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## The Role of Green Quality Management and Product Life Cycle Costing in Achieving Competitive Advantage

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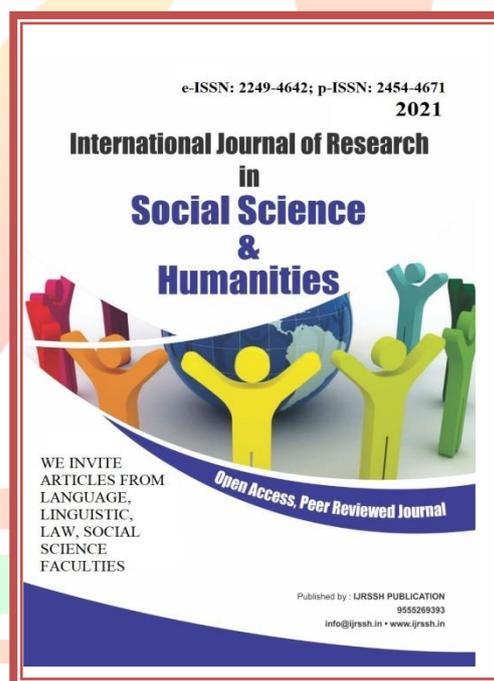
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**ABSTRACT**

The principal objective of this study is to demonstrate how green quality management and product life cycle costing may help an organization gain a competitive advantage. Green quality management's influence on increasing product quality and meeting environmental criteria, as well as tracking the activities of product life cycle before, during, and after production, is demonstrated. Orienting these activities toward the production of eco-friendly products that fulfill the needs of customers, hence increasing organization's market share. We found from our study that proposed framework can help organizations improve their competitiveness. Green quality management contributes to environmental protection and the provision of high-quality products that fulfill needs and desires of green customer, enhancing product differentiation. Product life cycle costing is to determine costs of environmental activities and seek to minimize those costs, which translates to lower product costs, allowing organization to adopt a cost leadership strategy and gain a competitive advantage.

**Keywords:** *Green Quality Management, Product Life Cycle Costing, Competitive Advantage.*

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## INTRODUCTION

There has been an increased interest in the techniques and methods of strategic cost management for the purpose of properly measuring, analyzing and determining the cost of the product for adoption in planning, control and decision-making processes. Therefore, many researchers focused in their studies and research on many modern cost techniques, including product life cycle costing at all stages before, during and after production processes.

Therefore, the idea of research crystallized in showing the impact of each of the product life cycle costing and green quality management in enhancing and improving competitive advantage. Green quality through a series of its main activities, starting from green research and development and ending with the activity of recycling and green supply chain, by analyzing activities to exclude activities that are not environmentally friendly and have a negative impact on the environment, which incur additional costs to the customer, which increases the costs of the product as well as its damage to the environment and thus the customer's reluctance to The deterioration of the competitive advantage of the product and the decrease in sales, profits and market share of the organizations, and the replacement of those activities with green

activities leads to improving product quality, improving competitive advantage, reducing costs, increasing product efficiency and leading to optimum utilization of available resources and increasing the market share of the organization.

## FIRST SECTION: RESEARCH METHODOLOGY AND LITERATURE REVIEW

### Research Methodology

#### First: Research Problem

Most countries suffer from environmental pollution due to the failure of most organizations to observe the standards and requirements of preserving the environment from any pollution of production processes from waste that is thrown to the environment, in addition to the damages caused by the use of traditional products to the environment and the customer. In order for organizations to maintain their market share, they must produce environmentally friendly green products. Therefore, organizations must follow up the production processes and the main activities to green them, exclude all non-value-added activities, enhance green activities, and demonstrate the impact of cost management according to the two techniques of product life cycle costing and green quality management in

measurement, analysis, and control. On costs, optimal use of resources and energy, and not harming the environment with production waste, because whoever polluter pays, and organizations bear costs and taxes to increase production efficiency, improve product quality, increase sales and achieve profits. Where costs will be measured and controlled through the activities and stages of the product life cycle and its quality management to achieve green products that are eco-friendly. In order to raise the level of quality and performance of operations and operational activities through the stages and activities of the product life cycle, the research problem is embodied in the main question, which is, how do each of the product life cycle costing and green quality management affect the achievement of competitive advantage?

