

CIRCULAR ECONOMY IMPLEMENTED IN A COSMETIC COMPANY: A CASE STUDY

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ABSTRACT: This research was part of a Scientific Initiation project developed during the Industrial Engineering course as complement of the undergraduate contents. The purpose of this work is to encourage the adoption of the concept of Circular Economy by the companies regardless of your size in order to reduce environmental impact and help to avoid the malefic effects produced by the tailings discarded by the majority of the companies. This research was based on an extensive literature review and on the formulation of a case study, which was implemented and fully assisted by the Cosmetic Bio Phito Therapeutical Company. Using the assistance offered by the Enterprise Resource Planning tool (ERP), it was possible to infer a mere substrate whose only purpose was to support the raw

material that would effectively be used to an applicability that, besides being profitable, brought circularity to the operational flow. The results obtained with the implementation of the Circular Economy brought to the company that was studied the opportunity to avoid inadequate waste management, in addition to a financial savings of around U\$ 2,000 per month due the reduction of expenses with a material that, instead of being improperly discarded, was reprogrammed for practical use, through recycling. The research was developed using the Problem Based Learning (PBL) approach and hands on activities during all the work.

KEYWORDS: Circular Economy; raw material; Enterprise Resource Planning; recycled.

1 | INTRODUCTION

Since the beginning, more specifically around 10 thousand years ago, the history of mankind was in the Upper Paleolithic period. A milestone in Prehistory in which the Cro-Magnon Man, a primitive population of the species Homo Sapiens, had already developed their first tools,

still with limited sophistication, given the incipience and simplicity of the techniques used, defining characteristics of this revolutionary moment in History.

From this point on, great waves were responsible for changing the course of humanity.

From the stone age to the beginning of the First Industrial Revolution. The, until then, hominids left the savannah and began to compose a new class that emerged in History, called artisans, the first industrialists on a modest scale.

Urban landscapes were radically changed, just as they made way for a vertiginous, unplanned urbanization, recurrent throughout Industrialization.

According to Schwab (2018) the Industrial Revolution in the 18th century brought several transformations in the production means and in the European urban scenario. With the industrial rise, handcrafted manufactures and productions were quickly replaced by a scenario of incessant search for technological development, arising from the abundant thirst for productivity.

Baine (2012) said that the Green Engineer must be one of the Engineering careers responsible to save the Earth, creating the infrastructure and means for impoverished countries to have access to clean water, electricity, and internet services to maintain the Sustainability of the planet. The circular economy is a concept of a true sustainable economy that it works without waste, save resources, and works with synergy with the biosphere.

Instead of looking at emissions, subproducts, and damaged or unwanted goods as waste or garbage, these materials in circular economy become raw materials and inputs for a new production cycle.

Throughout the consecutive Industrial Revolutions, certain triumphs became noteworthy, namely: machinery, the progress of means of transportation, the advance of intercontinental communication, the advent of the Internet and new technologies, resulting in the expansion of the, until then restricted, Globalization.

From the mitigation of infant mortality, good quality and life expectancy to the approach of the numerical, Campos et al., (2011), for the levels of education, health, and income, according to the HDI indicator. From high levels of education and literacy to high per capita income. It is palpable that these Revolutions, including the most recent one, the so-called Industry 4.0, have been responsible for significant improvements in the welfare of society, especially in the so-called developed countries. However, their price is being charged.

The human population continues to grow exponentially around the world, with the imminence of reaching a population of about 10 billion people by the year 2050. Therefore, the combination of population growth and social upswing has put increasing pressure on essential natural resources.

With the atmosphere and oceans overburdened with carbon, coupled with uncontrolled burning of fossil fuels, unprecedented climate disruption is manifesting itself. The enormous extraction of resources from nature, with no or minimal replanting policy, leads to the current

emergency of the Brazilian flora, defined by the problems of deforestation and wildfires.

The ocean covers about 71 % of the planet Earth, and the waste generated by human activities is totally dispersed in it.

In almost every corner of the ocean, there are already records of the presence of plastic and microplastics. From the above, science shows that more than 80 % of this material is located decanted on the ocean floor and has been degrading successively into smaller and smaller particles.

