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# Increased sales numbers of the museumsshop of the Oceanário de Lisboa – Are they related to the restructuring of their business?

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## Abstract

In order to be well positioned for the future, the operators of the museum shop at the Oceanarium in Lisbon want to have an answer to their increased sales figures. In June 2018, the shop was completely renovated and brought up to date. In the same year, they also started to replace the first products with more sustainable ones. Was it a combination of both points or was one of the components the reason for the increased sales? Due to the Covid-19 pandemic, it is not yet possible to make a scientific statement about the sustainable products in connection with increased sales. Therefore, the research question is whether the renovation of the museum shop in the oceanarium in Lisbon has a statistically significant impact on the performance of the shop?

The impact analysis clearly shows that the renovation has a positive impact on the sales figures of the shop. The results were generated using the R package *CausalImpact*.

A fim de estarem bem posicionados para o futuro, os operadores da loja do museu no Oceanário em Lisboa querem ter uma resposta para o aumento das suas vendas. Em Junho de 2018, a loja foi completamente renovada e actualizada. No mesmo ano, começaram também a substituir os primeiros produtos por outros mais sustentáveis. Foi uma combinação de ambos os pontos ou foi um dos componentes o motivo do aumento das vendas? Devido à pandemia de Covid-19, ainda não é possível fazer uma declaração científica sobre os produtos sustentáveis em ligação com o aumento das vendas. Portanto, a questão de investigação é se a renovação da loja do museu no oceanário em Lisboa tem um impacto estatisticamente significativo no desempenho da loja?

A análise de impacto mostra claramente que a renovação tem um impacto positivo sobre os números das vendas da loja. Os resultados foram gerados utilizando o pacote R *CausalImpact*.

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# **1 Introduction**

## **1.1 Aquarium as part of the museum world**

The Aquarium is a special kind of exhibition. The oceanarium, that is the correct term, is a large scale aquarium, such as the Oceanário de Lisboa. In this form of museum, live fish and other inhabitants of the water are shown. It is an oceanographic museum, to classify it precisely (Hamid, 2010). For my theoretical part, my research is focused on all kinds of museums. Since an oceanarium is part of the museum world, conclusions can be drawn about it.

## **1.2 Challenge Description**

Since 2018, the operators of the museum shop have invested a lot of time and money in the reorientation of the shop. Due to the Covid-19 crisis as well as the Russian war against Ukraine, there were many unpredictable events in Europe. In order to be well positioned for the future, they wanted information about the shop's direction. They wanted to know what made the shop successful. Was it the complete reconstruction of the shop or the switch to sustainable products. Or was it possibly a combination of both.

## **1.3 Problem Statement**

Was it the conversion or renovation of the shop or the switch to sustainable products that brought success?

## **1.4 Research Question**

Did the museum shop renovation in the oceanarium in Lisbon have a statistically significant effect on shop performance?

## **2 Literatur Review**

### **2.1 Sustainable Consumption**

Santala, (2004) studied consumption behaviors in shopping centers. The findings indicate that a change toward strong sustainable consumption is primarily an ideological change: it involves a shift in issues such as mindset, values, and priorities. In this study, it was determined that these modifications lead to alterations in an individual's lifestyle and behaviors. Based on the findings, it appears that adopting sustainable consumption behaviors is primarily about thinking about others, caring for them, and taking responsibility for the well-being of others and the environment, as opposed to making a conscious decision to consume less: when we trust that there is enough for everyone and have empathy for others, we make sustainable decisions automatically. Based on the findings of this study, it can be assumed that a shift in ideology precedes sustainable consumption behavior. (Santala, 2004)

Piligrimiene et al. (2020) examined the determinants of sustainable consumption of consumers. The findings of their study revealed that respondents favored the promotion of green products and the use of other "engaging mechanisms" for promoting sustainable consumption. Social organizations could benefit from any consumer engagement initiatives, as research indicates that one-way communication about the harms of overconsumption and unsustainable consumption is not as effective as promoting sustainable consumption through more interactive means. (Piligrimiene, et al., 2020)

From literature review study by Bălan (2021) , the development of sustainable consumption cannot fall solely on the shoulders of consumers, who must exert pressure on producers and retailers to steer them toward sustainable production and offering. Due to their position in the supply chain at the interface with shoppers and consumers, retailers must also play a crucial role. (Balan, 2021)

Lamberz et al., (2020) studied the link between sustainability and consumer buying decision at point of sales. The results indicate that consumers with a favorable attitude toward sustainable foods engage with product information more thoroughly. (Lamberz, et al., 2020)

Zhang & Dong (2020) systematically assessed consumer purchasing decisions. Individual factors, product attributes and marketing strategy, and social factors are the three dimensions into which the factors influencing green consumers can be categorized, with relevant research on individual factors predominating. (Zhang, et al., 2020)

## **2.2 Increasing sales figures**

According to Buraga (2019) , given the amount of resources the stores in Portugal are currently utilizing, it can be confirmed that if best practices were implemented, they would sell 25% more products. By this the author means that the shops would sell significantly more if they had a defined corporate identity and followed it. This includes a specific shop concept and associated products as well as trained staff. (Buraga, 2019)

According to Hernandez & Miranda (2020), instead of perceiving repairability as a potential threat to their economic survival, companies should design business models in which repairability represents a new revenue stream and an enticing way to approach and better understand their customers and products. This shift will likely be prompted by new political directives and heightened consumer awareness. An increase in repair services could have significant effects on the economy, it must be noted. Through direct and indirect effects, it is estimated that a 1% increase in this sector would increase the EU Gross Domestic Product (GDP) by 7.9 billion euros. (Hernandez, et al., 2020)

## **2.3 Impact of Covid-19 and purchasing decisions**

The findings of Severo et al., (2020) indicate that the Covid-19 Pandemic is a significant factor in the modification of human behavior, which has implications for environmental sustainability and social responsibility. Notable is the fact that the Covid-19 Pandemic had the greatest impact on sustainable consumption, followed by environmental consciousness, and then social responsibility. Additionally, the perception of the Baby Boomer generation was more prominent in Portugal. (Severo, et al., 2020)

Sayyida et al., (2021) assessed impact of Covid-19 on retail sales. The results indicate that during the Covid-19 pandemic, webrooming and pure online shopping are the predominant shopping trends. In these nations, retail sales in physical stores account for more than 70 percent of total retail sales, while retail e-commerce sales account for less than 30 percent of total retail sales. This research is anticipated to aid marketers in enhancing their retail marketing strategies during the Covid-19 pandemic. (Sayyida, et al., 2021)

Esposti et al. (2021) examined the effects of the Covid-19 pandemic on the consumption habits of a sample of female Italian college students. The sample indicates that attitude, knowledge, responsibility, and fashion are positively associated with the intent to purchase sustainable products. In addition, the girls' willingness to purchase products with a low environmental impact demonstrates that the younger generation's awareness of ecological and social issues is

growing, as is their appreciation for brands that pay more attention to the environmental impact of the supply chain. (Esposti, et al., 2021)

## **2.4 Change in sales area**

Chebat et al. (2014) study indicates that the mall renovation has had no effect direct impact on consumer spending. The physical transformation of the shopping center will only be successful if customers perceive a more pleasant and harmonious shopping environment. As environmental psychology theory suggests, a favorable shopping environment will encourage customers to process more information and investigate further. The affective benefits of shopping are summarized by hedonistic and utilitarian shopping values. When consumers are satisfied with their purchases, they are more likely to spend more money. (Chebat, et al., 2014)

Additionally, According to Webber et al., (2018) remodeling strategies had the greatest positive impact with respect to the internal processes perspective. This perspective's indicators include the enhancement of service, the average duration of customer service, the implementation of new processes, and the deadline for service delivery. (Webber, et al., 2018)

Some conclusions can be drawn from the previous literature review. People do not directly want to consume less in the future. They want to consume differently. They want to be able to consume exactly enough so that the generations after us can consume the same. (Santala, 2004) This idea is also part of the concept of "conservation". A sustainable purchase decision automatically arises from this thought. It follows that a change in ideology is the first thing to happen, and from this a sustainable consumer behaviour emerges.

The Covid-19 pandemic also has an impact on consumer behaviour in terms of sustainability and social responsibility.

Through the literature review, it became clear that the retailer itself plays a decisive role in the development of sustainable consumption and is therefore analyzed in detail.

By analyzing the sales figures in connection with different factors, one tries to get results for success.

Was the change of products, the renovation of the museum shop or a combination of both the factors that guaranteed the success of the shop?

