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Costs Accounting Under Automated Environment – Costs Accounting and Automation Literature Review

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Abstract:
Fixed costs increased due to the large investment required by modern technology, which has led to an increase in annual depreciation expenses, which is calculated on the basis of the replacement cost and not the historical cost because technologies are constantly changing, machines are constantly changing, and prices change. The paper will also explain how indirect costs in traditional companies have changed into direct costs in high-technology companies. In addition, the most important benefits of nanotechnology, fears of environmental risks and health effects of this technology will be discussed, as well as what proactive methods should be used to ward off these potential dangers to ensure the success of this technology and benefit from it. The research concluded that managers today have become interested in total product costs, both industrial and non-industrial. Traditional cost accounting systems (static cost management methods, such as job order and process costing) provide a static assessment of the profitability of the product because they focus on the process of manufacturing the product. Therefore, it is useful for short-term decisions rather than the long-term. The research concluded that because managers need information about the profitability of their products during all stages of the product's life, which traditional methods cannot meet because they work to evaluate the products that have a greater contribution to the company's profits, the role of the dynamic cost management method comes into play (which is represented by the Activity-based system, target cost, Just in time, and product life costs) to evaluate the profitability of the product in order to provide management with information related to the profitability of the product over its life, which makes it a useful basis for making long-term decisions.

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Key words: Cost accounting, Automated environment, Historical cost, Modern technology, and Flexible Manufacturing System (FMS).

1. Introduction

There were big changes at the start of the 2000s that changed the economic landscape of Western economies. The market went around the world. Customers only want a smaller amount of goods that are more specialized now. Customers also want to be treated as unique individuals. Companies must use digitally controlled manufacturing processes and computer-based shop floor control in order to compete with small batch production and give customers what they want.

2. Historical perspective

Companies put in a lot of work in the 1970s and 1980s to keep their manufacturing processes under control. They did this by using formal systems like manufacturing resource planning and enterprise resource planning, as well as scheduling and controlling workers on the shop floor. In the early 1990s, businesses were trying to become global, so they used total quality management to keep an eye on their processes and keep getting better. In addition, they used just-in-time production methods like zero inventories, cellular manufacturing, quick change-over, one-piece part flow, and cellular manufacturing. Around the end of the 1990s, it was time to build on these gains and create lean manufacturing methods like Agile manufacturing and lean manufacturing.

3. Integrated manufacturing systems

It can be broken down into two parts: Part one is called Lean manufacturing systems (LM), and it includes methods like Lean manufacturing and Agile manufacturing. The second part is called World Class Manufacturing (WCM). The LM is different from the WCM because it deals with things we can't change, like a turbulent climate. (WCM) does things we can control very well. When you use an agile manufacturing method, you can do well in a world where things are always changing and are hard to predict. Lean production isn't just about getting used to change; it's also about taking advantage of the chances that come with it.

Very fast and out of the blue, everything changes. The market wants goods that are customized, of high quality, and not made in large quantities. These products only last a short time and take a very short time to build and make.

Mass production had to end. Customers want to be taken care of as unique people. Because of this, the process requires a lot of people, and excellent quality and very good service levels are expected and wanted.

A lot of businesses are having trouble with their inventory and overhead costs because of the fast trend toward making a lot of finished products with short lead times for development and production. People were trying to use old-fashioned mass production methods without understanding that everything had changed. When people buy small amounts of highly customized,

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made-to-order goods and where extra services and features that add value, like product upgrades and future reconfigurations, are just as important as the goods themselves, mass production doesn't apply. Many people find it hard to believe that we need to switch from mass production to other ways, but there are some clear signs that we do. Spread of finished goods; fast growth in the number of new products; short product life cycles; customers asking for products that are especially designed to meet their needs. Mass production ideas that have worked well for Western businesses for decades are being thrown out by all of these trends.