### **Second: Research Hypothesis**

The research is based on the main hypothesis that:

"Product life cycle costing and green quality management contributes in achieving the competitive advantage of organizations".

### **Third: Research objectives**

The research seeks to achieve the following objectives:

- 1- Defining the knowledge bases for product life cycle costing and green quality management.
- 2- Clarifying the measurement of the costs of the product life cycle activities by considering the identification of green activities that add value and trying to get rid of non-green activities that do not add value in a way that leads to the optimum utilization of available resources and improvement of production efficiency, which is reflected in the achievement of competitive advantage.

### **Fourth: Research Importance**

The importance of the research is summarized as follows:

- 1- The use of product life cycle costing and green quality management techniques, which are considered one of the strategic cost management techniques, contribute to helping organizations reduce environmental costs, reduce environmental pollution rates, innovate eco-friendly products, and Optimal utilization of natural resources, raw materials, and energy.
- 2- Using the techniques of product life cycle costs and green quality management leads to the

preservation of quality through the production of products that considering the standards and requirements of environmental quality, as well as the organization not incurring taxes for harming the environment, and achieving the requirements and desires of customers because the product is eco-friendly and these products add value to the customer and protect it from environmental and health risks.

**Literature review: Some studies related to the research topic will be presented as follows:**

**1- A study of (Tsai et. al, 2015) entitled: Integrating the Activity-Based Costing System and Life-Cycle Assessment into Green Decision-Making**

The main objective of this study is to develop a decision-making model associated with activity-based costing (ABC) within the life cycle assessment (LCA) aspects of the electrical and electronic industry. In order to maximize the organization's profits and reduce the environmental impact within limited constraints and resources. The study found that the electrical and electronic industries face more risks when the environmental impacts of commercial activities are considering. So, the electronics industry

faces problems in making green manufacturing decisions that must be overcome.

**2- A study of (Dwaikat & Ali, 2018) entitled: Green Buildings Life Cycle Cost Analysis and Life Cycle Budget Development: Practical Applications**

The aim of this study is to improve the understanding of life cycle costing adoption in the construction industry by providing a detailed description of the procedures used in developing life cycle budgeting for a green building throughout its whole life cycle. The study also provides details of the various life-cycle cost components, in particular the life-cycle budgeting. The study found that the energy cost is 48% of the total life cycle cost of the building, which is more than double of design and construction costs. Therefore, it was found that reducing energy consumption is the most influential factor in reducing the total life cycle cost of a green building.

**3- A study of (Banglong, 2016) entitled: Research on The Calculation Method and System of Product Life Cycle Green Cost**

This study aims to focus on the green product life cycle costing and provide a method for calculating the green cost according to the activity-based costing method in order to help organizations

understand the state of resource consumption, environmental pollution, and the cost related to the product during its life cycle. The study concluded that organizations need to reduce the costs of their products, reduce pollution resulting from the manufacturing process, and improve environmental protection to achieve a competitive advantage. In order to achieve this, it is possible to rely on green product life cycle costing in calculating the costs of its products.

**4- A study of (Ning, 2015) entitled: The Application of Green Quality Management System in Ship Industry Research**

The study aims to analyze the relationship between environmental theory and green quality management. As well as seeking to adopt green quality management in order to enhance competitive advantage, protect the ecosystem and achieve long-term development in the shipbuilding industry. The study concluded that green quality management compensates for the shortcomings in total quality management through environmental protection, effective use of resources, and meeting the requirements of sustainable development. The Green Quality Management System combines the goals of zero defects and a pollution-free environment throughout the product life cycle.

