importance of applying throughput accounting tools in Saudi industrial companies from the point of view of managers and accountants, the descriptive statistics (means and standard deviation) of the responses and their ranks, which were elicited using a five-point Likert scale were calculated via SPSS, where means ranging from (1-1.80) were considered very low, from (1.81 to 2.60) were considered low, from (2.61-3.40) were considered moderate, from (3.41-4.20) were considered high and from (4.21-5.00) were considered very high. Table 3 below shows the descriptive summary of the responses to the questionnaire's items used to measure the implementation of throughput accounting tools.

Table 3
SUMMARY OF PARTICIPANTS' RESPONSES TO ITEMS MEASURING THE EXTENT AND IMPORTANCE OF APPLYING THROUGHPUT ACCOUNTING TOOLS IN SAUDI INDUSTRIAL COMPANIES (N=100)

Statement	Mean	Std. Deviation	Rank	Level
1. Resources are optimally used and managed within the organization throughput accounting, which guarantees cost reduction and production enhancement.	4.1900	0.90671	5	High
There is control over the use of resources in the organization by tracking the used resources and idle energies.	4.2100	0.79512	4	Very High
The organization determines the amount of resources and the size of the expected costs to implement certain activities or operations at the product design stage.	4.2300	0.81470	3	Very High
Productive activities are categorized into both value and non-value-adding activities, which helps in eliminating unnecessary	4.3100	0.78746	1	Very High

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activities and reduce losses.				
5. Throughput accounting provides the information related to when the restricted activities are completed.	4.1400	0.88785	6	High
Throughput accounting provides cost information relevant to the modern manufacturing environment.	4.1100	1.01399	7	High
. Enterprise management is concerned with using throughput accounting to find solutions to bottlenecks and constraints that affect the efficiency and effectiveness of performance	4.2600	0.73333	2	Very High
Overall	4.2071	0.82388	Very High	

It is clear from Table 3 above that the arithmetic means that measure the extent and importance of applying throughput accounting tools in Saudi industrial companies were high and very high ranged from (4.110- 4.3100). It can be noticed that item (4) which stated: "Productive activities are categorized into both value and non-value-adding activities, which helps in eliminating unnecessary activities and reduce losses", represents the highest agreed mean statement (4.3100, St. = 0.78746) and was followed secondly by item (7) in which it stated: "Enterprise management is concerned with using throughput accounting to find solutions to bottlenecks and constraints that affect the efficiency and effectiveness of performance" with a mean (4.2600, St.= 0.73333), followed thirdly by item (3) which it stated that: "The organization determines the amount of resources and the size of the expected costs to implement certain activities or operations at the product design stage" with a mean (4.2300, St.= 0.81470), followed fourthly by item (2) which stated: "There is control over the use of resources in the organization by tracking the used resources and idle energies" with a mean (4.2100, St.= 0.79512), followed by item (1) fifthly which stated: "Resources are optimally used and managed within the organization throughput accounting, which guarantees cost reduction and production enhancement" with a mean (4.1900, St.= 0.90671), followed by item (5) sixthly which stated: "Throughput accounting provides the information related to when the restricted activities are completed" with a mean (4.1400, St.= 0.88785) and followed by item (6) seventhly which stated: " Throughput accounting provides cost information relevant to the modern manufacturing environment" with a mean (4.1100, St.= 1.01399).

Furthermore, the overall mean for this axis was (4.2071) which shows that most of the study sample are highly agreed with the items of this part of study showing the importance of using throughput accounting in Saudi industrial companies instead of traditional accounting tools, because of their significant impact on controlling the use of resources in the organization by tracking the resources used and idle energies, and providing information related to the time of completion of the restricted productive activities, as well as providing important information related to the modern and complex manufacturing environment and finding solutions to bottlenecks and constraints that affect efficiency and effectiveness of companies' performance.

