

COVID-19 Impact on Tourism: The System Thinking Approach Applied to the Case of Portugal

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ABSTRACT

This work applies systems theory and tools to build a flexible framework for sustainable tourism in Portugal due to the Covid-19 impacts. The objectives are (1) to explore the cause-effect relationships between and among the variables involved; (2) to develop a causal loop diagram that resumes the role of tourism stakeholders and (3) to identify policy directions to enhance Portuguese tourism. Tourism recovery in the country will depend mainly on interlinked factors of economic, social and health fields. Its complexity requires new approaches in tourism research, such as system thinking models and testing tools such as neural simulation. As well as statistical data and tourism official documents, a panel of European specialists has been used. The proposed approach is innovative as it helps the integration of tourism theory with other fields, and outlines policy solutions to the situation in Portugal which can be dynamically adapted. A qualitative analysis pointed out how crucial are the policy making activities (rebalancing measures) counteracting the causes and negative consequences of the problem.

KEYWORDS

Tourism, System Thinking, Sustainability, Crisis Management, Recovery.

ARTICLE HISTORY

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1. Introduction

Due to the present pandemic, tourism management has raised safety and health policy issues as priorities around the globe. Widespread travel restrictions have caused a massive drop in demand and according to the UNWTO (2021) tourism suffered its deepest crisis in 2020 with a drop of 74% in international arrivals. The collapse of international travel represents an estimated loss of more than 11 times the loss from the 2009 global economic crisis.

In addition, markets had significant decreases in their overnight stays: in 2020 all main markets recorded decreases above 65%, especially the Irish (-89.5%), United States (-87.7%) and Chinese (-82.8%). In Europe, arrivals declined by 70% representing over 500 million fewer international tourists, while the Americas had a drop of 69%. Even in the early days of the pandemic, EU officials estimated that the European tourism industry was losing 1 billion € per month due to fewer arrivals from China. Every month, there have been significant decreases of stays in tourist accommodation establishments. Therefore, the latest UNWTO Panel of Experts survey showed a mixed outlook for 2021: almost half of respondents (45%) envisaged better prospects, while 25% expected a similar performance and 30% foreseen a worsening of results. The overall prospects for a rebound in 2021 have worsened. Most experts do not consider a return to pre-pandemic levels happening before 2023, with 43% of respondents anticipating recovery in 2023 but 41% anticipating 2024 or later. Regarding tourism experiences, experts forecast a growing demand for open-air and nature-based activities, with a higher interest in domestic tourism and local travel.

In this context, despite classical science having researched and reached great results through analytical thinking, more and more research has become intangible in order to deal with contemporary complex challenges (Jakulin, 2017; Gössling, Scott & Hall, 2021). Today, a systemic approach may be suitable to deal with complex questions, such as tourism in a global society. Several realities should be understood in a holistic way as Covid-19 has demonstrated that travel and tourism are sensitive to external disruptions. A system thinking approach, embedded in strategic foresight and scenario planning, is crucial to ensure long-term resilience and should be explored as a methodology to anticipate disruptions in the complex travel and tourism system (Postma & Yeoman, 2021).

Given the instability of this pandemic, a resilient approach to the future is necessary. Thus, this work establishes a framework to understand and manage complexity and adaptive system thinking applied to Portuguese tourism. It applies Systems Theory for building systems thinking on sustainable tourism to help: (1) explore the cause-effect relationship between and among the variables involved; (2) develop a causal loop diagram (CLD) that explains how tourism participants respond to the complex structure of tourism policy; and (3) identify policy actions for tourism recovery in Portugal and the mitigation of threats post Covid-19.