**5- A study of (Tao, 2015) entitled: Research on Construction and Evaluation of Green Quality Management System in Enterprise**

The study aims to use the green quality function deployment over the product life cycle and to use the hierarchical analysis process (AHP) to create a green quality management system. The study also aims to adopt a green quality management system to verify the efficiency and effectiveness of this system. The study concluded that traditional quality management pays great attention to the manufacturing process without paying attention to environmental protection as well as ignoring the waste of energy and resources. As for green quality management, it considering the optimum utilization of resources as well as maximizing green benefits and meeting the green demand of customers.

**SECOND SECTION: KNOWLEDGE BASES OF GREEN QUALITY MANAGEMENT**

**First: the concept of green quality management**

Since its emergence in the twentieth century, quality management has gone through three stages: quality inspection, statistical process control, and total quality management. Despite this, traditional total

quality management did not integrate the green concept into the quality management process, and the environmental factors of the operations were neglected, Green quality management is concerned with the efficient use of energy resources and their environmental compatibility, while also considering the economic benefits of the economic unit (Xiangshu & Ming, 2018: 91).

Definitions and perspectives were numerous. Green quality management can be defined as the integration of development concepts of social, economic, health, and environmental friendliness with the concepts of total quality management process (Gaoqian, 2012: 46). According to (Sui et al., 2019), green quality management can be defined as a method that seeks to find green products that are harmonious and eco-friendly on the basis of traditional total quality, in order to meet the green demand of customers whereas considering the needs of society, resources, and the environment, as well as customer satisfaction. Social development, environmental protection, sustainable energy, and other dimensions of satisfaction, as well as their compatibility (Sui et al., 2019: 130-131). According to (Mei et al., 2004), green quality management is defined as a technique that takes green demand as its goal and takes comprehensive

consideration of economic, social, and environmental benefits, which leads to the customer obtaining satisfactory product characteristics in terms of environmental protection and energy conservation (Mei et al., 2004: 46).

The researchers argue that green quality management can be defined as a technique that is based on the green concept of energy conservation and environmental protection, the comprehensive view of social and environmental resource needs, the production of green products that satisfy customers, and promotes harmony in energy conservation and environmental protection. This philosophy uses new technologies and processes in the product formation process to reduce environmental pollution caused by hazardous waste, and takes sustainable development as a guiding principle for saving and protecting resources and promoting resource renewal.

### **Second: Green Quality Management Principles**

Green quality management is based on several principles, the most essential of which are: (Jie, 2010: 79-80; Lihui, 2007: 44-45; Ning, 2015: 9-10)

- Meeting the green requirements of customers and satisfying all stakeholders: Business units should pay attention to identifying and satisfying the green needs of customers

and other stakeholders, including current, potential, and future needs, to ensure that all stakeholders benefit, including business unit owners, employees, suppliers, partners, society, and the environment.

- **Lifelong Quality:** Green Quality Management seeks to achieve overall satisfaction for a large system based on the coordinated development of the economic unit, society, resources, and the environment, with a focus on achieving quality throughout the product life cycle stages.
- **Attention to environmental satisfaction:** Satisfying consumers while considering the environment leads to an improvement in the organization's green benefits, and customers receive green satisfaction as a result, so that public benefits, including the environment, are considerably improved.
- **Environmental satisfaction:** Satisfying consumers while considering the environment improves the organization's green benefits, and customers receive green satisfaction at the same time, resulting in a significant improvement in public benefits, including the environment.
- **Achieving superiority:** As we know, the environmental crisis is worsening. The relationship between supply and

demand cannot be viewed only as a profitable situation, but the harmonious relationship between humans and nature should be considered. By protecting the environment, selecting high-quality suppliers, and integrating them together, the overall superiority of the organization can be achieved.