These results are consistent with Islam (2015) and Draziclutilsky et al.'s (2016) studies which showed that throughput accounting is among the most important modern accounting systems that helped in providing accurate information to management in factories and production lines in a way that enabled it to set priorities and answer questions related to the duration of completion during a specific period and evaluate its ability to maximize the effectiveness of the rate of completion of its activities through the use of financial measures in the best way and exploited its potential opportunities, which leads to reaching the target production quantities within a specific unit of time, thus achieving the maximum financial return and reducing costs. This was also affirmed by Parkhi et al. (2015) who stated that throughput accounting represents a measure of the added value from the company's internal flows in the form of revenues or sales, and this confirms the importance of this approach in continuous improvement to maximize the completion rate versus reducing costs.

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Results Related to the Implementation of Lean Accounting Tools in Saudi Industrial Companies

In order to identify the extent and importance of applying lean accounting tools in Saudi industrial companies from the perspective of managers and accountants, a set of questions were asked about the most prominent tools and solutions related to the use lean accounting in companies. Likewise, Likert scale of five points was used in arranging the respondents' answers, and the results of the descriptive analysis were as shown in Table 4:

Table 4
SUMMARY OF PARTICIPANTS' RESPONSES TO ITEMS MEASURING THE EXTENT AND IMPORTANCE OF APPLYING LEAN ACCOUNTING TOOLS IN SAUDI INDUSTRIAL COMPANIES (N=100)

Statement	Mean	Std. Deviation	Rank	Level
Materials are received from small number of suppliers on time and with pre-requisite quality.	4.0100	1.04924	7	High
The needs of materials and supplies are purchased according to the request of the next production stage.	4.2200	0.84781	2	Very High
The corporation is keen to reduce the storage spaces between the various production stages.	3.9300	0.94554	8	High
The corporation works to enhance the procedures by ensuring that the work environment is clean and always organized.	4.1600	0.80050	5	High
5. The firm is keen to strengthen procedures related to early detection of malfunctions and the training of workers.	4.1900	0.96080	4	High
6. The internal arrangement of the factory is designed on the basis of integrated cells (a small working group), each of which is devoted to a specific product or a specific production stage.	4.1900	0.78746	3	High
The management of the organization allows the employees to visualize (a board) that expresses the process flow maps that include all stages from receiving materials to the end of product delivery, and which shows work procedures and activities.	4.0130	1.14924	6	High
. There is a continuous review of activities and processes so that the highest possible levels of performance are communicated and the best performance is circulated among the two employees.	4.2900	0.85629	1	Very High
Overall	4.1250	0.87797	High	

It is clear from Table 4 above that the arithmetic means that measure the extent and importance of applying lean accounting tools in Saudi industrial companies were high and very high ranged from (3.9300-4.2900). It can be noticed that item (8) which stated: "There is a continuous review of activities and processes so that the highest possible levels of performance are communicated and the best performance is circulated among the two employees", represents the highest agreed mean statement (4.2900, St. = 0.85629) and was followed secondly by item (2) in which it stated: "The needs of materials and supplies are purchased according to the request of the next production stage" with a mean (4.2200, St.= 0.84781), followed thirdly by item (6) which it stated that: "The internal arrangement of the factory is designed on the basis of integrated cells (a small working group), each of which is devoted to a specific product or a specific production stage" with a mean (4.1900, St.= 0.78746), followed fourthly by item (5) which stated: "The firm is keen to strengthen procedures related to early detection of malfunctions and the training of workers" with

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a mean (4.1900, St.= 0.96080), followed by item (4) fifthly which stated: "The corporation works to enhance the procedures by ensuring that the work environment is clean and always organized" with a mean (4.1600, St.= 0.80050) and followed by item (7) sixthly which stated: "The management of the organization allows the employees to visualize (a board) that expresses the process flow maps that include all stages from receiving materials to the end of product delivery, and which shows work procedures and activities" with a mean (4.0130, St.= 1.14924).

