



Circular Economy and Green Products in the Building Construction Sector- The Impact in the Society

Master degree in Product Design Engineering

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Dissertation under the supervision of Professor Susana Cristina Serrano Fernandes
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Dedication

To my dearest parent for life, love and education and my country.

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Abstract

Now days we can see how the Earth have been affected by non-conscious use of products that contribute considerably to the pollution of the ecosystem. The human being is everyday more worried about to preserve ecosystem, finding, designing and using materials and products that doesn't or affect less the ecosystem neither the humans. Green products have been designed to do the least possible damage to the environment whether in their production, use or disposal. Defined as products or materials that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose (Speer, 2011).

The civil building construction that for the case of study is going to be mention only as building construction, have and extensive direct and indirect impact on the environment during their whole lifetime (Vierra, 2016). During the construction, occupancy, renovation, demolition, building use energy, water, raw materials, generate waste and produce harmful atmospheric emissions (Vierra, 2016). Due to these facts have surged the necessity of implementing a circular economy model, creating green building standards, certifications, and rating systems to help mitigate the impact of the building on the environment through a sustainable design (Vierra, 2016).

A practice that support the concept of circular economy is the building deconstruction. Developed and emerging economies are adopting the circular economy model leading to the creation of markets for recovered materials (Commision, European, 2014).

When we talk about Green Products in the building construction we involve two aspects, the materials and the technique used. A material can be a green product by itself, for example the Bamboo, but also using a traditional material, a construction can transform into a green product by the technique used.

Companies that produces green products are developing different labels and ways to communicate the consumers of their benefits (Vierra, 2016). By these the consumer gets acknowledge of how and why is a green product makes the consumer takes a decision between buying traditional products or green product.

Keywords

1. “Circular Economy”
2. “Green Products”
3. “Green Building”

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List of Abbreviations

AIG	National Authority for Government Innovation
CAPAC	Panamanian Chamber of Construction
CFL	Compact Fluorescent Lamp
EXPOCAPAC	Exposition of the Panamanian Chamber of Construction
LEED	Leadership in Energy & Environmental Design
LED	Light Emitting Diode
PGBC	Panama Green Building Council
VOC	Volatile Organic Compounds
WRAP	Waste Resource Action Plan

1 Introduction

The aim of this chapter is to detail the outcomes of the research project. The chapter comprises seven main sections. The first section outlines the purpose of the research (also showed in the introduction chapter). The objective of this sections is to relate between the research aims and the research findings. The next section refers to the uniqueness and originality of the research. The aspects of the research that were not found in any literature review that made it unique are mentioned. This research resulted in theoretical and managerial implications that are mentioned ahead in other section. The findings are the section ahead, were a comparison with the literature review was made to corroborate or deny the findings of the literature review chapter. These research section, was done by comparing the survey the research made vs the surveys founded on the literature review chapter made by other researchers. In the fourth section are presented the managerial implications, that are the contributions of these research to professionals workers in the area of the building construction in Panama such as the architects and the building construction companies and others involved in the sector. Finally, the sixth section identifies the limitations of the research and the seventh section suggests areas for further research.

1.1 Background of the research

The construction activity is one of the most contributing to the economy of the country, a productive engine that has maintained a noticeable dynamism in the last decade that, since 2014, has positioned itself as the second activity with greater participation in the generation of added value in the Gross Domestic Product (GDP), reaching 14.9% in 2016, according to figures recently published by the National Institute of Statistics and Census (INEC). In addition, these figures indicate that by 2016, this economic sector was the third in GDP with the highest growth of 8.1% (higher than the total growth of 5.0%), a rate that also places it in third place among eighteen countries in the region that together they decreased (-0.6%), according to the Inter-American Federation of the Construction Industry (FIIC). Construction and economic growth have shown similar behaviors over the years, since construction does not enrich itself but is strongly articulated with different activities, some

of which depend directly on the strong demand it stimulates in the manufacturing industry, trade and transport, among others.

On the labor market, the construction activity is labor-intensive and employment-generating, both direct and indirect. In the last four years it has presented the highest percentage of employment contracts registered in the Ministry of Labor and Labor Development, more than 400 thousand jobs driven by large construction sites. In addition, those employed in the construction sector receive one of the highest salaries among economic activities and the median salary has been growing in recent years.