- **Zero Defects and Zero Pollution:** Green Quality focuses on "zero pollution" and "zero defects". To achieve perfection, Green Quality Management emphasizes the goal of "zero defects", as zero defects lead to zero pollution. Organizations should promote energy saving, low pollution, and low emissions, as it affects not only cost reduction, but also improves environmental protection, promotes environmental responsibility, and prevents potential negative consequences of violating environmental management regulations. Ensuring long-term sustainable development. Green quality management combines defect prevention and pollution prevention.
- **Focus on prevention:** This means moving quality management's focus from pollution treatment to pollution prevention. As a result, businesses should take effective steps to prevent infection. And looking for better ways to protect the environment and people's

health. Furthermore, all operations are focused on prevention.

- **Continuous Improvement:** Organizations should take steps to ensure green continuous improvement of their operations by planning and performing the essential actions to ensure the improvement process, as well as evaluating the improvement's impact. It must also analyze the resources, technology, processes, and other factors of the environment, and moreover require continuous innovation in order to achieve high performance.

### **Third: Green Quality Management Steps**

The following procedures must be followed by organizations in order to establish green quality management: (Sui et al., 2019: 133; Wuwei & Huimin, 2006: 8)

- 1- Green-quality planning, A quality plan should be developed by the organization, which includes quality targets, necessary operations, and relevant resources, as well as the planned results. The green quality management system must be carefully established in order to increase the quality of products and services and reach eco-friendly standards. Any new activity requires planning, and

developing a strong plan is the first step toward success.

- 2- Management process, an organization should develop different green quality functions at different stages of production, such as green design, green procurement, and green manufacturing.
- 3- Quality Control, Organizations should verify the effectiveness of the green quality management system and implement quality control across numerous procedures, such as production facilities and materials, employee training, product distribution, and after-sales service.
- 4- Continuous improvement requires not only considering the process of positive flow of quality management, but also incorporating the trend of environmental protection into the way that the process of quality management is reflected on the product after the end of its life cycle in terms of product recovery, reuse, recycling, and making further improvements to these practices.

### **Fourth: The differences between total quality management and green quality management**

By reviewing the literature, we believe that traditional total quality management failed to achieve the comprehensive concept in a real way because it did not take into

account the environmental aspects, and focused only on meeting the needs of customers. Table (1) shows the difference

between total quality management and green quality management.

Table (1): Differences between total quality management and green quality management

Contrast Factors	Total Quality Management	Green Quality Management
the aim	Customer and organization satisfaction	The overall satisfaction of the customer, community, environmental systems
Management objectives	Zero defects, continuous improvement and focus efforts to reduce final product inspection.	Efforts to reduce the environmental impact during the production process, and make zero impact on the environment
Scope	business organizations	Business organizations, social systems, large-scale ecosystems
Strategic decision-making	Maximize the benefits of organizations and keep all parties requesting supply	focusing on long-term development, sustaining the company's profitability while also protecting the parties who request supply and considering the environment
guiding factor	Oriented by customer's request	Oriented by green customer's request
Quality Responsibility	Taking responsibility for product quality during the manufacturing process	Responsibility for quality throughout the product life cycle
Development trend	Waste minimization	Environmental protection and development in harmony and conduct in-depth research on green technologies and methods
Cost	cost is inversely proportionate to the product's quality level.	Green marketing channels enhance the productivity and reducing cost.
Method of decision making	Short and long-term decisions are made throughout the organization	Strategic decisions are made by all enterprise departments and external parties
organization culture	Quality team is responsible for product quality	Ethical concept is responsible for product quality
The Role	Continuous improvement of technology and process, reduce project cost and increase efficiency	Controlling the project's environmental impact, reducing energy usage, and environmental protection

Source: (Ming, 2018:15; Ning, 2015:11; Qiang, 2017: 20; Sui et al., 2019:132; Tao, 2015: 38).