Furthermore, the overall mean for this axis was (4.1250) which indicates that most managers and accountants of Saudi industrial companies strongly agree on the importance of lean accounting tools, in terms of their ability to deal with a specified number of suppliers and receive materials with high quality and low cost and its ability to accurately determine the needs of materials and supplies according to the different stages of production, as well as reducing the time wasted between these processes, and cancelling operations that do not add value to production and represent a waste of time, as well as their importance in strengthening procedures related to early detection of malfunctions, training workers, and carrying out a continuous review of activities and operations in a manner that ensures high performance and reduces production costs.

These results are consistent with Muhammad and Isah (2020) and Mashkour and Sameer's (2020) studies who showed that the application of lean accounting has become a necessity in industrial companies because it is a system used to improve management's ability to make decisions, determine waste levels, overcome all processes and stages that does not add value to work, reach loss-free production and improve service quality in response to market requirements and customer needs.

Results related to the Reduction of Cost in Saudi Industrial companies

In order to identify the extent of the reduction in costs in Saudi industrial companies from the perspective of managers and accountants, a set of questions were asked and in the same manner Likert scale of five points was used in arranging the respondents' answers. The results of the descriptive analysis were as shown in Table 5:

Table 5
SUMMARY OF PARTICIPANTS' RESPONSES TO ITEMS MEASURING THE EXTENT OF REDUCTION IN COSTS IN SAUDI INDUSTRIAL COMPANIES (N=100)

Statement	Mean	Std. Deviation	Rank	Level
1. The company's accounting strategies take care to exclude waste and loss in production processes to reach minimum costs.	3.9600	0.90921	7	High
2. The enterprise aims to improve resource use, increase profitability, and achieve financial goals.	4.2900	0.85629	1	Very High
. The enterprise seeks to reduce production costs in order to enhance its competitiveness in the market.	4.0900	0.96499	4	High
4. The company carries out periodic maintenance of the machines in order to reduce the cost of production disruption	4.0800	1.04137	5	High
. The company balances between the quantities that must be kept from inventory and the quantities that must be invested in to secure customer needs	4.2200	0.77303	2	Very High
. The company adopts training and continuous improvement policies for its employees to reduce castration rates and reduce losses	4.0500	1.02863	6	High
The company produces small quantities and various products in light of customer needs in a manner that reduces the total costs of production	4.1800	0.93614	3	High
Overall	4.1243	0.90206	High	

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It is clear from Table 5 above that the arithmetic means that measure the extent of reduction in costs in Saudi industrial companies were high and very high ranged from (3.9600-4.2900). It can be noticed that item (2) which stated: "The enterprise aims to improve resource use, increase profitability, and achieve financial goals", represents the highest agreed mean statement (4.2900, St. = 0.85629) and was followed secondly by item (5) in which it stated: " The company balances between the quantities that must be kept from inventory and the quantities that must be invested in to secure customer needs" with a mean (4.2200, St.= 0.77303), followed thirdly by item (7) which it stated that: "The company produces small quantities and various products in light of customer needs in a manner that reduces the total costs of production" with a mean (4.1800, St.= 0.93614), followed fourthly by item (3) which stated: "The enterprise seeks to reduce production costs in order to enhance its competitiveness in the market" with a mean (4.0900, St.= 0.96499), followed by item (4) fifthly which stated: "The company carries out periodic maintenance of the machines in order to reduce the cost of production disruption" with a mean (4.0800, St.= 1.04137), followed by item (6) sixthly which stated: " The company adopts training and continuous improvement policies for its employees to reduce castration rates and reduce losses" with a mean (4.0500, St.= 1.02863) and followed by item (1) seventhly which stated: "The company's accounting strategies take care to exclude waste and loss in production processes to reach minimum costs" with a mean (3.9600, St.= 0.90921).

Furthermore, the overall mean for this axis was (4.1243) which indicates that the accountants and managers of the industrial companies in Saudi Arabia strongly agree that all industrial companies aim to reduce waste and loss in production processes to reach the minimum costs, improve resource use, increase profitability and achieve financial goals in order to enhance their competitiveness in the market, which requires advanced accounting systems, which those system effects on reducing costs will be investigated in the next part.