### **3 Theory**

#### **3.1 Museum shop - more than 2000 years old**

The invention of museum shops is not a modern achievement. The first museum souvenirs were mentioned in documents as early as 300 BC, or more precisely in the Hellenistic era. At that time, fragments from statues or buildings were sold to tourists. With this approach, the locals tried to prevent cultural tourists from breaking off small pieces from figures of the gods and their buildings. These were gladly alienated as souvenirs. At the same time, this first form of souvenir pieces generated good sales at the time. (Brock, 1997)

#### **3.2 USA - the pioneer of museum shops**

The first modern museum shops as we know them were located more than 2000 years later in the USA. These also were the first large and professionally run shops. A good example is the Metropolitan Museum (MET) in New York. Since the beginning of the 20th century, it has operated a majority of museum shops in its building at a high level. Shop openings at various museums followed throughout the country in the mid-20th century. This trend was established in 1955 with the founding of the Museum Store Association in Denver. The Association represents the interests of museums and primarily assists in the development of items for sale in museum shops. It also promotes further education or the transfer of know-how in the purchasing as well as distribution of museum shop products. The trend in the USA continues. Small modest shops have become large professional retail businesses. (Association, 1994)

#### **3.3 Museum shops in Europe**

At the beginning of the 1960s, the first great wave of museum shops was founded in Europe. The pioneers were France and Great Britain. Germany and other European countries increasingly followed in the 1980s. In this decade, shops were opened widely in most other countries. Before this time, mostly only catalogues, postcards or other small things were placed on rather boring tables and offered for sale. Sometimes there was also the possibility to buy posters at the cash registers.

Meanwhile, a large number of medium-sized and large museums now offer shops for museum articles. For a few years now, the proportion of museum shops at smaller museums has also been growing. The articles are widely spread and also include a variety of "book" and "non-book" articles. A wide range of experience has been gained. (Günter, et al., 2004)

Currently, museum shops should also deliver a message to the customer. (Association, 1994)

## **4 Goals and functions of museum shops**

The museum shop is primarily intended to be a sales space within a museum (the museum is regarded as an overall unit). In art museums, products such as collection catalogues, posters or postcards are sold there. In addition, in-depth literature, merchandise or licensing products find their place on the shelves and sales areas. In oceanographic museums, various simple items were sold in the past that were not aligned with the museum's message.

The shop within the museum can take on different sizes and orientations. The range goes from small additional areas to large-scale, multi-storey shops to so-called "off-site museum shops". These are also called "satellite shops" and are often found in pedestrian zones or other public places. (Leimgruber, 2006), (Günter, et al., 2004)

The guiding motive for establishing a museum shop is the service itself. It is a "must have" service. This includes all services that, from the customer's point of view, absolutely have to be provided in order to create a successful experience. So, the shop is part of the "overall museum experience". The museum shop can be listed in the category of so-called "value-added services". This means a secondary service in combination with a primary service (the exhibition in the Oceanographic Museum). (Leimgruber, 2006)

The results listed from the study show the three target components of a successful museum shop:

- Museum shop as part of the museum's performance policy (mediation and educational goals) Products, product selection
- Museum shop as part of the museum's communication policy (raising awareness, merchandise) Setting up the shop, furnishing
- Museum shop as a "profit enterprise" (economic goals)

### **4.1 Museum shop as part of the performance policy**

The museum shop as part of the performance policy refers to the mediation and deepening of certain museum contents. The aim of the shop should be to deepen the museum's message. In this case, the shop should have a further educational function and transport the statements from the exhibition to the customer one more time. (Borrus, 1999)

It has also been found that museum shops that mainly have products in their portfolio that have a high recognition value with the exhibition (the core product) achieve above-average sales. (Borrus, 1999)

In this case, the museum also manages the tightrope walk between profit and the exhibition itself. Because with the right products, education can be extended even after the visit to the museum.

#### **4.2 Museum shop as part of the communication policy**

The shop also plays an important role in communication policy. The visitor-oriented facility will contribute to the museum's name recognition and play an important role in this respect. (Klein, 2005) The focus is on two fields. The design of the sales area plays a central role (corporate design). In addition, qualified sales staff (corporate behavior and communications) should be an integral part of the museum shop's communication policy. (Kotler, et al., 1998)

- The brand "museum" or its content can be transported and strengthened by selling the right articles.
- The visitors' bond with the museum is extended and prolonged into the future through the right choice of products (marketing aspect)
- Packaging materials reinforce the corporate design and are a decisive factor in today's world
- Furthermore, museum shops promote people who need to be encouraged to visit museums, because the way something is conveyed is easier to bring closer.

#### **4.3 Museum shop as a "profit enterprise": additional source of income for the museum**

At the moment there are more than 40.000 museums worldwide (Zils, 2000). All museums in Europe combined are estimated to attract more than 370 million visitors a year (Creigh-Tyte, 1998). As already mentioned, the museum shop serves as a source of income for the museum. Due to the tense financial situation caused by various crises in recent years (Covid-19, Ukraine), the importance of the shops for the museums is growing. The financial situation can be eased by the income generated from the sale of the articles. In addition to direct investments for the shop, the income from the shops is also used for budget consolidation or maintenance costs for the exhibition. (Günter, et al., 2004)

The strategic combination of an education-oriented (with a mediation task) shop offers with commercial as well as entrepreneurial know-how can lead to a financial success. (Günter, et al., 2004)

To evaluate the performance of a museum shop, it is important to know how much turnover is generated per museum visitor. The average turnover per visitor in America is 1,70€. (Leimgruber, 2006)

This value can serve as a basis for comparing the success of Portuguese shops. In addition to the turnover per visitor, the turnover per square metre can also be used as a valuable measuring instrument. In the USA, for example, the value is around 1,500€/m<sup>2</sup>. This value should also be aimed for by our shop. Museumsshop können schätzungsweise bis zu 5% der Gesamteinnahmen des Museums erwirtschaften. (Günter, et al., 2004)

This makes the museum shop the most important source of secondary income for a museum. The bottom line is that it is crucial that the shop calculates all costs, such as the staff, the purchase of the products, the storage, and the operating costs. Under no circumstances should the shop be a minus business for the museum. It should contribute to a balanced budget.

## **5 Current trend and prospects: Commercialisation or further education of museum shops**

With the opening of the museum in 1998, the museum shop was also opened. The shop was very simple and had no well thought-out concept. Only a small number of different products were sold. In June 2012, the shop was leased to an American company named Event Network. For the Americans, only the maximum profit was in the foreground. There was still no connection between the museum and the shop. Under the management of the American company, no sustainable products were offered and little thought was given to a meaningful and coherent product policy.

In order to understand the restructuring of the shop of the Oceanário de Lisboa, the general trend in museum shops must be briefly explained. The museum shop has become a symbol of the discussion about the "commercialisation" of art, culture or other goods, such as the sustainability of the world's oceans in the present example. At this point it must be said directly that both sides, i.e. pro commercialisation and pro further education, should basically be proved right. Accordingly, the truth or the current position of museum shops lies between the two fronts. The prejudice of commercialisation applies to many museum shops. In our case, however, we will distance ourselves from it. Behind the museum shop of the Oceanário de Lisboa you will find a sustainable concept with a certain message. (John, 2000)

In other shops, there are a variety of items which are more reminiscent of gift shops and most of the items have no direct connection to the exhibition. Moreover, poorly organised shops, as they are to be found in a large number, can neither make a satisfactory contribution to the consumption policy nor to the museum's mediation policy.

The right products have a great positive influence to differentiate themselves from other "normal" museum shops. (Hütter, 1997)

There is also the danger that the main product, i.e. the museum with its exhibition, as well as the exhibits on display (in our case the animal world under water), can be pushed into the background if the museum shop does not match the museum itself.

This problem arises from the lack of integration into the general marketing concept, no synergy in the museum objectives and in the everyday museum work (changing exhibitions or special themes in the museum).

The result is that the products of the museum shops are often not in harmony with the values of the museums. This harmony is often not sufficiently tested, as there is often a lack of financial resources.

However, after a number of negative examples, in this paper I would like to come to a large part of positive possibilities and what brings success to museum shops.

A museum shop as a component of the "overall museum experience" can not only bring image effects, but also achieve advertising and teaching effects. As mentioned above, appealing merchandise articles play an important role.

In our case, the museum shop should take on the very important role of education in addition to its commercial role. The shopper should take the conveyed concept of sustainability from the museum to the gift shop and anchor it.

If this alignment of parallel focus succeeds, it can be expected that the museum shop will generate satisfactory income. How this balancing act can work or whether one should rather focus on one thing is evaluated in the following.

In this context, the gift shop stands as a motor to approach the thematic complexes of the museum and to contribute another important part of the transmission to the visitor.

The path from a conventional museum shop to a modern high-quality shop was completed through the reorientation (renovation and product range).