### **THIRD SECTION: KNOWLEDGE BASES OF PRODUCT LIFE CYCLE COSTING**

#### **First: The Concept of Product Life Cycle Costing**

From marketing perspective, the product life cycle was used in the growth of the automotive industry from 1900 to 1920. The product life cycle is an inexhaustible concept because it touches every aspect of marketing and drives many elements of the organization's strategy (Pesonen, 2001: 36). During the 1930s, the product life cycle costing technique was used primarily for economic engineering. Life-cycle costing seems to have been used in US government procurement since the 1930s (Mithraratne et al., 2007: 65). The history of the concept of life cycle costing can be clearly traced back to 1965, when the Logistics Management Institute prepared a report entitled Life Cycle Cost in Equipment Purchase for the US Department of Defense. The term life cycle costing is used for the first time in this document (Dhillon, 2002: 126). In 1976, a project titled "Life cycle budgeting and costing as an aid in decision making" appeared by the US Department of Health, Education and Welfare. The adoption of life cycle thinking at that time was very slow in other industries, as the public

sector was one of the promoters of the concept of life cycle costing (KUZU, 2012: 21). With the rise of competition in the 1980s, this technology was further developed and used as a strategic decision-making tool in the commercial, purchasing, and manufacturing processes (CONTUK, 2018: 745).

Product life cycle costing technique is defined in a variety of ways, (Blocher et al., 2019) They define product life cycle costing as a method used to identify and control product costs throughout its life cycle. The life cycle consists of all steps from product design, material procurement, to delivery and service of the final product. The steps also include research and development, product design, manufacturing, inspection, packaging, warehousing, marketing, promotion, and distribution, and after-sales services (Blocher et al., 2019: 14). Product life cycle costing is defined as the total cost of all economic resources spent on a product, whether directly or indirectly, from conception to disposal (Kayrbekova et al., 2011: 219). Product life cycle costing are also referred to as a combination of design, verification, manufacturing, and warranty costs (Kleyner & Sandborn, 2008: 796). Product life cycle costing analysis is also defined as an organized analytical procedure for evaluating various designs or alternatives with the aim of determining

the most efficient use of limited resources (Senthil Kumaran et al., 2001: 261). Product life cycle costing are also defined as all costs that will be incurred over the entire life cycle of a particular product. Usually it includes initial costs, installation, energy, operating, maintenance, environmental, and disposal costs (Waghmode, 2014: 245).

### **Second: Product life cycle costing objectives**

Organizations use product life cycle costing to achieve a variety of objectives, including: (CONTUK, 2018: 746; Kaplan & Atkinson, 1998: 236; Leszczyński & Jasiński, 2020: 1)

- Calculate life-cycle costs and develop cost strategies for new products based on them.
- Provide decision-makers with the tools they need to calculate, analyze, report, and manage costs all over the product life cycle.
- determining if a product's profit will cover the cost of development or whether it will be discarded during the production phase.
- Determine the product's environmental costs and take measures to decrease or eliminate these costs.
- Provides a comprehensive view of product costs, whether industrial or environmental, from cradle to grave to

help decision makers understand the cost consequences of making a product and identify areas in which cost reduction efforts are desirable and effective

### **FOURTH SECTION: THE IMPACT OF GREEN QUALITY MANAGEMENT AND PRODUCT LIFE CYCLE COSTING ON ACHIEVING COMPETITIVE ADVANTAGE**

By studying the previous literature, the researchers seek to develop a theoretical framework for both green quality management and product life cycle costing in order to reduce product costs, Thereby achieving a competitive advantage. According to the following steps:

- 1- Defining product specifications: The primary goal of the green product is to identify the product's characteristics and specifications in terms of quality and functionality from the perspective of the customer. As a result, the customer evaluates the perceived value of each characteristic. The customer is ignorant of environmental requirements when it comes to green products. Result from a lack of indications in many industries, the concept of "green" or "eco-friendly" is frequently confusing. Environmental laws, on the other hand, regulate green

product requirements. These requirements are frequently regarded as inevitable, and their fulfillment has little effect on the customer's perception of the product's value. Organizations, use green product characteristics and functions on a pull or push basis. Information about the industry and sustainability reports from competitors are employed to learn about the green product's characteristics and specifications. Furthermore, environmental management operations and the organization's programs might be carried out internally (Horvath & Berlin, 2012: 30).