Today, humanity is at a turning point.

It has become imperative to carry out emergency planning to ensure the subsistence of the next generations.

To this end, it is unthinkable to conjecture an eventual renunciation of everything that humanity has already achieved. Nevertheless, it is feasible to rewrite the formula that will unveil the secret responsible for perpetuating, in a sustainable way, this new Industrial Age.

According to Stahel (2016), [...] "Today's goods become tomorrow's resources at yesterday's price"

2 | SCOPE

The model with which this scientific study was developed, directly implies rigorous exploratory research through literature review. In addition to the meticulous analysis and investigation of previously published theoretical material, field research was also proposed.

According to Powell & Weenk (2003); Kolmos et al. (2009), the Project Based Learning approach (PBL) is a very important method of Engineering Education and put the students in a real contact with the professional environment where the students will be work in the future. To get this knowledge is necessary that the students participate from the start of the project to the final step to learn all the steps and learn to read and implementation of the project.

Campos et al. (2012) show how to create an environment of learning, mainly using, a hands-on activity based on the PBL approach.

Lima. M. R. et al. shows as is important the projects developed with the Industry for the development of Professional Competences in Industrial Engineering Education.

Based on these concepts we decided to use PBL approach in this research.

This comprises data collection, which suggests an interpretation of the results obtained.

Conducted right in the original environment where your object of study is located, field research results in accurate, timely, and exceptionally efficient analysis.

In line with both pillars, a Case Study was also introduced. As this is still a little explored theme and little diffused in the market, opportunities for development in techniques and business models that apply Circular Economy in practice, as an inherent part of the

production line, can be evidenced.

A Chemical Industry, from the Cosmetology field, was selected for the deepening of this study and the introduction of the concepts of circularity in the daily life of a Small Business Company. Small businesses are made up of micro and small companies and individual micro companies. In Brazil there are on average 6.4 million establishments and, of this total, it is measured that 99% are registered as micro and small company. That said, it is demonstrated as a niche of strong representation in the Brazilian scenario and as an opportune chance to be demonstrated through example, data and proven results, that it is an action whose applicability depends on few resources; low investment cost; and is still able to result in the reduction of materials held in stock, reducing storage costs, increasing the turnover of inputs and the protection of the amount of its working capital. Finally, it ensures a better financial planning of the company and a redistribution of investments. Thus, the focus shifts to improvements in the production belt and, in a possible automation, in the means of production.

This proves, therefore, the endless returns that are generated for society, in terms of sustainability and environmental preservation, as well as the positive cycle that is incited.

According to what was said above, this study aims to demonstrate that the practice of Circular Economy should not be restricted to large industries, nor does it require the export of technologies to be feasible, on the contrary, implementing a system that brings circularity to the process allows all companies to have an experience of intelligent manufacturing, in which natural resources are saved, the destination of cash flow is reconfigured, and therefore new technologies arising from Industry 4.0 can be implemented, democratizing competitiveness within the national market itself.

3 | APPLYING RESEARCH IN ENGINEERING EDUCATION

When focused on the educational context, this study addresses efforts to improve logical investigation skills and to improve the search for solutions to overcome the obstacles presented, which are intrinsic characteristics of an engineering education.

Aiming to acquire this knowledge to conduct efficient research, with results that are tangible to reality, notes were taken on articles presented at the UNESP Symposium of Industrial Engineering (SIMPEP), in 2020, through which it was possible to understand more clearly the characteristics that differentiate Circular Economy from a Recycling Process, for example, among other details that highlight the importance of this concept today.

It's important to highlight some academic-scientific-cultural activities promoted by the Pontifical Catholic University of São Paulo, which were of immeasurable contribution to the formulation of this research. These activities consisted, mainly, of lectures and seminars that dealt with subjects of fundamental importance to the development and conclusion of the chosen thesis. Some of the subjects approached were The Future of Industry; Prototyping

Technology Applied to Factory 4.0; Use of Technology in Small Business and Opportunities of Waste Management.