3.1 Computerized Lean manufacturing system

Maskell and Kennedy argue that the role of the computer is evident in Lean manufacturing through the elimination of overhead cost, as concentration in this system is based on the value stream in collecting product costs and that the production process has been divided into cells that include workers and machines that have been grouped. With cells on the basis of specialization, therefore, the value flow costing system adopted by the flexible manufacturing process calculates the value flow on the basis of the conversion cost, and when calculating the cost of one unit, the time that the product took at that station is used until it is completed. The value flow costing method has eliminated working hours. The machine or the working hours of the worker, which is tainted by the element of estimation and inaccuracy, while the modern method is based on the actual time spent, which is calculated by the computer at each station to calculate the cost of one unit or the value flow rate. In addition, the value flow is tracked by the computer system through Display screens for the purpose of detecting stops by specialized observers who fix those stops as quickly as possible in order to eliminate wasted time during stops (Maskell & Kennedy, 2007).

The lean production method takes into account the fact that businesses need to provide customers with small amounts of custom-designed parts that are of the highest quality, are delivered on time every time, and don't cost much. The company has to be truly world-class and use lean manufacturing methods for the technique to work. This is where things begin. Some fields are more aware of these changes than others. Even more clearly can be seen the need for flexibility in the consumer electronics and auto businesses. It's easy to get new things. A huge number of new products are being added all the time. Customers and markets are spreading out and becoming more specific all the time. Innovative and quick-moving businesses will be able to handle these changes.

3.2 Flexible manufacturing system (FMS)

It is very important for the manufacturing system to be able to adapt to changes as quickly as possible in order to stay competitive in the market. This is because customer needs and product specs are always changing. Because diversity makes things less productive, this trend often causes problems in the production system. The flexible manufacturing system (FMS) is a good example of this because it is both flexible and productive. The main goal of this method is to be flexible. (Al Alam, et al. 2011).

Czech
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It is expected that a competitive (FMS) will be able to handle small batches of customer orders. Since building a new production line is very expensive, the current one is rearranged to keep up with the many changes being made to the design of new products.

While the flexible production system (FMS) is a highly linked manufacturing system, not much is known about how its different parts work together because the system is so complicated. Since FMS are so complicated, it is hard to use mathematical methods to properly measure how well they work in designing them. Because of this, computer simulation is a popular numerical modeling method for looking at very complicated flexible manufacturing systems (Cheng, 1985; Jain & Foley, 1986; Kalkunte et al., 1986).

Modeling and simulation (FMS) are an area of study for many people right now. This is because they are all trying to find ways to get faster speeds and more flexibility, which will make production more productive. From a design point of view, networks are useful for modeling, qualitative analysis, performance review, and coming up with code. In this study, Petri net was used to help develop FMS, and Visual Slam AweSim was built in to look at its performance metrics. The theory of constraints method (bottleneck for comparison) was also used, and the simulation results were checked to make sure they were correct.

3.3 Technology and cost structure

Because of changes in technology, the way products are priced has changed a lot. Costs that are seen as secondary in traditional businesses are actually direct in "high-technology" businesses (Seed, 1984). The ratio of fixed costs to variable costs has also gone up (Chalos, 1986).

Seed also says that the minor connections between "direct" and "variable" and "indirect" and "fixed" become clear in a "high-tech" setting. When it comes to the structure of product costs, most authors say that direct labor costs have gone down and are now rarely important (Bolwing, et al. 1986; Dilts, & Russell, 1985) and that logistics costs have become more important (Bruns & Kaplan, 1986 & 1987).

So, we can talk about the general theory that says companies with automated production processes have lower direct labor costs as a share of their total costs. When companies use automation to make things, secondary costs change to direct costs, which makes it easier to keep track of costs.

4. Nanotechnology

Physicist Richard Feynman, winner of the Nobel Prize in 1986, talked about the modern technology called nanotechnology for the first time in 1959 (Eisenberger, 2019; Al-Tamimi, S. A., & Al Anssari, M. A. 2022)

Definition of nano: The precise metric unit known so far (nanometer), and its length is one billionth of a meter, which is equal to ten times the atomic measurement unit known as the Angstrom (Rababah, 2017).

Czech
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Nanotechnology is enabled by very small materials called nanomaterials and is already present inside many of the products we use every day (Geng, 2016).