## **6 Oceanário de Lisboa**

The oceanarium in Lisbon, or Oceanário de Lisboa as it is called in Portuguese, was opened in 1998. It is currently the largest indoor aquarium in Europe. It was built for the 1998 World Expo and was considered the main attraction among visitors. It is built on water and is located on the river Tagus in the capital Lisbon. 8000 sea creatures live in the museum's permanent exhibition and it contains 7 million litres of salt water. In addition to the permanent exhibition, smaller exhibitions on various themes change at different intervals. The Oceanário is visited by about 1 million people every year and is Portugal's most popular cultural attraction. The number of visitors has dropped sharply due to the Covid-19 pandemic. I will come back to this in detail later in the case.

As an aquarium with the highest standards, it strives to continuously develop educational activities to stimulate visitors to learn more about the oceans and marine species. The Oceanário also focuses on its mission and tries to draw people's attention to current environmental issues. In this sense, it works with various institutions to promote the sustainability of the oceans by supporting scientific research and projects to preserve marine biodiversity.

The permanent exhibition features numerous species of penguins, jellyfish, corals, octopus, fish, amphibians and plants.

A group of sea otters also lives in the exhibition.



*Figure 1: Gift shop in 2015 (1)*

From 2013 until the beginning of 2018, the museum shop was run by an American company. It is easy to see in Figure 1 that there was no connection to the exhibition. The majority of the products came from Bangladesh at that time. There was no approach to sustainable products. The assortment was not very differentiated and, like the entire shop, had no relation to the exhibition. The colour selection was related to the colour white and not harmonious with warm colours related to the museum.

## **6.1 Conservation as a guiding principle for the entire museum**

Conservation is considered a guiding principle for the entire museum. But what exactly does conservation mean?

Nature conservation refers to all measures to preserve biodiversity. This includes measures for the protection of species and the restoration of disturbed ecological relationships and habitats. (The Oceanário de Lisboa, 2020)

At Oceanário de Lisboa the main aim is to draw attention to the protection of the world's oceans and all the creatures that belong to them, and to explain as much as possible to the visitors.

## **6.2 Museum shop Transformation 2018: Renovation and start of conversation to sustainable products**

### **6.2.1 The reconstruction of the Oceanário de Lisboa museum shop**

Continuous improvement and adaptation are the prerequisites for growth and success for any company. To meet the requirements of a modern and sustainable museum shop, the shop was completely renovated in June 2018. In order to meet their own requirements, as well as those of the visitors, a new overall concept for the shop had to be created. The operators of the oceanarium understand sustainability as the process of continuous improvement. This process

should take place in step with the protection of the oceans as well as the environment. The museum shop before the renovation was decorated simply and without much thought.



*Figure 2: Gift shop in 2016*

Figure 2 clearly shows that there is no concept behind the layout of the sales floor. Furthermore, Oceanário believed that the visitor quickly notices that not enough time was taken to arrange the products in a meaningful way. The lighting technology was outdated and did not invite the visitor to buy something or to review the museum visit. This was one of the reasons why the operators decided to rebuild and restructure the shop.



Figure 3: Gift shop in 2015 (2)

Figure 3 clearly shows that before the renovation, some of the articles were simply placed on the shelves as if on a basar. In addition, everything was painted a monotonous white. The whole thing looks more off-putting than inviting to the visitor.

The design of the salesroom as part of the advertising for the products can be considered under the aspect of advertising and sales psychology. The effectiveness of advertising lies in the subconscious. The message must be received and understood by the recipient with all organs of perception. The aim is therefore to create a "positive perceptual climate", whereby information is better processed via the subconscious and a connection to a brand or a company is created that evokes the desired memory when the advertisement is viewed again. (Kroeber-Riel, et al., 2011) The pleasure of visiting the museum is recaptured and followed up when entering the museum shop.

In the museum shop, this has been achieved very well with the renovation and redesign of the sales rooms. Through an appealing presentation of the products, showcases, shelves and sales islands, the attention of the customers is increased and an incentive to buy is created. The colour white dominates here. In addition, the material wood has also been deliberately chosen, which is associated with sustainability in addition to the sustainable sales goods. Here, an aesthetic

effect of advertising is deliberately achieved and a positive sales atmosphere is created with visual features. The effect can be seen in figures 4,5,6 and 7.

The light-dark contrast is also important, which can highlight the products to a certain degree. (Felsler, 2015) Here one can see the design of the ceiling in the colour blue/green and the design of the sales areas in light colours white and light brown. A continuity in the colour design of the sales rooms strengthens the perception for the products and thus leads to an increase in sales success.



*Figure 4: Gift shop 2020 (1)*



Figure 5: Gift shop 2020 (2)



Figure 6: Gift shop 2020 (3)

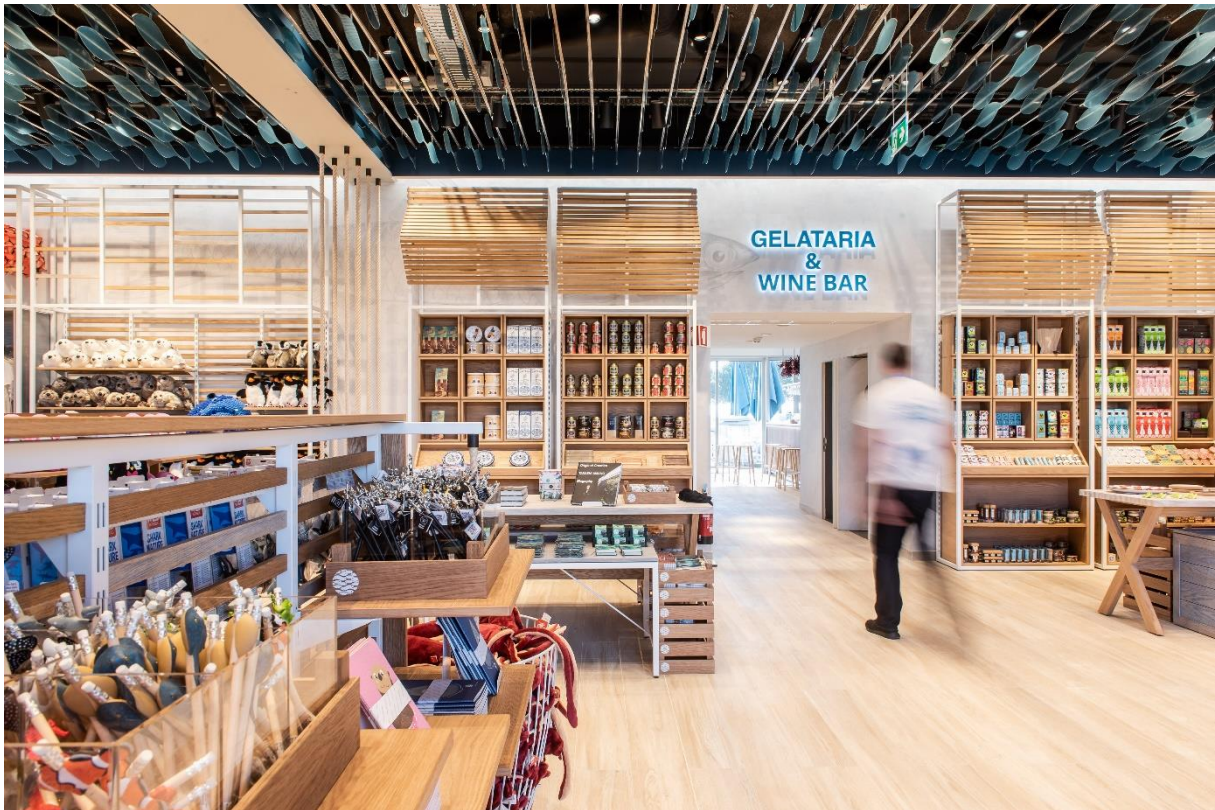


Figure 7: Gift shop 2020 (4)

### 6.2.2 Product change

At the beginning of 2018, the first ideas came to replace the existing items in the shop with sustainable products. Otherwise, it would not be possible to carry the message of the oceanarium further. For museums, it is important to build a positive and strong image, and to adapt their product and their associated values to the different sectors because Museums cannot be all things to all people (Kotler N. a., 2001). Because the products we buy and sell are one of the biggest problems for sustainability on our planet. When choosing a sustainable product, the environment for the museum shop is in the foreground. These should be able to have a much lower environmental impact compared to the old products. A sustainable product uses sustainable materials, is produced sustainably, and transported sustainably to the respective location. The durability as well as the possible disposal of the product is also crucial.

In addition, the products are arranged without a system and sometimes have no relation to each other. Furthermore, it should be mentioned that the products rarely have a real connection to the museum's message. Namely, the sustainability of the oceans and how to promote it.