Finally, the experience obtained by following the daily routine of the factory floor, in the industry selected for the application of the Case Study, was extremely enriching at the juncture of studies, aiming at a future training in the Engineering career. There, it was possible to learn about the manufacturing processes, how the organizational structure of a company works, the obstacles faced during production management, planning strategies and risk analysis, financial control, and, focusing on the theme of this project, the most appropriate methods of waste disposal and management. The purpose of the study was to reduce the generation of production waste to as close to zero as possible. This opportunity of proximity with the cosmetics industry Bio Genetec, also allowed to acquire the knowledge of using the Corporate Software ERP (Enterprise Resource Planning). This technology is becoming more and more usual in Engineering and, frequently, required in the management areas because it makes possible to analyse and follow up each step of a production process, besides allowing a rigid stock control. The ERP tool helped, rigorously, in the monitoring of each result obtained.

4 | THE CIRCULAR ECONOMY

Due to the usual logic of extraction, production, consumption, and disposal, humanity has submitted itself to a Status Quo limit situation. The, until then, trivial model of traditional and linear economy has suffocated natural resources and expressively mitigated the quality of life of the inhabited environment. Emerging as an alternative to contain the consequences that this and the next generations will be subject to face, a definition emerges in defence of the operating modes that surround the sustainable model.

In 1989, what is today an integral part of the lexicon of the economy, namely known as Circular Economy, was born.

Elaborated in an autonomous article by British economists and environmentalists David W. Pearce and R. Kerry Turner, it was demonstrated, through analysis, that the environment was totally disregarded in the unbridled search for the consumer market and the desire to gain a position of influence among the capitalist nations, an episode reinforced and contextualized in the midst of the Fall of the Berlin Wall (1989), which culminated in the end of the Cold War and caused, subsequently, the dissolution of the Soviet Union.

At the time, the environment was bequeathed a secondary role, as a simple waste reservoir. Also known as “cradle to cradle”, Circular Economy does not work with the idea of waste, after all, everything can be progressively reused in a new cycle. In other words, by designing the product design in its entirety before manufacturing it, it was possible to avoid the use of materials that cannot be reused, so that all creation returns to the production cycle, drastically limiting waste generation.

According to the United Nations (**UN**) and the Circle Economy report, only 9 % of the global economy is circular, which in practice confirms that of the 92.8 billion tons of waste generated by industrial and residential means, less than 10 % returns to the production chain, that is, more than 80 billion tons of plastics, fossil fuels and biomass are inadequately disposed of to the environment.

Essentially, Circular Economy is based on value creation through a “closed loop”, in which industrial and social evolutionary concepts aim to achieve integral sustainability objectives in relation to a no-waste philosophy, starting from a regenerative system.

4.1 The Waste Management Issue

Waste, on the other hand, pragmatically suggests an extra cost within a corporation and, accordingly, has a negative impact on its reputation, depending on the type of disposal that is routinely performed. To this end, the Federal Accounting Council (**CFC**) has been orienting accountants to bring these environmental points to the balance sheet of their partner companies, aiming at the lowest wear and tear not only to the already scarce natural resources, but also to the very image of the corporation in question and, consequently, aspire to the protection of the balance sheet in view of inspection agencies, such as: the Civil Police, CETESB, and the Sanitary Surveillance.

Currently, inadequate areas of final disposal, such as dumps, and controlled landfills receive an average of 80 thousand tons of waste per day. These are 80 thousand tons that could be redirected and better used, by transforming them into by-products. However, the consequences for this phenomenon called, Inadequate Waste Management, are impacted soil; impacted groundwater; impacted rivers and lakes; spreading vectors and, because of these calamities, human beings are fervently impacted.

Between the years 2017 and 2018, the generation of MSW (Urban Solid Waste) in Brazil increased by almost 1%, reaching the mark of 216,629 tons per day. As the population also grew in the period (0.40 %), the per capita generation obtained a minimally reduced elevation (0.39 %). This means that, on average, each Brazilian generated a little more than 1 kilo of waste per day.

However, taking into account the contemporary atypical situation in which society has been subjected, it is important to take into account the change in this statistic, given that in 2020 and 2021 the number of food orders via apps will expand exponentially, causing a predicted increase in the number of disposable packages that lead to an extreme increase in waste originating in homes and likewise, as a reflection of the pandemic, a radical demand for hospital supplies.