These results are consistent with Okutmus (2015) and Kocamiş (2015) who have shown that all industrial firms seek to reduce costs and move from the current level of costs to a lower level, by taking measures that lead to changing working conditions so that the company can produce the same product but at a lower cost. Moreover, the result is in line with Awadallah and Al-Siddiq (2018) who also emphasized that the aim of reducing the cost of production is the optimal use of resources in a way that reduces areas of misuse, which leads to an increase in the competitiveness of companies and institutions, and helps the organization to achieve consumer satisfaction with regard to the quality of services provided and within the appropriate price.

The Effect of Integration between Throughput Accounting and Lean Accounting on Cost Reduction

In order to test the effect of integration between throughput accounting and lean accounting on cost reduction, Pearson correlation and multiple linear regression analyses were implemented utilizing SPSS and the results were as indicated in the following Table (6) and Table (7) below:

Table 6
PEARSON CORRELATION VALUES OF INDEPENDENT VARIABLES (INTEGRATION BETWEEN THROUGHPUT ACCOUNTING AND LEAN ACCOUNTING) WITH THE DEPENDENT VARIABLE (COST REDUCTION)

No.	Independent variables	Pearson correlation (r)	Significance (α)
1	Throughput Accounting	0.889**	0.000
2	Lean Accounting	0.895**	0.000
** Correlation is significant at the 0.01 level (2-tailed)			

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According to the previous Table 6, the first independent variable (lean accounting) has a Pearson correlation value (r= 0.895), p=0.000 < 0.01 and the second independent variable (throughput accounting) has a Pearson correlation value (r= 0.889), p=0.000 < 0.01 with the dependent variable (cost reduction). Hence, it can be concluded that the integration of throughput and lean accounting have significant and high correlation with the dependent variable which is the cost reduction in Saudi industrial companies.

Moreover, multiple linear regression analysis was conducted between the integration of lean and throughput accounting tools as independent variables and cost reduction in Saudi industrial companies as dependent variable. The results were as shown in Table (7):

Table 7
MULTIPLE REGRESSION OF THE IMPACT OF THE INDEPENDENT FOUR FACTORS ON IMPROVING PATIENT FLOW IN SAUDI HOSPITALS

Dependent variable	Model Summary		ANOVA		Coefficients				
	R	R^2	F	sig	independent variables	β	Std. Error	T	Sig (α)
Cost reduction	0.896	0.803	6620.715	0.000	Throughput accounting	0.297	0.055	5.363	0.000
					Lean accounting	0.748	0.052	14.396	0.000

From the above Table (7), the multiple correlation coefficient is (R = 0.896) indicating that there is a strong positive correlation between the integration of lean and throughput accounting and cost reduction in Saudi industrial companies and this correlation is statistically significant, where F reached a value of (6620.715) at the significant level (α=0.000 <0.05). This means that the independent variables (lean and throughput accounting) and the dependent variable (cost reduction) change in the same direction. Moreover, the goodness of fit value of (R^2=0.803) indicates that the integration of lean and throughput accounting can explain (80.3%) of the variation and change in cost reduction in Saudi industrial companies

However, in order to identify which of the accounting tools have the most influential effect on cost reduction, standardized (Beta) coefficients (β) and (α) significance levels in the multiple linear regression were used to test that effect. Table (7) shows that the β coefficients were statistically significant at the significance level (α <0.05). In term of the strongest effect of the accounting tools on cost reduction, the level of effect of these accounting tools depends on the (β) value, the higher (β) value the higher effect on the dependent variable. Accordingly, the lean accounting (β=0.748) has the strongest effect, followed by throughput accounting (β=0.297).

Hence, this proved the impact of the integration of lean and throughput accounting on cost reduction in Saudi industrial companies which is in agreement with Abdeen (2015) and Utiyama and Filho (2013) who emphasized that these two systems (lean and throughput) are complementary and important to reduce costs and improve performance and that no one of these methods has preference over the other, as the task of the company's management is to determine which of these systems is more suitable for the company's work. This ultimately leads to the need for Saudi companies to pay attention to modern management accounting tools including throughput and lean accounting and employ them to support the administration with important information that enables it to achieve its performance and reduce costs effectively.