2- Use green target costing: The target selling price is determined in this step by analyzing competitive market conditions and consumer feedback. Defining a green target price can be conducted with a variety of tools, such as: (Soror & Abdul Ridha, 2018: 434-435)

- Direct customer survey: potential customers are surveyed directly and their responses about prices are recorded; this is a quick and easy technique to learn more about a bigger group of customers.
- Market data analysis: econometrics and the functional parameters of the reverse demand function are

used in this method. The target price is calculated using data gathered from the market.

- Expert opinions: This strategy relies on personnel who are both experienced and knowledgeable. This procedure is quick and inexpensive, but the quality of the result is dependent on the experts' abilities.
- Price experiments: when the buyer's behavior is tested for various prices, where the price is adjusted on a regular basis and is blamed for this method since it takes a long time and is costly.

The target profit margin is reduced from the green target price and the green price premium to obtain at the green target cost of the product. It's worth emphasizing that all costs incurred during the product's life cycle should be sufficient to cover the selling price.

Target costing contributes to determining product life cycle costing by: (Atwa, 2020: 76)

- Introducing and developing new innovative manufacturing processes that have not yet been applied, as well as new raw material inputs and other production procedures that can be used.

- To be guided by competitive selling prices in a competitive market while designing the target costing, which serve as guides to the target cost's limits from the perspective of customers.
  - Recognizing the behavioral aspects of costs help in the determination of product target cost.
  - Reducing costs enables businesses to realize the target cost in order to gain a competitive advantage without risking product quality.
- 3- Define green product life cycle activities: In this step, the researchers argue that the activities which consume the organization's various resources are determined by financial resources, raw materials, and energy sources, and that the activities are identified for the various phases of the product cycle from the perspective of the organization to the following:
- Pre-production Phase: includes R&D, green design, and green product planning activity.
  - Production Phase: includes green manufacturing, pollution prevention, and social activities focused on protection of environment.
  - Post-production phase: includes green marketing, after-sales service, recycling and waste disposal activities.
- 4- Analyze and classify activities: Both green quality management and green activity-based costing are employed in order to identify activity pools and classify them into activity pools related and not related to green quality, and activities can be divided according to the phases of the product life cycle into: (Banglong, 2016: 21-22)
- Activities not related to green quality include production of samples of the product, testing samples, assembly of parts, transportation of raw materials, logistics activities, warehousing, advertising, transportation of the product, assembly of the product, and disassembly of the product, and often the drivers of these activities are machine-hours, working hours, consumed quantity of raw materials, handling times, kilometers, repair times, processing times.
  - Activities related to green quality, which are prevention, Appraisal, internal failure, and external failure, and are include Green design, environmental protection, pollution treatment, green packaging, and waste recycling activities.

Most drivers of these activities are measures of water, air, and soil quality deterioration, which are indicators of water, air, and soil depletion, measured by pollution times, treatment environmental pollution times, implementations of preventive procedures times.

5- Use green value engineering: The researchers believe that it is possible to employ green value engineering is at the design phase because of the comprehensiveness of its impact. The design phase fundamentally affects all phases of the product life cycle and represents a link between all phases of the product life cycle. Green value engineering is implemented by collecting the necessary data about the product, identifying the components and functions of each part, its costs, and environmental impacts, and seeking to suggest design alternatives that lead to achieving functionality and reducing emissions and waste at the same time. for eliminate non-value-added activities, enhance job entitlement, or reduce costs of value-added activities.