On August 2, 2010, Law No. 12.305/10, better known as the National Solid Waste Policy, was enacted and is fully responsible for organizing the way in which the country manages its waste, requiring from the public and private sectors transparency in the

destination and treatment of its waste. This law establishes the principle that everyone, from the person in charge of receiving the raw material to the dispatch supervisor, is fully responsible for the management of these remaining materials.

A viable solution to be undertaken and, increasingly, instituted in reference corporations in the market to encourage their competitors in the industry to apply the same strategy, is the so-called Reverse Logistics.

This instrument consists in the economic and social development, characterized by a set of actions, procedures and means that enable the collection and return of solid waste to the business sector, for reuse in its production cycle or even proposing the realization of a new final route, this time, environmentally appropriate.

These procedures consist, respectively, in reusing or reprocessing the raw material for the production chain; waste generation by the manufacturer (during manufacture); waste generation by the merchant (during commerce); waste generation by the consumer (after use); disposal; voluntary delivery point; collection and recycling; reusing or reprocessing the raw material for the production chain.

All phases, whether of manufacture, marketing, or use, can be returned and reprocessed for the creation of a new raw material, without necessarily having to extract new resources from nature and much less discard the old ones.

The state of São Paulo has been one of the forerunners of the implementation and obligation of Reverse Logistics in more and more products with flammability risk or that, today, have an inadequate disposal.

4.2 The Microplastics Issue

Considered one of the most problematic, dangerous, and difficult to solve issues on this subject, special attention should be paid to the topic of microplastics.

The difficulty of the subject matter becomes clear when, upon reflection, it becomes possible to conclude that every little piece of plastic that has been created to date still exists. Even after reaching its degradation limit year, plastic will never completely disappear, it will only decrease in size. The problem lies in the fact that the smaller the material gets, the easier it is for an organism to ingest it without realizing it, and this can lead to an interaction with different chemical components as soon as it fragments.

Microplastics, when dispersed in the ocean, are often found in plankton, which provide about 60 % of the oxygen found in the atmosphere by carrying out photosynthesis. However, since plankton in the pre-existing food chain relationship also serves as a subsistence for some species of fish, the fish ingest the plastic, and the plastic is automatically incorporated into man's food chain when he feeds on it.

Recent research conducted by European scientists from the Medical University of Vienna has shown, by collecting human excrements from different countries, that all the

excrements studied contained more than 50,000 microparticles of plastic each.

Demonstrating at last that the contamination of the garbage has reached our intestines.

Actions admittedly capable of mitigating the existence of plastic in the seas consist of investments to enable the use, productively, of the new bacterium identified in 2016, which is called *Ideonella sakaiensis* 201-F6 and has the capacity to degrade PET, using it as its main source of carbon and energy.

According to Bornscheuer (2016), if terephthalic acid can be isolated and reused, it could generate huge savings in producing new polymers, without the need for petroleum-based feedstocks.

Aggravating factors related to socioeconomic and occupational problems should also be assumed, since in Brazil, the great source of waste that reaches the sea through the watersheds, about 80 %, is located on land roads, mostly from irregularly occupied areas, because there is no collection service and proper disposal of solid waste in these regions.

After all, similarly, considered as a viable option for the resolution of the adversities caused by improper residual disposal, the concept of Industrial Symbiosis is presented. This can be defined as a long-term association between two organisms of different species, i.e., submerging the concept to the corporate environment, it is assumed that the waste generated in one company can be used by another, following the minimization or total elimination of waste.

4.3 Successful Cases

In the domestic sphere, the number of consumers who demand differentiated attitudes is growing, and above all, from the circular economy perspective, they opt for sustainable products and services, in which the responsibility for waste management is planned from manufacturing to the final disposal of packaging after consumption.

Within the cosmetics industry, two companies stand out for their socio-environmental concern: Natura, responsible for launching a challenge to itself which consists in the search for innovative solutions, such as zeroing the brand's packaging waste, has already started to demonstrate positive results for the theme, by declaring that the "**Kaiak Oceano**" perfume packaging is produced with plastic residue of which, at least 50 % of the total of this material that is used in the confection of each packaging, is taken from the ocean and collected on the beaches of the Brazilian coast.