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CONCLUSIONS AND RECOMMENDATIONS

The economic and technological developments in recent decades have led to the development of the industrial environment locally and internationally, and in light of intense competition, traditional accounting systems have become ineffective in meeting the company's administrative requirements in light of the constant endeavor of management to improve the quality of its products and reduce their costs, which required Saudi manufacturing companies to apply the new accounting systems represented by both lean and throughput accounting to meet the various needs of management. Accordingly, this study aimed to investigate the effect of integration between throughput accounting and lean accounting on cost reduction in industrial companies by obtaining data from a sample of Saudi companies. The study showed the importance of using throughput accounting in Saudi industrial companies, because of its great impact in providing accurate information to management in factories and production lines in a way that enables them to set priorities and answer questions related to the duration of completion during a specific period and exploiting the potential opportunities, which leads to reaching the target production quantities within a specific unit of time, thus achieving the maximum financial return and reducing costs.

The study also revealed the importance of applying lean accounting in Saudi industrial companies because it is a system used to improve the management's ability to make decisions and identify waste. It also helps to get rid of all processes and stages that do not add value to the work, reach loss-free production and improve service quality in response to market requirements and customer needs. Moreover, the study concluded that there is a statistically significant, positive and strong correlation between the integration of lean accounting and throughput accounting and cost reduction in Saudi industrial companies, and that these two systems (lean and throughput) are complementary in their ability to reduce costs and improve performance, as the task of the company's management is to determine which of these systems are more suitable for company work.

Based on the results of the study, the researcher recommends the necessity of using throughput accounting in conjunction with lean accounting in Saudi industrial companies in a way that leads to the optimal use of the establishment's resources and thus reducing costs. Moreover, the study recommends expanding the scope of the research to include a greater number of Saudi and Arab industrial companies in other countries in a way that adds comprehensiveness and generality to the results of this study.

REFERENCES

Abdeen, M. (2015). *Introduction to achievement accounting for the development of cost systems, no in light of recent trends in management accounting (an applied study on palestinian industrial establishments)*. Master Thesis in Accounting and Finance. The Islamic University, College of Commerce.

Alhosban, & Alsharairi. (2019). Effect of lean accounting on the effectiveness of internal control in Jordanian Industrial Companies. *International Journal of Business and Economics Research, 8*(3), 142-149.

Andersch, A. (2014). *Lean implementation and the role of lean accounting in the transportation equipment manufacturing industry* (Doctoral dissertation, Virginia Tech).

Apuke, O.D. (2017). Quantitative research methods: A synopsis approach. *Arabian Journal of Business and Management Review (Kuwait Chapter), 6*(10), 40-47.

Awadallah, L., & Al-Siddiq, B. (2018). The effect of integration between resource consumption accounting and the lean accounting system in reducing costs (a field study on some food industry companies in Sudan). *Journal of Economic and Management Sciences, 19* (1), 103-118.

Cesaroni, F., & Sentuti, A. (2014). *Implementing a lean accounting system in a lean enterprise*. Conference: IAMB International Academy of Management and Business Rome 2014 Conference.

Citation Information: Almashkor, I.A.S. (2021). The effect of integration between throughput accounting and lean accounting on cost reduction (applied study in Saudi industrial sector). Journal of Management Information and Decision Sciences, 24(S1), 1-14

Draziclutilsky, D., Liovic, D., & Markovic, M. (2016). Throughput accounting: Profit-focused cost accounting method. In *International Conference Interdisciplinary Management Research XIV, Opatija–Croatia, 18–20 May 2018.*

Elsukova, T.V. (2015). Lean accounting and throughput accounting: An integrated approach. *Mediterranean Journal of Social Sciences*, *6*(3), 83-83.