Many people prefer the more sustainable option when buying products. Therefore, many companies are also confronted with the issue of sustainability and deal with it. Thus, a form of "green marketing", also called sustainable marketing or ecology-oriented marketing is applied

in the entire marketing process, which aims to identify, awaken, and satisfy the needs of customers in a profitable but also sustainable way. (Felser, 2015)

The conversion of products to sustainable products is the most important part of the marketing mix in green marketing, as the environmentally oriented buyer needs are satisfied in the long term. Existing products are to be improved or extended or, if necessary, completely removed from the market. (Kroeber-Riel, et al., 2011)

The Utopia Study 2022 states that 61% of those surveyed "would like to see more information about the sustainability commitment of companies on products". This result shows that green marketing can increase the demand for sustainable goods. (Kleene, 2022)



*Figure 8: Gift shop Checkout in 2020*

A transparently communicated sustainable product range will engage the customer and signal that the company wants to take responsibility for the environment. A higher price for products is thus also understandable. (Greipl, 2021)

In addition, the products are arranged without a system and sometimes have no relation to each other. Furthermore, it should be mentioned that the products rarely have a real connection to the museum's message. Namely, the sustainability of the oceans and how to promote it.



*Figure 9: Gift shop products*

Due to the Covid-19 pandemic as well as the war in Ukraine, the available data are not sufficient to scientifically investigate a possible connection between the increased sales figures and the sustainable products. With further data in the coming years, it will be possible to examine this trend and check for a possible connection. This is also the reason why the renovation of the shop was examined in the methodology (chapter 7 and following).

### **6.2.3 Google reviews**

Another indicator of customer satisfaction with the new product portfolio is Google reviews. For ease of evaluation, I have picked out some very good and one bad review as examples. We can see that the change of products might have a positive impact on the museum experience.



Filip Dunajewski  
4 Rezensionen



Great exposition but after all the anti-plastic pollution stuff you will enter big **shop** with toys made in China 🙄

Figure 10: Review before the change

The evaluation of the exhibition seen in figure 10 is very meaningful but as well just a highlight. The visitor is disappointed that after the exhibition the museum shop conveys exactly the opposite of what was learned in the exhibition.



Stephanie Cazel  
Local Guide · 19 Rezensionen



Not sure the seasonal exhibit was worth it because of how many kids were around (go early I would recommend), but the entire aquarium was great. The whole thing is central around one large tank, with smaller exhibits for each part of the world for otters, penguins, etc. The main aquarium is awesome, but you'll get some bottle necking right at the beginning. Would recommend waiting til you are halfway around to get a good look as the crowds die down (as it's a different view of the same tank from 8 different spots. Also impressed by the gift **shop**-it's focused entirely on conservation.

Figure 11: Review after the change

In the last sentence of the evaluation, one can see the clear transformation of the museum shop. The shop is linked to the exhibition and should carry the feeling to the end. For sure at this moment is not possible to say that there is already a trend at the comments on google. But they are going in the right direction. In the future, Google comments should be viewed and evaluated regularly. Together with surveys to visitors, valuable information can be gathered.

#### **6.2.4 Covid-19 pandemic March 2020**

The Covid-19 crisis has brought unpredictable challenges for the whole world. Since the museum shop at the oceanarium was of course also affected by it and the analysis of sales figures is also affected by it, I briefly discuss the crisis in this chapter.

##### *6.2.4.1 General Overview*

The Covid-19 pandemic, better known as the coronavirus pandemic, is an ongoing global pandemic of coronavirus disease. The new virus was first identified in Wuhan, China in 2019 in mid-December. The World Health Organization (WHO) designates 30 January as the official day of the outbreak and also the international health emergency. On 11 March, the WHO changes the status to pandemic. (Wikipedia, 2022)

##### *6.2.4.2 Effects on the museum industry*

The pandemic triggers severe social and economic problems worldwide. These include the biggest global recession since the Great Depression in the 1930s. In most countries around the world, educational institutions, entire corporations as well as public sectors are partially or completely closed. Most cultural events have been cancelled or postponed indefinitely in 2020 and 2021. In April 2020, the Oceanographic Museum had to close completely. Accordingly, the museum shop was also closed. Due to stricter entry regulations, the entire tourism industry worldwide has suffered. As a result, significantly fewer visitors have visited the museum.

## 7 Method

The method section is divided into four sub-chapters. First, the data at hand will be examined and explored, describing the timeline from 2017 to 2022. Then, the methodological approach will be discussed and control variables introduced. Finally, the obtained results, both the main analysis with *CausalImpact* as well as additional analyses - using individual product categories, time periods, and methods - will be presented.

The analysis relies heavily on the R package *CausalInference*. It is perfectly suited to give answers to the research question because it enables causal inference about the effect of an intervention on a time-series variable. In our case, this response variable is the performance of the gift shop. The package uses Bayesian structured time-series models to calculate a counterfactual, an estimation of how the response time-series would have evolved if the intervention - in our case the renovation of the gift shop - had not happened. The model is supplemented with control variables to account for potential biases and increase the likelihood of isolating a causality.

In comparison to other methods suited for time-series data like panel regression, this approach offers multiple advantages. First, the results obtained from the *CausalInference* package precisely quantify the relative and absolute effect of the event (in this case, the shop renovation) on the data, whereas results from a panel regression would be more limited in their depth. Second, the *CausalInference* package calculates both incremental and cumulative effects and visualizes them in custom plots. And third, it is specifically tailored to questions of causal inference. In general, panel regression methods are used to estimate the relationship between two variables in a fixed panel of individuals or entities and are not specifically designed for causal inference since they may not provide as robust or accurate estimates of treatment effects. Therefore, this analysis is exclusively focused on answering the causal inference research question at hand using the *CausalInference* package.

### 7.1 Data description: Shop performance over time (2017 to 2022)

The data at hand can be split into monthly and yearly shop performance data. The yearly dataset, as opposed to the monthly data, includes the rate of sustainable products within the performance metrics. The time period in both datasets reaches from June 2017 to September 2022. The performance metrics used for both monthly and yearly data are number of units sold, overall revenue, absolute margin, and relative margin.

Figure 12 shows the development over time of the normalized equivalents (between 0 and 1) for units sold (blue), overall revenue (green), and absolute margin (red). The progression between the three metrics is very similar. Performance of the shop is clearly driven by seasonality, with the summer months accounting for the best period of the year. Since the beginning of COVID in early 2020, performance has dropped considerably compared to the previous years. 2022 has shown some relief, however the pre-COVID level has still not been reached.

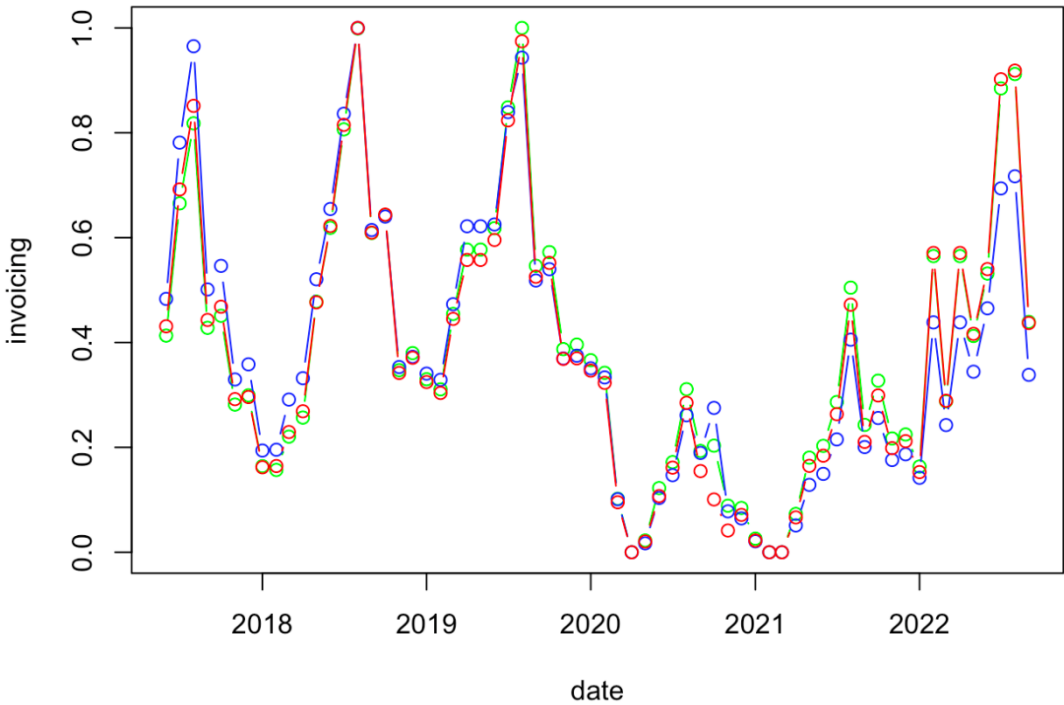


Figure 12: Shop performance development: Normalized time-series data of units sold (blue), overall revenue (green), and margin (red). Source: Oceanário de Lisboa

While the three normalized metrics show very similar progression, two things stand out: First, the difference between units and revenue/margin at the 2017 peak is unexpected given that all three metrics align at the 2018 and 2019 peaks. While units sold were similar in all three years, revenue and margin showed a relative increase in 2018 and 2019 compared to 2017. This suggests that product prices might have been increased at some point between the 2017 and 2018 peaks.