Another even more recent measure taken by the **Natura & Co** group is the launching of its packaging recovery program at its branches located in Mexico. Aiming to be able to contribute even more effectively to reducing the environmental impact generated by improper handling of waste, the Brazilian company has promoted the action "Reverse logistics of post-consumer packaging", with which it invites consumers and its entire network of consultants

to join the Circular Economy by taking empty, clean, and dry Natura packaging to any of its physical stores. By participating in the initiative, the contributor will receive 25 % discount on refills for each 5 packages delivered.

“With this proposal we want to invite people to be part of the movement, promoting the circularity of post-consumption packaging, in line with our commitment to be an agent of change that adds value to society and generates positive impacts, achieving a world with more beauty and less waste,” said Griscelda Ramos, Director of Sustainability at Natura Mexico.

In June 2020, the 4th largest holding company in the beauty business in the world, which gathers Natura, Avon, The Body Shop and Aesop, presented its plan *“Commitment to Life”*, to face the most urgent global problems. Among the commitments highlighted in the document is that of “embracing circular economy and regeneration”, to achieve greater circularity in packaging. A clear example of this is in the constitution of the container used for the Natura Ekos and Tododia lines, according to Alves (2017) and the Brazilian company itself, PET plastics from the recovery of bottles that feature this material are used, extending in such a way the useful life, and contributing to its maintenance within a productive cycle.

By implementing these good practices, packaging material is reduced by up to 80%, avoiding more than 3,000 tons of waste annually, as well as the emission of 8,000 tons of greenhouse gases, according to company data. In 2020 alone, Natura managed to recover 667 tons of waste.

Another reference brand in the search for sustainable solutions associated with its products is B.O.B., responsible for offering a bar alternative, aiming at gradually replacing the plastic packaging of shampoos and conditioners.

The digital transformation, although it may seem “cleaner” than its predecessor technologies, will generate a legacy that is even more harmful and difficult to control if not wisely handled. Thus, the Circular Economy coupled with Industry 4.0 arises, intending a sustainable management of the supply chain, through the Internet of Things, which connects stakeholders to efficient flows of materials and information. Thus, by linking ideas, people and places, the generation of good opportunities is potentialized as a result.

5 | THE CASE STUDY

After searching for a practical means and a feasible experience for the application of the concept of Circular Economy in an Industry, whose manager is configured in the same classification of Micro and Small entrepreneur, as well as the 99 % of entrepreneurs located in the national territory who, despite all the fiscal disincentive and the lack of credit stimulus with which they are afflicted, it is important to emphasize that they continue to leverage the country’s economy by sustaining about 27% of the Gross Domestic Product (GDP) and ensure 54 % of formal employment in Brazil, according to data from **“Brazilian**

Service Support to Micro and Short Companies” (SEBRAE). The idealization of taking advantage of the representativeness that the sector enjoys in the private sector sowing sustainable practices that, in parallel, also play a financially attractive role to the company, was conceived. In response to the above, the structuring of a case study was outlined that, after all the work of elucidating, theorizing, defining which strategies are more palpable and experimenting with possibilities, it was possible to attest to the simplicity with which Circular Economy not only can, but should be present in each stage studied during the formulation of a product and/or in the operational planning that surrounds a production.

The target company of this study was *Cosméticos Bio Phito Terápicos Ltda.*

Founded in 1984 in the city of São Paulo, *Bio Genetyc*, the brand for which it is recognized in the market, started its activities manufacturing cosmetics for third parties and for the retail market. Today, with over 30 years of continuous experience acquired, its main focus is to offer products geared to the needs of distributors and clients from the international market, clients who aim to work alongside a company constantly concerned with the quality, sustainability and technological innovation promoted in its merchandise, whose origin is entirely from the domestic industry and each production process, from the development of products to the act of packaging them are thought out and closely monitored by its manager.

With the help of the Enterprise Resource Planning (ERP) tool, it was possible to observe in detail all the production chain related to the industry in question, in order to establish the procedures that, when optimized or possibly replaced by more viable techniques, would achieve tangible results for the corporation, serving as an example for commercial partners and even competitors, whether in the same sector or not, to contemplate the unmeasured benefits that were added after the experimentation of this pilot, encouraging them in such a way, to apply similar methods in their production cycles, expanding the benefits gained in an unprecedented quantitative scale.