Fuadah, L.L., Safitre, R., Yuliani, Y., & Arismana, A. Determinant factors' impact on managerial performance through management accounting systems in Indonesia. *Journal of Asian Finance, Economics and Business, 7*(10), 109–117

Haik, S. (2021). Affine lines and advanced probabilistic model theory. *Mathematical Statistician and Engineering Applications, 70*(2), 1-14.

Gračanin, D., Ćirić, D., Lalić, B., Ćurčić, J., & Tasić, N. (2019). The impact of lean improvements on cost-time profile. *Procedia Manufacturing*, *38*, 316-323.

Graham, J.M. (2006). Congeneric and (essentially) tau-equivalent estimates of score reliability: What they are and how to use them. *Educational and psychological measurement*, *66*(6), 930-944.

Islam, K.A. (2015). Throughput accounting: A case study. *Int J Financ Bank Res, 1*(2), 19-23.

Kocamiş, T.U. (2015). Lean accounting method for reduction in production costs in companies. *International Journal of Business and Social Science*, *6*(9), 6-13.

Mashkour, S. & Sameer, M. (2020). *Lean thinking in cost accounting - a theoretical framework and practical application*. Dar Almanahej, first edition.

Mohammadi, K., & Hamed, M. (2011). Examining throughput accounting function power with respect to theory of constraints to evaluate production companies economic performance.

Mohsen, I. (2016). *The extent of using lean accounting tools in light of the competitive advantage in light of overall quality*. Master Thesis, Al- Azhar University, Gaza, Palestine.

Muhammad, L. & Isah, A. (2020). Impact of Lean Accounting on Financial Performance of Private Hospitals in Kaduna State. *Usmanu Danfodiyo University, Sokoto Journal of Management Studies, 22*(1), 121-136.

Najarian, G. (2004). Opposing Teams? Toward a new model of accounting in the era of lean. *APICS*, April. -pp.24-29.

Najm, A. (2019). *The effect of the use of lean accounting on planning production processes in jordanian industrial companies*. Master Thesis, Al-Bayt University, Mafraq, Jordan.

Nguyen, D.D. (2020). The impact of environmental factors on the international harmonization process of accounting on SMEs: Evidence in Vietnam. *Journal of Asian Finance, Economics and Business, 7*(10), 641–649.

Ogar, K., Samad, M., & Shu, Y.L. (2017). *Value creation with lean accounting optimizing utilization of resources through the value chain applying management accounting techniques in a package around management control system*. Master Program in Accounting and Finance, Accounting and Management Control.

Okutmus, E. (2015). Resource consumption accounting with cost dimension and an application in a glass factory. *International journal of academic research in accounting, finance and management sciences*, *5*(1), 46-57.

Parkhi, S., Tamraparni, M., & Punjabi, L. (2016). Throughput accounting: An overview and framework. *International Journal of Services and Operations Management*, *25*(1), 1-20.

Rojer, L. (2021). On the characterization of paths. *Mathematical Statistician and Engineering Applications, 70*(2), 153-162.

Soleimani, E., Sawaleh, K., & Hamidi, S. (2019). *The use of agile accounting tools in cost management between the theoretical framework and the practical reality - A case study of a sample of institutions* -. Master Thesis, Al-Shahid Hama Lakhdar University in Al-Wadi. Department of Finance and Accounting.

Stone, T. (2017). Lean accounting comes to lean software development. *In Seventh International Engaged Management Scholarship Conference,* 17-030.

Sumiai, S. (2020). Improving small business performance: The role of entrepreneurial intensity and innovation. *Journal of Asian Finance, Economics and Business, 7*(10), 211–218.

Utiyama, M.H.R., & Godinho, F.M. (2013). Literature on the comparison between the theory of constraints and lean manufacturing: review, classification, and analysis. *Revista Gestao & Producao, Sao Carlos*, *20*(3), 615-638.

Citation Information: Almashkor, I.A.S. (2021). The effect of integration between throughput accounting and lean accounting on cost reduction (applied study in Saudi industrial sector). Journal of Management Information and Decision Sciences, 24(S1), 1-14