Secondly, the differences between units and revenue/margin during multiple months of 2022 stand out as well. This time, the relative number of units is lower compared to revenue and margin. The gap is widest at the peak of 2022, where the graph seems to suggest that compared

to the 2017 peak, more revenue/margin had been achieved despite a far lower number of units sold. Again, an increase in prices could be the explaining factor.

To investigate this further, an orange line representing the normalized revenue per unit is added to the graph. Given the assumption that similar proportions of product categories were sold, it suggests that prices per unit increased over time.

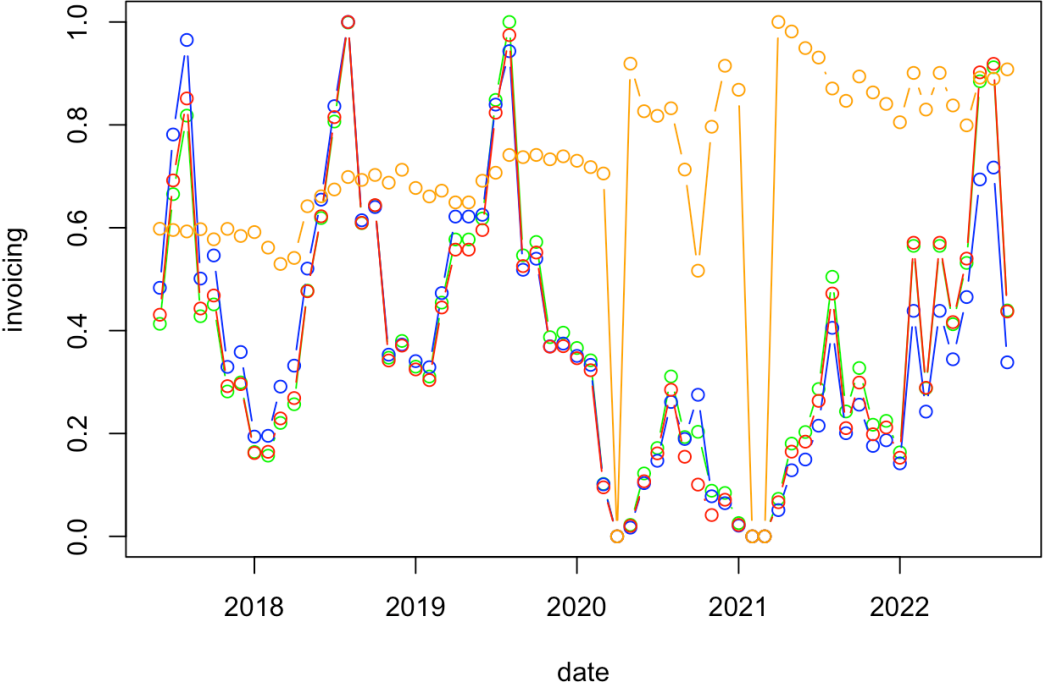


Figure 13: Shop performance development: Normalized time-series data of price per unit (orange), units sold (blue), overall revenue (green), and margin (red). Source: Oceanário de Lisboa

Overall, shop performance appears to have been mainly affected by two factors: Seasons—with peaks in summer and troughs in winter—and Covid-19. Before Covid-19 hit in 2020, the fluctuations from 2017 to 2019 were relatively even, with August being the peak month every year. The Covid-19 pandemic has had a huge negative impact on performance in both 2020 and 2021. The museum was even closed for a total of three months (April 2020 and February to March 2021; all missing data was replaced with zero). The current year 2022 has been shaky as well, but performance—especially using the revenue/margin metrics—has come close to pre-pandemic peaks this summer.

The gift shop has been moving towards more sustainable products since 2018. Figure 14 shows the percentage of sustainable products sold over time. In 2022, close to 100% (97%) of the

shop’s revenue was achieved with sustainably sourced products. The larger amount of sustainable products might be a reason for the hike in product prices.

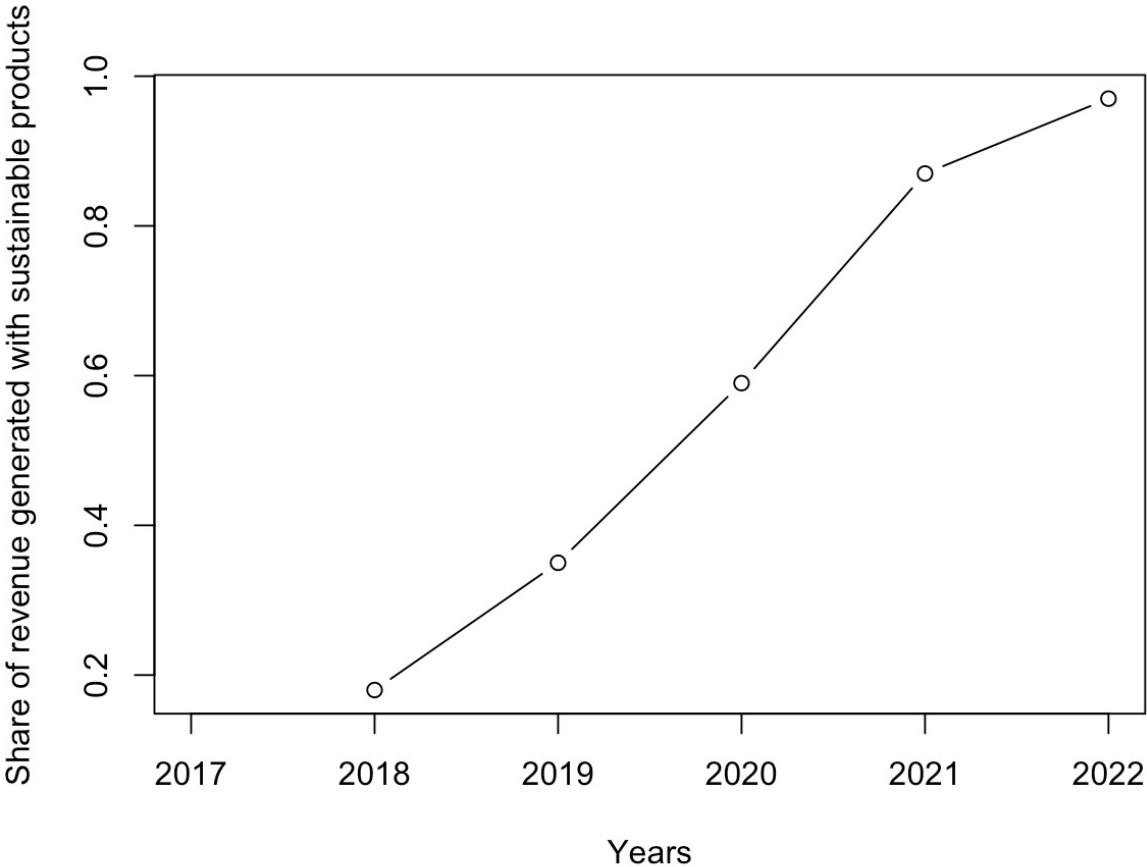


Figure 14: Share of revenue generated with sustainable products, 2017 to 2022. Source: Oceanário de Lisboa

According to museum representatives, The intention behind the gift shop renovation was to make the store and its products more appealing to customers, in order to ultimately improve performance. To investigate if this chain of effects has in fact materialized, this analysis will look at how the performance data has changed over time, focusing on a potential effect of the intervention by the renovation after May 2018.

### 7.2 Statistical approach

The research objective at the core of this analysis is to find out to what degree the strategic turnaround of the gift shop—starting in June 2018—has had an influence on its performance. Since the shop renovations were quite substantial and also involved a switch towards more sustainable products, the research hypothesis assumes that the makeover has had a statistically significant positive effect on performance. The calculation of statistical significance will also be presented in the following.