For this study, it was selected within the context of raw materials, the roll of labels, thus being elected as the target object, where the understanding regarding the applicability of Circular Economy would be properly tested.

Once the first phase of decision making about the most suitable raw material to undergo the readjustment process was concluded, the possible strategies to implement the concept were defined.

Initially, it was conjectured the use of the smooth roll, making use only of its substrate, without the conjunction of labels on the surface so that it could be reused to wrap the products already boxed, about to be shipped to the carrier.

However, it was noticed the low efficiency in what concerns the protection of the products contained in the box; in the little aesthetic attractiveness given and in the little performance promoted to the material, as much as it was expected when readjusting the utility of its function.

Thus, the idea of using a paper shredder emerged, one of those easily found in offices and accessible in the main stationery stores. The objective is to take advantage of the physical concept that comprises, for example, the springs. By going through the fragmentation process, the paper acquires the property of flexibility, which enables it to store mechanical energy, making it, therefore, a pseudo-spring able to dampen the movement of objects inside the box during transportation, ultimately avoiding damage to them.

Despite the addition of an extra procedure in the production chain, with the insertion of the fragmentation action, it was possible to verify a significant improvement and a true optimization regarding the amount of material spent, given the increase in volume caused, as well as in the improvement of aesthetics and the benefit of its new assignment.

In short, an investigative process can be evidenced in practice, with a simple, effective, and easily absorbable solution in the day by day of an organization, in which by recovering all its production, a work of identification is carried out on which inputs, products, and methodologies are likely to be incorporated into the closed production cycle.

When one acquires the ability, by observing the whole, to promptly search for the opportunities contained, a ridiculous raw material, in the eyes of the layman, is equivalent to the master key capable of solving an important humanitarian setback, in the eyes of the visionary.

Thus, a mere support for the labels is transformed into a resource of unavoidable usefulness, which is interesting to highlight the fact that it is manufactured with waxed paper or impregnated with impermeable substances, configuring a non-recyclable waste and difficult to compost.

In other words, the technique of certifying the safety provided in the transportation of goods was improved and new costs were avoided with the purchase of materials such as bubble wrap, whose average price to cover a small box is evaluated at US\$ 0.04. When considering a production of 50 thousand boxes per month, it is palpable as a result the conception that just with the implementation of this simple addition of function to a material that would be discarded in the production cycle, besides avoiding an inadequate waste management and an accumulation of materials improperly discarded in landfills, it also brings a saving of about US\$ 24,000.00 for the company per year.

Therefore, the maxim that “waste is nothing more than raw material out of place” is proven.

During the process I was present from the start of the Project till its final, working in all steps in activities hands on.

6 | CONCLUSION

This work brings to me the opportunity to apply several concepts learned in classes and develop in floor of company, competences and skills of engineering professional, based

on the confluence generated by the bibliographical review, the field research promoted by the collection of data and experiences of partner companies in the segment, as well as on the empirical investigation on the others authors of this essay, demonstrated as a result the initiation of a transformation in the population's view of the Circular Economy theme, ranging from the micro company to the most knowledgeable CEO in the market.

The consumer market is progressively more demanding in selecting which company value their investment and help to maintain the sustainability of the planet, preserving the natural resources in the production cycle, minimizing the impact generated by the discarding and mitigation of the need for extraction of new inputs taken from the environment. In addition to the sustainable benefit granted to the planet, which will reflect significantly on society, the implementation and insertion of Circular Economy instinctively to the internal flows, is also able to promote a boost in its invoicing, from the economy provided in line with the profitability achieved due to the positive movement that had been promoted, and may even gain important highlights of real relevance to the agenda, raising and consolidating such a way, a consumer market even more reliable.

Finally, this case study presented its role in offering the necessary subsidies for companies inclined to adopt such practices, and can be applied due its simplicity and, synchronically, with the endless constructive return that can be achieved, as evidenced in the calculations and analyses based on the data offered.

Besides that, the implementation of this approach brings financial saves to the companies.

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