The organization will develop a number of alternatives depending on the previous, as illustrated below: (Khattab & Al Hassan, 2015: 209)

- Products that are both profitable and eco-friendly. They are green products that satisfy the needs of customers and the organization's goals. They comply to environmental regulations. These products should be conserved and manufactured.
- Products that are more profitable and more harmful to the environment, and these products meet the organization's profit objective, but they do not meet the needs and desires of the green customer and do not comply with environmental requirements. In this case, the organization should rethink the methods of manufacture or raw materials used in the design, and develop the necessary means to make these products comply with environmental requirements.
- Less profitable and eco-friendly products. Despite of these products are eco-friendly, satisfy the needs of green customers, and meet environmental criteria, they do not meet the organization's profit objective, motivating it to looking for a way to decrease the cost of these kind of products without losing their green status. And it's friendly to the environment.

- Products that are less profitable and more harmful to the environment, and which do not meet the desires of all parties, the organization, the

customer, and the community, and which the organization should not produce and instead seek out ideas for green, eco-friendly products.

The proposed framework for green quality management and product life cycle costing is shown in Figure (1).

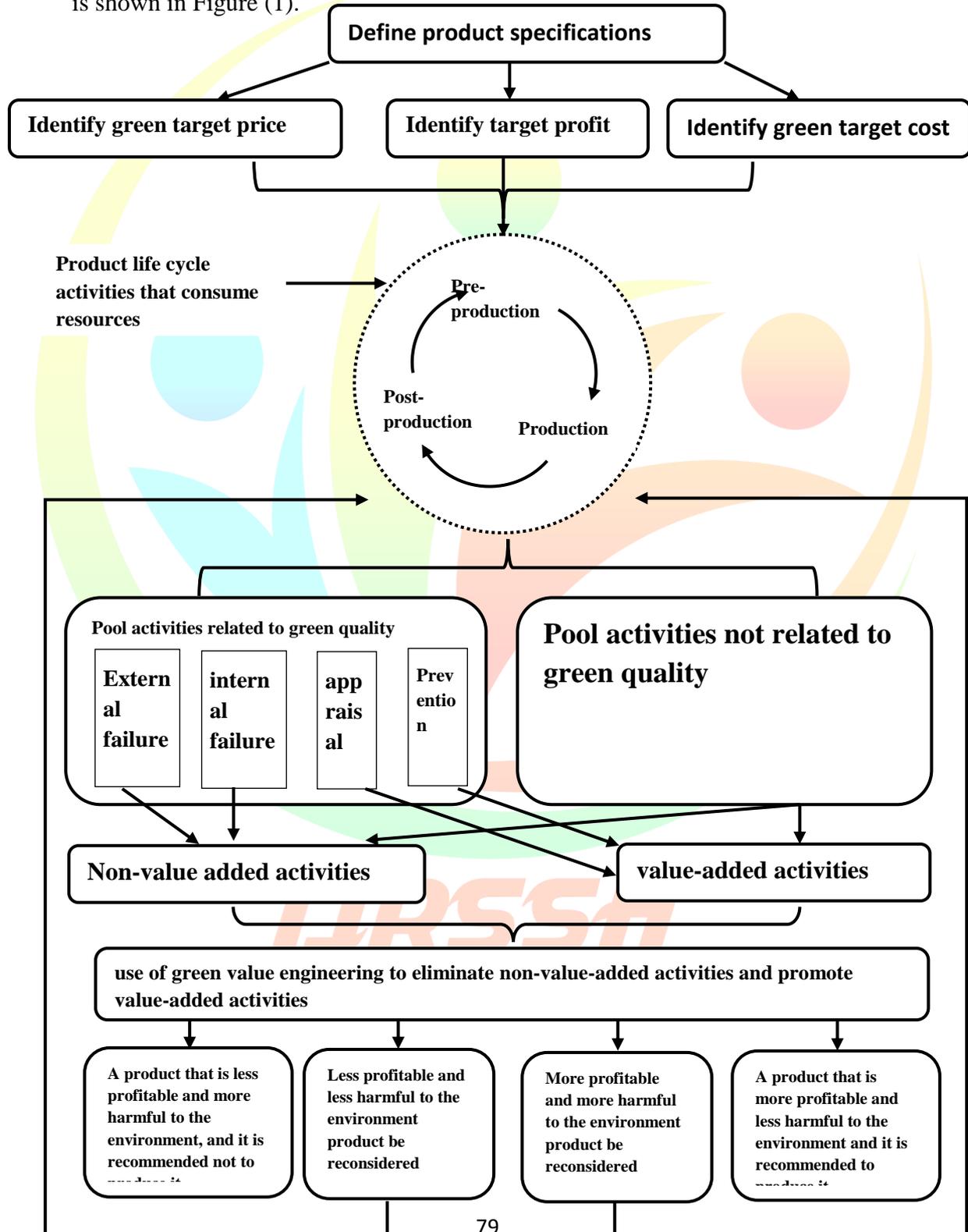


Fig. (1): proposed framework for green quality management and product life cycle costing

## FIFTH SECTION: CONCLUSIONS AND RECOMMENDATIONS

This study attempted to develop an integrative framework for green quality management and product life cycle costing in order to achieve competitive advantage for organizations. The study contributes to developing a knowledge basis about one of the most important strategic cost management tools, which is green quality management, and its role in achieving customer desires and meeting the requirements imposed by environmental legislation. Moreover, the study reviews product life cycle costing and its importance in accurately determining cost of products and reducing that cost in a way that leads to obtaining a competitive advantage.

The proposed framework for green quality management and product life cycle costing in this study has the following features:

- help meet the achievement of environmental requirements and provide the customer with a high-quality product through the application of the content of green quality management.
- Helping in the optimal use of resources, reducing energy consumption, using renewable energy

by adopting product life cycle costing and encouraging use of recyclable raw materials in order to preserve natural resources, protect the environment, reduce costs, and differentiate the product as being green and eco-friendly.

- It satisfies the needs of the green customer by identifying the product specifications which the customer desires and determining the green target price which customer is willing to pay using green target costing.