When looking at the performance development over time as shown in Figure 12, the impact of Covid-19 appears quite drastic; while shop performance had mainly been characterized by seasonality before the end of 2019, it takes a huge hit and becomes very irregular for most of 2020 and 2021, and still shows irregular patterns in 2022 compared to the pre-Covid-19 years. It's likely to assume that this development starting in 2020 is almost entirely explained by the pandemic and its consequences. In other words, to investigate the effect of the renovation on shop performance, one would need to account for this enormous external bias.

To answer the research question in the most statistically valid way, the main analysis will be limited to a post-renovation-period of 19 months from June 2018 to December 2019. This period is assumed to be largely unaffected by such big macroeconomic events as the pandemic and can be considered a quite normal performance cycle.

Results using the entire post-renovation time period, including the pandemic, will also be presented in section 7.4.1, but won't be looked into as deeply as the main analysis.

Similarly, alternative statistical methods—including the use of panel regression and comparing pre- and post-period averages—will be reported in section 7.4.2.

The main analysis revolves around a causal inference model built with the R package *CausalImpact* (Brodersen KH, 2015). It assumes a pre-period from June 2017 to May 2018 (12 months) and a post-period from June 2018 to December 2019 (19 months). Using pre-period performance data, the method forecasts the expected continuation—i.e. the counterfactual—of that performance in the post-period. It also accounts for the effect introduced by control variables, which are described in section 7.2.1. The method then compares actual post-period performance to its forecasted data, yielding a difference in relative and absolute terms within a 95% prediction interval. Since the research question asks to evaluate the effect of an event retrospectively and data on a theoretical control group is inaccessible, this approach is the method that comes closest to causal inference.

The model takes a performance indicator in time-series format, e.g. overall gift shop revenue, as its response variable. This vector includes the pre-period (the period before the intervention) and the post-period (the period after the intervention). The dates corresponding to pre- and post-period are then specified and also given to the model as separate arguments. Additionally, two control variables are appended to the response vector in the same time-series format. In this case, all data is monthly. The model uses both the intervention date (derived from pre- and post-

period dates) as well as the two control variables to compute a counterfactual (and a prediction interval around it) of the response in the post-period. This counterfactual represents the expected continuation of the response after the pre-period, assuming that the intervention had not taken place. The difference between the counterfactual predicted by the model and the actual post-period continuation of the response corresponds to the absolute effect of the intervention. Statistical significance of this effect is given if this difference is large enough, specifically if the predicted.

### **7.2.1 Control variables: Tourists in Lisbon and museum visitors**

The performance development over time as shown in Figure 12 gives clues about which external factors might influence shop performance. First, the peak during August of each year as well as the trough in every winter corresponds to tourist levels in Portugal, particularly in Lisbon, which could have a big impact on the number of gift shop customers. It is also plausible that tourists spend more money on gift shop souvenirs on average compared to locals.

Second, the number of museum visitors directly corresponds to the number of potential customers of the gift shop, as visitors usually pass the gift shop as part of their visit.

These two control variables—the number of nights booked at Lisbon accommodations (as a proxy for Lisbon tourist levels) and the number of museum visitors—were therefore included as control variables, so that their impact on shop performance is accounted for by the model.

The model assumes that the covariates are not themselves affected by the intervention (i.e. the shop renovation themselves), which is the case.

The monthly tourist data was sourced from the official Portuguese statistics database, while the monthly museum visitor data was sourced from the museum itself.

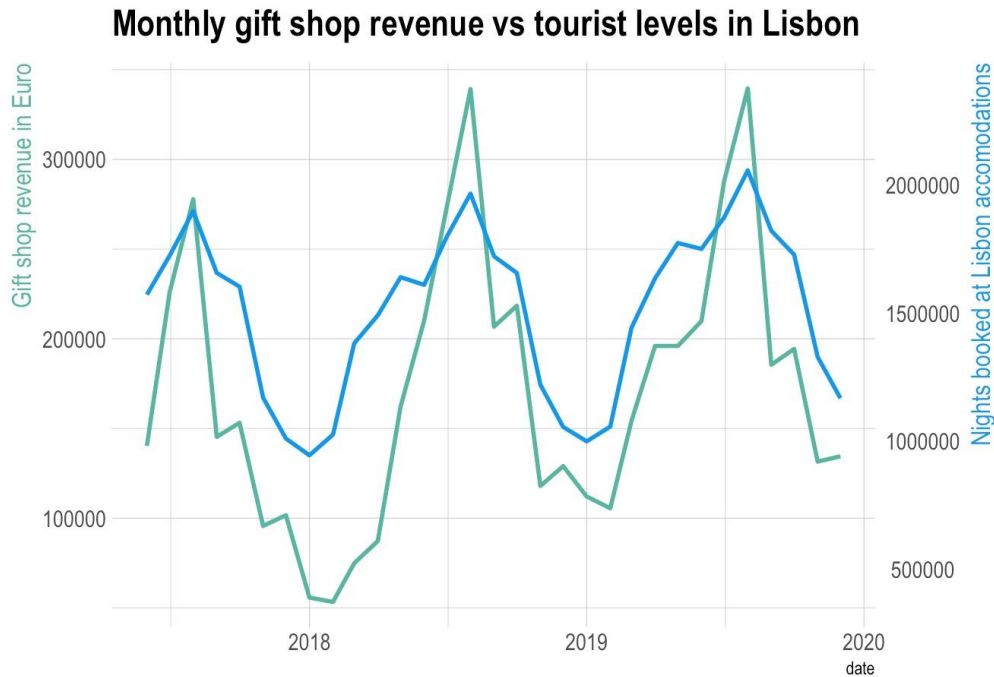


Figure 15: Monthly gift shop revenue vs tourist levels in Lisbon



Figure 16: Monthly gift shop revenue vs museum visitors

Figure 15 and 16 show the monthly overlay of the revenue data with the amount of nights booked at Lisbon accommodations and the amount of museum visitors, respectively. Both figures use two different y-axes to enable comparison of absolute numbers.

The tourist levels in Lisbon appear to follow a very regular cycle, with peaks in August and around Easter. They are slightly increasing over the three years.

The amount of museum visitors follows a similar seasonal cycle, but seems to be slightly decreasing in the given timeframe.

Both figures use an overlay that intentionally matches the peaks in the summer of 2017, to be able to compare the development in 2018 and 2019 to a reference point. Visually, it appears as though the increase in gift shop revenue is driven by neither control variable. This could be a hint that the increase is due to some other factor; potentially the renovation. The next section will investigate this question using the aforementioned causal inference method.

### 7.3 Impact analysis: 2017-2019

#### 7.3.1 Overall revenue as dependent variable

The main causal impact analysis is conducted using overall revenue as the dependent variable and both museum visitors and nights booked at Lisbon accommodations as control variables. The pre-period spans from June 2017 to May 2018, while the post-period spans from June 2018 to December 2019. Figure 17 shows the three plots provided by the package. The dotted vertical line in gray depicts the intervention date (June 2018). The model estimates a positive effect of the intervention.

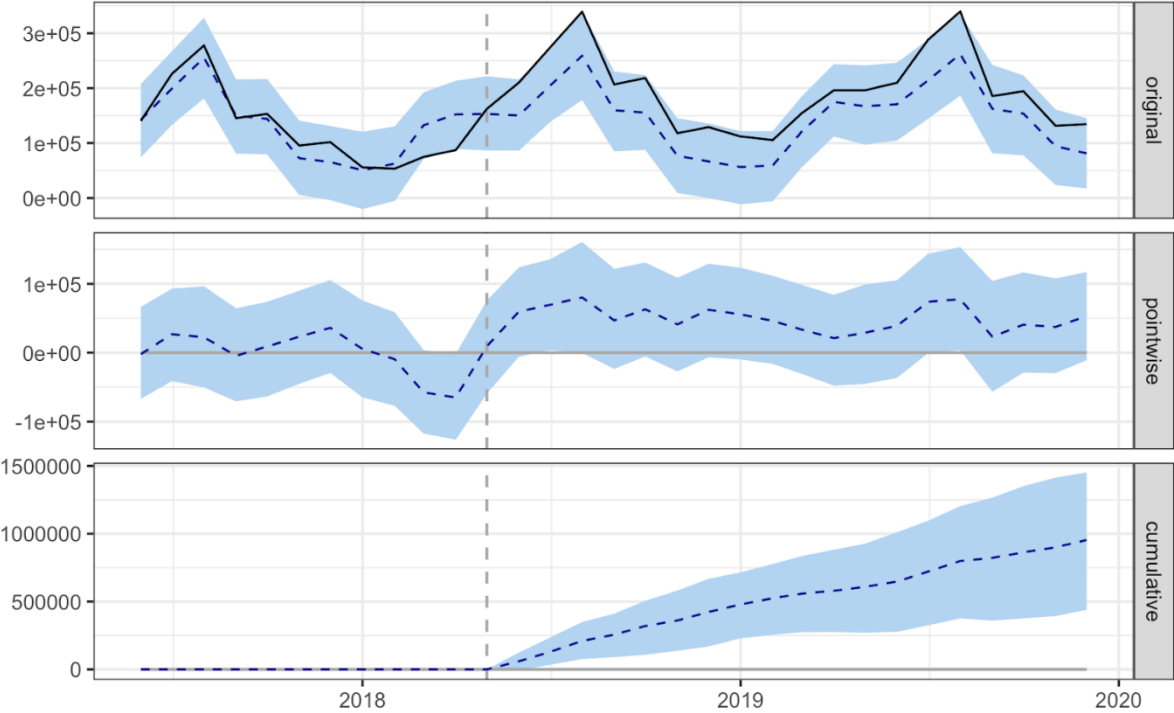


Figure 17: Overall revenue as dependent variable (1)