Akinlabi and others believe that the application of nanotechnology in manufacturing processes can be called the Fourth Industrial Revolution, as it will be preferred in most future applications that will be used, as it is lighter in weight through nanomaterials, stronger materials, cleaning polluted ground using nanoparticles, and using membranes with Nanoengineering to obtain more energy, purify water, and efficiently desalinate water (Akinlabi el al. 2020).

It is a small or micro-scale manufacturing process, sometimes ranging from the width of a human hair. It includes the manufacturing of microfluidic devices, integrated circuits, solar panel cells, flat panel displays, semiconductors, sensors, fuel cells, and more. Sizes are measured in micrometers, also known as microns which is equal to one thousandth of a millimeter. This is similar to nanotechnology, but smaller than the components of nanotechnology (Eckstein, 2002).

4.1 Environmental impacts of nanotechnology

Some people are worried about how nanotechnology might affect the environment and people's health, as well as how it might be used in the military. Some people also think that funding research into how nanotechnology affects the environment and health should go hand in hand with funding research into how this technology can be made better. To make sure this new technology will still work in the future, you need to find and build ways to keep an eye on possible new risks and deal with them in a smart way (Rickerby & Morrison, 2007 and Iavicoli et al., 2014; Alshawi, E. J., Al-Tamimi, S. A., Anssari, M. A. A., & Hanoon, M. F. 2023).

4.2 Nanotechnology and cost accounting

4.2.1 Nanotechnology and the value chain

Nanotechnology is expected to perform an essential function across the entire value chain of the commodity or products, and the impact will be through the valuable properties of nanomaterials. They are extremely small materials that lead to the production of high-quality products at a very low cost.

The use and improvement of nanotechnology will allow the rapid creation of new Nano factories with the same properties.

4.2.2 Nanotechnology and reducing unit cost of production

Nano factories will cut many types of costs by cutting down on direct work and getting rid of the need for shipping, distributing, and storing goods. Nanotechnology-based goods will be very small and won't need any storage or transport room. Derby Zucker says nanotechnology will accelerate the process of making things better and lower the cost of each one. (Darby & Zucker, 2003)

Czech
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4.2.3 Nanotechnology and change in cost structure through high increase in fixed cost

Cooper thinks that when new technologies are used in production, more machines will be used and the rates of variable and set costs will change. Because the cost structure will change, and the share of direct labor costs will go down to cover secondary costs, or overhead costs, that need to be properly distributed across goods and services (Cooper, 1988). Rababa (2012) and Cooper (1988) both say that the use of new technology in. The production process will raise the profit margin, and so will the net profit per unit of product made with a new technology. This is because the more efficient technology will lower total costs. (Rababah, 2012).

4.2.4 Nanotechnology brings back the problem of cost allocation

Following a search of the literature, the author Rababah did not come across any studies that talked about assigning a fixed or indirect cost to each unit of nanotechnology-made goods. He also did not come across any studies that talked about the cost system that should be used in the new nanotechnology manufacturing environment (Rababah, 2017).

Many researchers think that cost allocations are very important because they help with evaluating inventory for making external reports, planning and keeping an eye on the cost of activities and operations, and making many strategic decisions. This means that cost accounting methods for allocating indirect costs will be used again.

- Production decisions
- Decisions to purchase some important materials and services for various products or services in the company.
- Product and service pricing decisions
- Decisions to add or remove various products and services,
- Decisions determining when to expand or contract the size of a portion of the company.

(Andersen, 1995); (Horngren, et al. 2018) (Cooper & Kaplan, 2003); (Drury, 2004) (Anssari, 2023)

Hansen and Maun both agree that it's hard to figure out what a product's secondary costs are. Since companies now use a lot of technology that makes them switch from using people to using machines, they need to use a new method. Because of this, goods and services need to be charged with more secondary costs, also known as overheads (Hansen & Mowen, 2000).

4.2.5 Nanotechnology and social and financial risks

There are risks to workers' and customers' health when they use nanotechnology (Hoyt & Mason, 2007).