- Uses green activity-based costing in order to accurately measure the cost of activities and to determine the green quality cost, value-added activities cost, non-value-added activities cost.
- It uses a green value engineering in order to eliminate activities that are not related to the green quality and not value added, as well as the eliminate of activities related to green quality and non-value added (internal failure, external failure), which is reflected in the achievement of the competitive advantage of organization.

This study, through the proposed framework, can contribute to providing decision makers with the necessary information for planning and making decisions related to the use of resources,

renewable energy, energy savings, waste and emissions reduction, and cost reduction. Leading to a win-win situation (organization, customer, community, environment).

We believe that the enforcement of environmental laws and regulations in many countries has resulted in companies spending a millions of dollars on waste treatment units and pollution reduction, resulting in higher product costs. As a result, these organizations' interest in developing ways to meet financial objectives, solve environmental concerns, and increase customer satisfaction by producing green, eco-friendly products developed.

We also argue that green quality management represents a turning point and development in the field of quality, as it works to reduce costs and protect the environment through the principle of zero defects and zero pollution, and this is what most organizations seek. It also seeks interests of the organization, the environment, and society and attempts to integrate the function of environmental protection from a comprehensive perspective, on the contrary, total quality management considers the interests of the organization as the core of its concern.

On the other hand, product life cycle costing contributes to providing a better view of the consumed resources, environmental pollution, costs incurred during the various phases of the product life cycle. in addition, product life cycle costing helps organizations identify activities that achieve better profitability as well as green activities that Complies with environmental protection requirements.

We believe that the integration of green quality management and product life cycle costing and the use of other auxiliary tools (green target costing, green activity-based costing, green value engineering). It contributes to determining the environmental costs of products as well as maximizing the profits of organizations by reducing environmental costs and enhancing the value of the product, which is reflected in increasing the market share and achieving the competitive advantage of the organization.

As for the future, we think that governments, organizations, and researchers should devote more attention to environmental protection issues by increasing efforts to use strategic cost management tools, including green quality management, product life cycle costing, green target costing, green value engineering...etc.

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