The first plot shows to what degree the actual sales data differs from the data predicted by the model, taking into account both the pre-period sales data as well as the pre- and post-period data of the control variables. The dotted blue line in the post-period reflects the forecasted sales,

with the blue coated area depicting a 95% confidence interval. The black line is the actual sales data. In the post-period, the actual sales data regularly lies above the predicted average, and even peaks above the confidence interval twice.

The second plot shows the predicted average monthly sales—the horizontal gray line—in comparison with the actual sales data, including a confidence interval. Again, it can be observed that the actual sales data surpasses the predicted data in the post-period.

The third plot adds up the gained differences between actual and predicted sales to a cumulative plot. Since the line is strictly positive, this indicates that the model estimates the impact of the invention to have a consistently positive effect.

The quantified effects seen in table 1 are as follows:

*Table 1: Quantified effects revenue*

	<b>Monthly</b>	<b>Cumulative</b>
<b>Actual</b>	196,981	3,742,647
<b>Prediction</b>	146,804	2,789,280
<b>95% CI</b>	[119,266 - 171,863]	[2,266,056 - 3,265,406]
<b>Absolute effect</b>	50,177	953,367
<b>95% CI</b>	[25,118 - 77,715]	[477,241 - 1,476,591]
<b>Relative effect</b>	35%	35%
<b>95% CI</b>	[15% - 65%]	[15% - 65%]

The model estimates the effect of the intervention on overall shop revenue to be quite heavy. The probability that the model estimates the effect to have happened randomly and independent of the intervention is 0.1%. The effect can be quantified as an increase of about 50,177€ in monthly sales, and 953,367€ increase over the entire post-period. This corresponds to a relative increase of 35%. This means that according to the model, the effect of the intervention can be quantified as an increase in monthly revenue by about 35%.

As mentioned previously, the price increases may also play a role in the rising revenue numbers over the years. That is why as a second step, the overall unit sales will serve as the dependent variable.

### 7.3.2 Overall unit sales as dependent variable

The model again includes the two control variables, now with overall units as its dependent variable. The plot output still shows a positive effect of the intervention, but it is much smaller compared to the model with revenue as dependent variable.

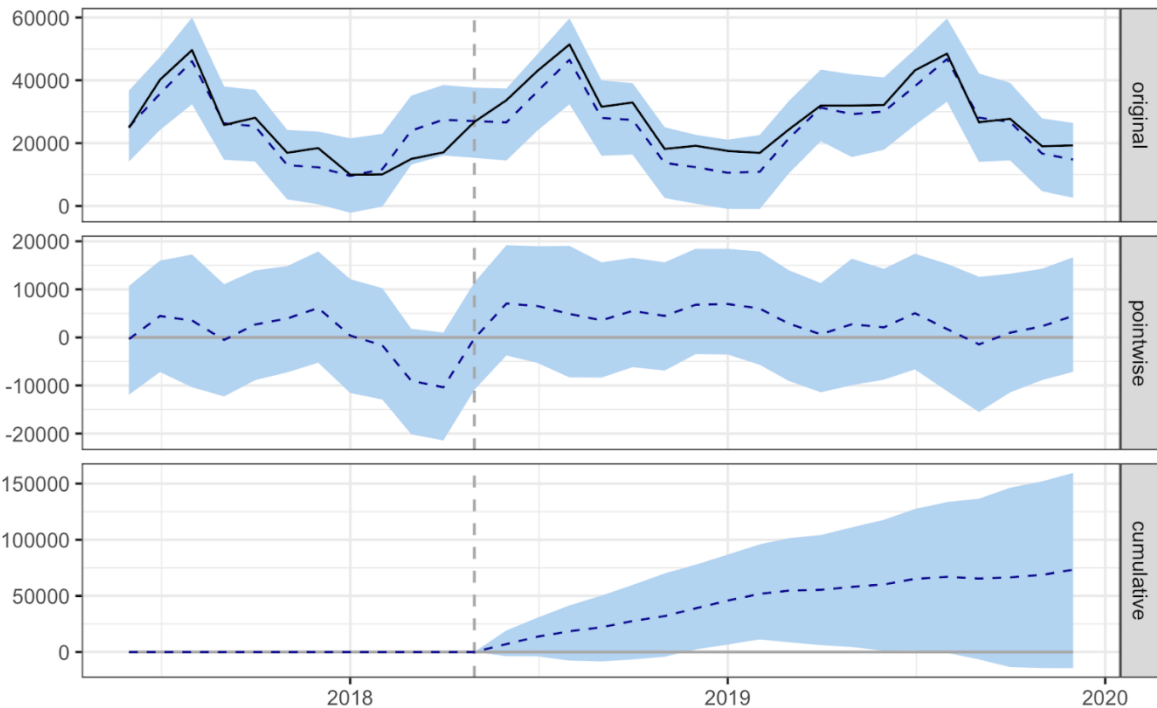


Figure 18: Overall unit sales as dependent variable

Table 2: Quantified effects unit sales

	Monthly	Cumulative
<b>Actual</b>	29,945	568,964
<b>Prediction</b>	26,089	495,693
<b>95% CI</b>	[21,519 - 30,603]	[408,855 - 581,455]
<b>Absolute effect</b>	3,856	73,271
<b>95% CI</b>	[-657 - 8,427]	[-12,491 - 160,109]
<b>Relative effect</b>	16%	16%
<b>95% CI</b>	[-2.1% - 39%]	[-2.1% - 39%]

The relative effect estimated by the model on a 95% confidence interval is 16%, which is less than half the relative effect of the previous model. This might reflect the effect that price increases had on the previous model.

### 7.3.3 Product category revenue as dependent variable

Table 3 presents the results of the same impact analysis using individual product category revenue as the dependent variable. The model predicts that the intervention has a negative effect on sales of the categories in red, a neutral or statistically insignificant effect on the categories in yellow, and a positive effect on the categories in green. For example, the green box next to the category Food means that the model predicts a statistically significant positive effect of the intervention on the performance of food products.

*Table 3: Individual product category revenue as dependent variable, statistically significant positive effect (green), no statistically positive effect (yellow)*

Accessories	Yellow
Toys	Yellow
Home and Decoration	Yellow
Food	Green
Stationary	Green
Adult book	Green
Children's book	Yellow
Plush toys	Green
Adult clothing	Green
Children's clothing	Green
Souvenir	Yellow

**7.3.4 Product category unit sales as dependent variable**

Similarly, the following table shows the effect in different product categories using category unit sales as the dependent variable.

*Table 4: Category unit sales as dependent variable, statistically significant positive effect (green), no statistically positive effect (yellow)*

Accessories	Yellow
Toys	Yellow
Home and Decoration	Green
Food	Yellow
Stationary	Green
Adult book	Yellow
Children's book	Yellow
Plush toys	Green
Adult clothing	Green
Children's clothing	Green
Souvenir	Yellow

The two Tables 3 and 4 show similar results for the product categories. The three categories Plush toys, Adult clothing, and Children’s clothing can be singled out as not only the most performative categories in general, but also the ones where the renovation seems to have had the biggest impact, both in revenue and units sold. Adult clothing seems to have seen the biggest increase in both revenue and unit sales, with a relative change of 93% and 75%, respectively. Again, these are relative changes that result from an impact analysis of the R package *CausalImpact*, using individual product categories as response variables instead of the summed up revenue as before.

**7.4 Further results**

**7.4.1 Impact analysis: 2017-2022**

*7.4.1.1 Overall revenue as dependent variable*

This causal impact analysis takes into account the entirety of the available data from June 2017 to September 2022. It again uses Lisbon tourism data and museum visitors as control variables, which is necessary to control the effect that the pandemic has had on the amount of gift shop customers, and shop revenue as its dependent variable.