Czech
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There is a high cost to putting nanotechnology to use for the first time. This will cause problems for investors who will pay their money and creditors who will lend money because they don't know how much the first cash outlay will be. This is because nanotechnology is still fairly new.

In terms of job opportunities, nanotechnology could be bad for the world. This is because nano factories will use machines and technology more than workers to make and sell things, which will cut down on the number of workers needed in production and sales lines. This means that workers will lose their jobs and be unwilling to adapt to new technology. (Sharify el al. 2010).

6. Numerical control machines (NC)

When computer languages that are managed by letters and symbols are used to automate the manufacturing process, this is called numerical control. Instructions for making a certain work function in numerical control tools come in the form of numbers.

There are two kinds of computerized numerical control (CNC) systems, which are called Reference-Pulse and Sampled-Data. This paper looks at them both.

When computers were used instead of controllers in numerical control systems in the early 1970s, it was a big step forward in the idea of numerical control (NC) for machine tools. This system uses both computer numerical control (CNC) and direct numerical control (DNC) to make a complete numerical control system for a single machine tool. It has a microcomputer that is programmed to do basic numerical control tasks and is managed by saved instructions. When you use DNC, many of the machines are run straight by a main computer. (Koren, 1977)

CNC, the more flexible type, is used more often in production systems like machine tools, welding, and laser beam cuts than the other type. This is because it requires less initial investment. Due to more microcomputers and microprocessors being available and their prices going down, CNC is becoming more popular over DNC.

A study by Suomala and others was called "Exploring the Programmability of Management Accounting Business for Increased Automation: An Intervention Case Study." First, the authors explained what they meant by "digitalization" in their article. This is the definition that Briney and Chris suggested: "the adoption or increased use of digital technology or computers from by industry organization, country, etc." In this case, digitalization was used to help make decisions in management accounting (Suomala, et al. 2020). People have been arguing for a long time about how digitalization will affect the accounting field. This is because digitalization in accounting means that integrated information systems, robotic process automation, and advanced analytics are being used in very useful ways. (Moll, J., Yigitbasioglu, 2019; Anssari, M. A. A., & Al-Tamimi, S. A. 2023).

In the book, the question of whether we can trust digital systems to help us make good decisions and do the work of experts in tough, non-routine decision-making situations is used. For example, when the job is clear and can be programmed, the question does not apply.

Czech
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To digitalize management accounting, people need to find a good way to divide up the work between human and machine accountants (Moller, et al. 2020; Al Anssari, 2023) and incorporate digitalization into current accounting processes. This is because one needs to learn from the experiences of those involved and improve the way work is done in organizations. But professionals need to carefully look at the tasks they want to automate and know if it is possible to use and maintain the planned automated system throughout its lifetime. In other words, they need to know if the possibilities of automating these tasks are real or not.

7. Computer Aided Design (CAD)

A computer is used in computer-aided design (CAD), which is also written as computer-aided design (CAD). Gives the user input tools to make the processes of planning, drawing, paperwork, and manufacturing easier. It usually gives off computer files that can be used for printing or cutting. Making CAD software has a clear link to running a software-based business (like manufacturing, construction, building, etc.).

A lot of the time, CAD systems have more than just shapes. Like when you write a guidebook for technical and engineering sketches, one of its results could be the sharing of information like materials, methods, measurements, and limits, as long as you follow the rules of a special agreements.

CAD is a very important art in industrial technology that is used in a lot of different fields, such as the aircraft and automobile industries, industrial design and architecture, robotics, and many more. Because computers are so common and powerful these days, engineers are using techniques that have never been seen before to make perfume bottles and even shampoo machines. In business, these tools can be used to create a wide range of goods. They are also used in medicine to make high-tech medical gadgets. In engineering, they are used for basic things like creating buildings, homes, big rooms, dams, and airports. They can also be used in a lot of other areas.

8. Computer-aided manufacturing (CAM)

It is the use of computer programs to control machines and related machines in the field of manufacturing operating parts, and in all manufacturing processes, production processes, management and storage. To aim for speed of production.