1.2 The Purpose of the research

This research aims to understand the current situation regarding circular economy and the use of green products in the building construction in Panama. It therefore aimed to:

- Understand the opinion of the professionals involved in the construction process of buildings to evaluate their position before the application of a circular economy and the use of green products. The results of the opinions on the professionals involved in the building construction reveal their willingness to apply or not a circular economy and if they were able to use green products in their building construction projects.
- Obtain from part of the society and professionals in the building construction the possible barriers that upfront sector towards circular economy and the use of green products.
- Analyze the position of the government in respect to a circular economy and green products. Investigate if there are laws created, benefits from the government that promotes a circular economy and the use of green products and government entities or ministries that assure the environmental issues.
- Obtain information in topics such as awareness, challenges, willingness, economic factors and educational factors of the society towards circular economy and green products (Alizadeh, 2016).

1.3 The uniqueness and originality of the research project

- a) This research have investigated a topic where almost no previous studies have been done Panama and not much information is available.
- b) Surveys in other countries were found, these surveys analyzed the society in context of the circular economy and green products in general, not specifically on the building construction sector.
- c) A survey instrument was applied to three different respondents, the consumers that were the possible buyers of apartments or any other commodities such as a villa, real state or a business purpose place, the architects that are the designers of buildings and the building construction companies. This survey includes these respondents as they were the most important persons in the buy-selling of building construction. The results of this survey helps and to have a detailed knowledge of these respondents to helps prove or disapprove the hypothesis.

The research generated important academia and managerial outcomes, which are described and discussed below.

1.4 Research Objectives

Below are the specific objectives that have been established for the development of the research.

- Understand the current situation regarding circular economy in the building construction in Panama
- Understand the opinion of the professionals involved in the construction process of buildings to evaluate their position before the application of a circular economy and the use of green products.
- Knowing the barriers of part of society before the step to follow a circular economy and greater use of green products
- Measure the use of green products in the construction processes in Panama

- Know the green products for construction available in Panama
- Evaluate the position of the government before the general application of a circular economy in the country
- Investigate existing laws in support of the environment to promote a circular economy and government support for the use of green products.

1.5 Thesis Structure

To facilitate the understanding of the thesis structure and its aims, the contents of each chapter are described below.

Chapter two provides and extensive information in general of the circular economy, starting from its concept, principles and benefits in general. It reviews how it is applied in the building construction sector with the goals that it follows and the benefits it promotes to the environment and the humans. Techniques that are follow to a circular economy are also presented in this chapter and the barriers that present the society to achieve a circular economy. Also present the concepts in general of the green products, the attribute a products need to be considered a green product. It also shows the different types of green certification a product can obtain to be considered a green product worldwide. The Green Building concept is introduced that consist in building construction projects that includes the use of green products and it is shown the benefits of this type of green building construction and their certifications.

It shows the actual situation of the national building construction sector in Panama, from the types of construction, investments and comparative through the years from 2011 to 2015 that are shown using the help of tables and graphic from different entities of Panama such as the Panamanian Chamber of Construction.

The actual situation in general of the country in matters of circular economy is presented, it was obtained only two projects in Panama that applies a circular economy and that are not from the building construction sector. It is also shown some projects that are in studies and review from part of the government to start, and their proposals are mentioned as their benefits.

Some of the circular economy products for the building construction sector that are sell worldwide due that in Panama are not sell, and also green products that are sell globally and in Panama.

Chapter three shows the literature review from other studies in other countries that used a primary data collection. It reviews literature on the concepts of awareness, willingness for the use of green products and circular economy. This chapter provides the key elements to develop a conceptual framework.

Chapter four presents the methodology used to achieve the objective f this research, where it presents the type of approach used that was the positivism approach, the research strategies, research purpose are mentioned also. This research used a multiple method for the data collection. The data collection methods and techniques are presented, to mention the exploratory interviews, in-depht interviews, semi-structured interviews and their advantages and disadvantages are present and the reason they were selected. Is presented how the interviews were prepared and developed. The questionnaires method is presented in these chapter where it is explained its source and development.

Chapter five, the results from the survey by questionnaire delivered via online by the use of the platform of Survey Monkey are presented and analyzed with the use of descriptivie statistics.

Chapter is where the conclusions are presentd, including managerial impliciation, theoretical implications, findings, limitations, further research.