Again, the model estimates a positive effect of the intervention. However, this time the model is more complex and results have to be taken with a grain of salt.

First off, the model actually predicts revenue to be negative for large parts of 2020 and 2021, which can be seen by the blue line being in the negative area in the first plot. This, of course, isn't possible, since we're using revenue data instead of overall profit data. The model therefore predicts that the gift shop outperformed expectations during the pandemic, even when it made no revenue at all. This is likely because tourism during that time declined at a sharper rate than gift shop revenue.

Despite these limitations, this analysis gives context to the shaky revenue data from 2020 onwards and puts it into perspective with regard to the simultaneously low tourism numbers. To answer the question of the effect of the store makeover, however, the time period until the end of 2019 is probably a more useful indication.

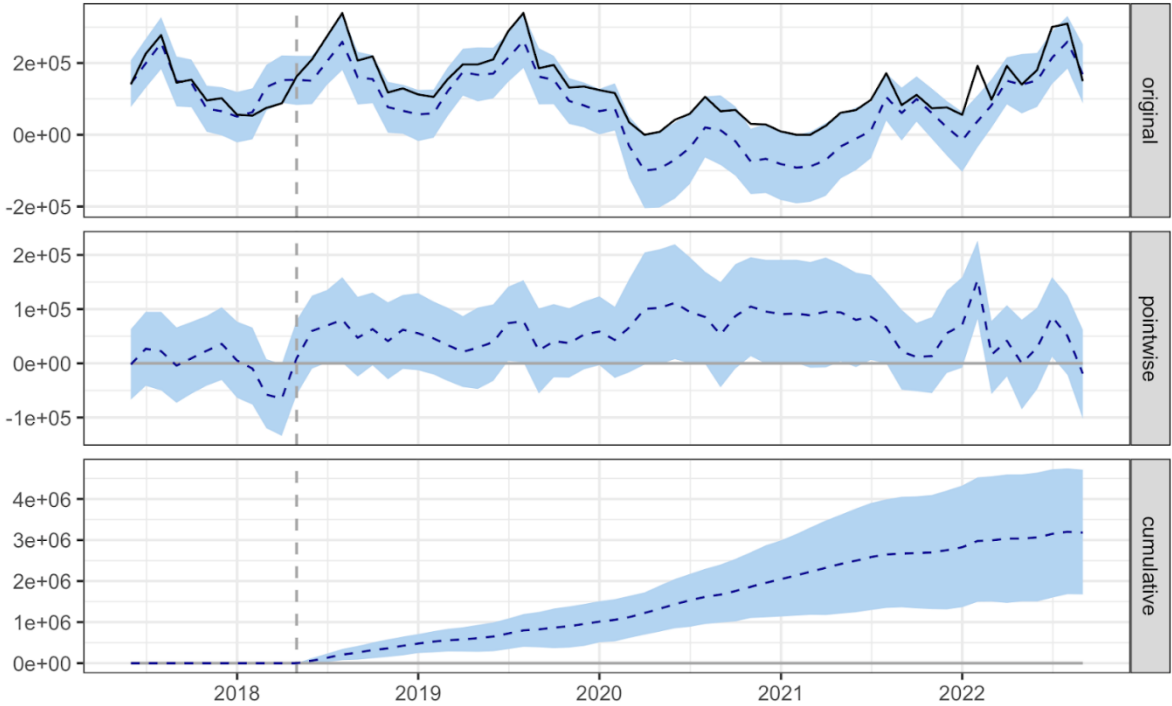


Figure 19: Overall revenue as dependent variable (2)

#### 7.4.1.2 Product categories as dependent variable

Table 5 shows again the results of the causal impact analysis for different product categories. The inclusion of the pandemic period seems to have lifted the effect for a few categories from negative to neutral. The top-performing categories—plush toys, adult clothing, and childrens’ clothing—remain in the positive effect range.

Table 5: Product categories as dependent variable, , statistically significant positive effect (green), no statistically positive effect (yellow), statistically significant negative effect (red)

Accessories	Green
Toys	Yellow
Home and Decoration	Red
Food	Yellow
Stationary	Green
Adult book	Yellow
Children's book	Yellow
Plush toys	Green
Adult Clothing	Green
Childrens clothing	Green
Souvenir	Yellow

#### 7.4.2 Panel regression

A panel regression is a way to estimate a regression model on timeseries or panel data. Within panel regression, one can generally distinguish between pooled OLS (ordinary least squares), fixed effects and random effects models. Pooled OLS models don’t account for subject-specific differences, which in our case translates to differences between product categories. This is why only fixed effects and random effects models are used. The best model can be evaluated with the help of a Hausman test.

A random effects model was fitted using revenue as the dependent variable and the binary variable shop (whether or not the new shop had been unveiled), the variable night (the amount of nights booked in Lisbon hotels), and the variable visitors (the amount of museum visitors) as independent variables. The results show that the independent variables are highly statistically

significant ( $p$ -value  $< 0.001$ ). The coefficient for shop is positive, which indicates that the effect of the unveiling of the new shop has had a positive effect on sales, across product categories.

## 8 Results

The research question of this study was: Did the museum shop renovation in the oceanarium in Lisbon have a statistically significant effect on shop performance? Shop performance was measured using either revenue, unit sales, or margin.

Comparing the three performance measures revealed a price increase across the product range over time, specifically following the opening of the renovated shop in May 2018. This was deduced from substantially higher revenues in 2018 and 2019 compared to 2017, but similar unit sales. Inquiring with the museum confirmed this suspicion.

Therefore, causal inference analyses using both revenue and unit sales as response variables were conducted to compare the effect of the renovation on performance. Impact analyses were performed using the R package *CausalImpact* from 2017 to 2019, with either revenue or unit sales as the response variable and both a proxy for the monthly number of tourists in Lisbon over time and the monthly number of museum visitors over time as controls.

The results of the analyses showed that there was a statistically significant difference between the actual performance data after the renovation and its counterfactual. For revenue as the response variable, the difference was much more pronounced than for unit sales as the response variable, where it was only borderline significant.

For revenue as the response variable, the absolute effect amounted to a monthly increase of 50,177€ (CI: 25,118 - 77,715), which corresponds to a relative increase of 35%. For unit sales as the response variable, the absolute effect amounted to a monthly increase of 3,856 (CI: -657, 8427) units sold, which corresponds to a relative increase of 16%.

The same analyses were repeated to compare individual product categories. Some product categories were omitted due to being dropped by the museum gift shop. Only four categories (Stationary, Plush toys, Adult clothing, and Children's clothing) showed significant effects in both the revenue and unit sales analyses. Plush toys, Adult clothing, and Children's clothing were not only the best performing product categories in general, but also benefitted most from the shop renovation.

Overall, these results suggest that the renovation of the museum gift shop of the oceanarium in Lisbon probably had a slight positive effect on its performance. In particular, the product categories Plus toys, Adult clothing, and Children's clothing seem to benefit from the change.

It is also possible that these categories benefitted from the move towards more sustainable products, although this relationship cannot be investigated with the current data.

It is important to keep in mind that part of the performance increase is due to an increase of product prices. However, the demand appears to have not dropped as a result. If anything, it even slightly increased.

Due to the shaky COVID-19 period, which followed after December 2019, only the period from June 2017 to December 2019 could be investigated. To substantiate the results, it is advised to incorporate new data as soon as the COVID-induced external bias has fully subsided. Since 2022 seems to still have had an unusual amount of fluctuations, 2023 might be more appropriate.

Based on the data at hand, this analysis attempted to answer the research question in the most statistically sound way possible. While limitations remain, the result of an overall slight positive effect of the renovation on performance seems to hold. The possibility of this effect being due to a different external factor is very unlikely.

## **9 Sales promotion campaigns**

### **9.1 Employees as success assistants**

The employed staff are in contact with the visitors throughout. It goes without saying that they should appear friendly. This includes greeting customers or noticing when they need help or advice. Of course, they should also be able to give information at any time. The staff of the museum shop must identify with the museum, the shop and their own work in order to guarantee a successful operation. The staff is the link to the visitors. In order to shape a short-term success related to employees into a long-term success story, an important issue needs to be constantly updated.

It is about the further training of the employees. Everyone should be informed about new items in the shop as well as trained. In addition, there should be an exchange about upcoming exhibitions in the museum. Long-term employees must be given the opportunity to continue their education in order to follow current trends.

## **10 Conclusion**

With the results described above, the research question can be answered without any doubt. The shop renovation of the oceanarium in Lisbon has a statistically significant effect on shop performance.

The sales numbers in the coming years will be very important for future analyses of the shop. Considering the new data in the following years, an increase in sales figures through sustainable campaigns might well be possible. This is where the shop operators should pick up. This also includes the training and further education of the employees described above.

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