The last decades of the twentieth century witnessed tremendous development in the fields of information technology. Various traditional sciences, such as mechanics, electronics, communications, automation, and control, benefited from this progress and kept pace with this development to achieve qualitative leaps at various levels and stages, starting with design, passing through accurate calculation of the product components, simulation, and ending with production. Traditional engineering fields, such as mechanics, electronics, and automation, are no longer

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sufficient separately for the purpose of designing and implementing an integrated product. Integration between these specializations together has become the key to success in creating economic products of high quality and reliability that meet the needs of the investor.

Partially or fully automated machines are provided with commands related to operating parts in digital form through a program that includes these commands. These machines vary between programmed lathes, programmed sorters, and machining centers (programmed sorters equipped with a storehouse for cutting tools p). The general structure of programmed machines consists of the machine body, motors, transmission mechanisms, sensors, and the machine control unit (computer).

After designing the part and studying its functional and geometric dimensions, the production engineer studies its manufacturing plan and chooses the programmed machine needed to implement it. He also chooses the sequence of manufacturing processes, operating stages, and how to install the part on the programmed machine to accurately obtain the dimensions and functional tolerances. This study later leads to simulating and representing the operating process. On the computer that generates the numerical program for operation in accordance with the machine in question. The program is a sequence of commands written in a programming language specific to programmed machines. These commands are divided according to their nature into several groups, the most important of which are preparatory commands, commands for determining the coordinates of moving from one site to another, choosing the operating equipment, operating parameters, speed of transition, rotation, cooling, and lubrication, in addition to other technical matters.

Before moving to the operating machines and executing the part, the technician executes the program on the operating machine's computer to ensure the correctness and accuracy of the sent commands. From the raw part, the computer shows the operating steps in a sequential manner and also shows the shape of the resulting part, which allows detecting any defects or errors in the operating program and avoiding them before Initiate implementation. Figure 2 shows a computer simulation of a rotary part milling process.

These commands are translated at the machine level under the leadership of motors that provide rotational or retractive movements, and the implementation of movement start and stop commands is monitored based on sensors (position encoders that translate mechanical movement into electrical signals). These sensors provide sufficient information to measure angular and retractive movements and also enable the computer A machine programmed to calculate the corresponding speeds and accelerations, control them accurately, and correct them when necessary.

9. Conclusion

The three decades of the previous century witnessed unprecedented technological developments, with some describing it as a qualitative breakthrough, as it was characterized by its speed and accuracy in completing work. These technological developments were accompanied by important changes in the manufacturing environments in global factories, as is the case in manufacturing

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industries such as cars and electronics, as computers, computer-embedded systems, and robots enabled manufacturers to produce what they could not do previously. Accordingly, companies began to increase their investments in automated manufacturing equipment in order to increase their competitive advantage by improving the quality of their products and increasing their ability to meet the various requests of their customers with small quantities. The literature has highlighted the benefits of modern technologies involved in production processes, as they have been described as techniques for completing quick and accurate work, represented by the software used in the computer or that is installed and controlled, which can be described as integrated techniques that are based on software and hardware and include a high-tech technical implementation process with. It provides continuous visual monitoring throughout the workstations and real-time troubleshooting to avoid production interruption, ensure the production process runs smoothly, and provide diverse, high-quality products. The accuracy of these techniques has had a direct impact on cost accounting. The accuracy of calculating the raw materials required for production led to a reduction in the materials component. In addition, the presence of automation and the aforementioned techniques led to a decrease in the proportion of the second cost element, labor wages, and at the same time fixed costs increased due to the increment in investments, which is Required by modern machines and equipment, as a result the annual depreciation expenses have increased, which are calculated on the basis of the replacement cost and not the historical cost, because technologies are constantly changing, machines are constantly being replaced, and prices are changing, and the result of this is a change in the product cost structure. Based on the above, the objectives of cost accounting have changed, and adopting a new philosophy, especially in the manufacturing environment, as well as considering the quality of products, and systems were followed that keep pace with these important developments, and many new systems were applied that aim to get rid of the overhead cost and general expenses alike.

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