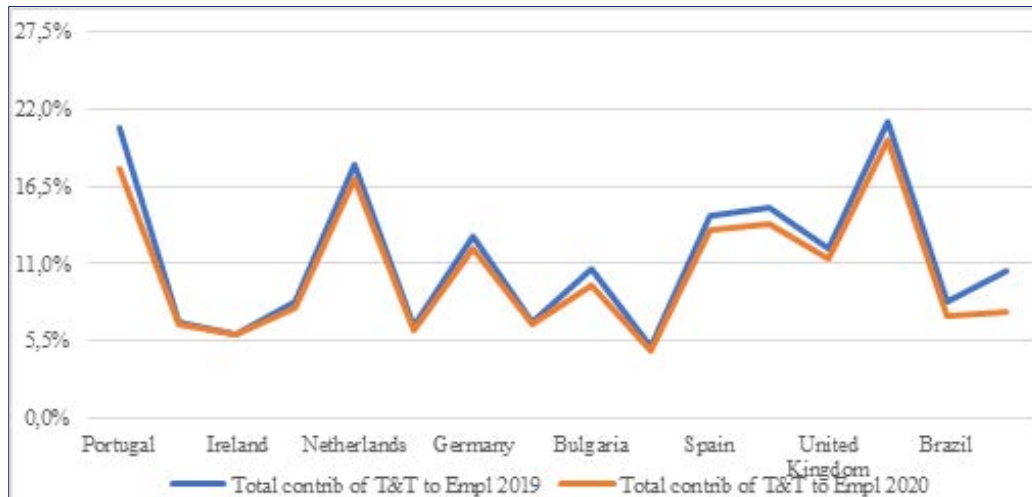
Its structure is as follows: section 2 presents the impacts of the pandemic on tourism sector in terms of employment, GDP, international vs. domestic visitor spend, and trust/security and raises the contribution of Systems Theory in searching for solutions; section 3 investigates the proposed methodology in terms of its origins and goals, and then applies it to tourism in Portugal; section 4 discusses results and outlines policy solutions for tourism recovery, including a new perspective from applying systems thinking approach. Finally, section 5 concludes the research referring limitations and future directions.

2. Literature review

In the past, the tourism industry bounced back from various crises and outbreaks (Novelli, Burgess, Jones and Ritchie, 2018). But today, in the aftermath of Covid-19, there is a perception that the future of tourism sector is uncertain. The OECD considers rebuilding tourism a priority, due to its importance for the global economy (OECD, 2020a). This sector must become more sustainable and resilient in the future. The Covid-19 pandemic, staying at the center of the world system, inflicted a major shock on global travel and trade and closely interrelates with both economic and public policy governance spheres. The economic impact is connected to the disease restrictions, whereas the policy governance is connected to the vaccines' development/distribution asymmetries as well as to the pandemic management within national states (World Economic Forum, 2021).

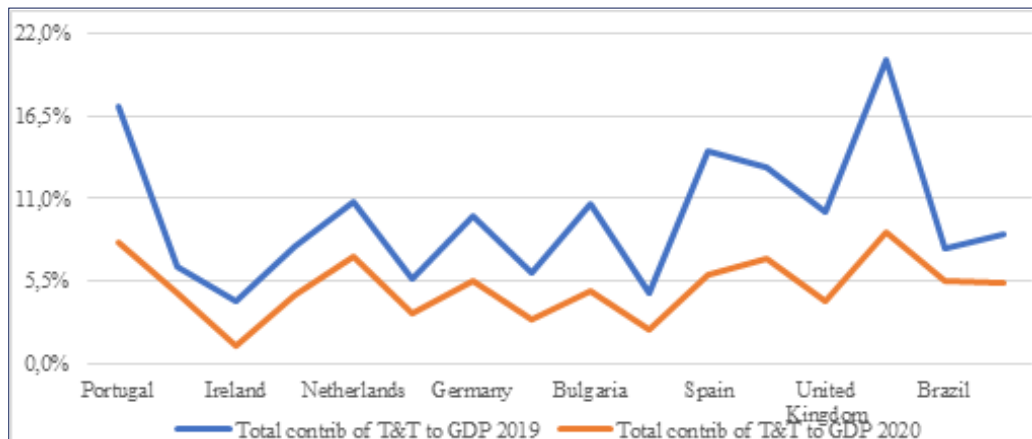
The unforeseen events, associated with the pandemic impacts, reinforce the need for research methods that deal well with the complexity and dynamics of tourism. Interactions between tourism systems and their environments is an area that requires deep research. For instance, during the pandemic, the global health system has proven to feed back into the tourism and economic systems with negative effects. The following charts show some of these effects on employment, GDP, and domestic vs. international spend (World Travel & Tourism Council - WTTC, 2021). From 2019 to 2020, there was a higher impact in GDP than in employment (figures 1, 2). Regarding the international vs. domestic visitor spend, figure 3 shows a considerable loss in international tourist spend.

Figure 1. Total contribution of travel & tourism to employment 2019-20

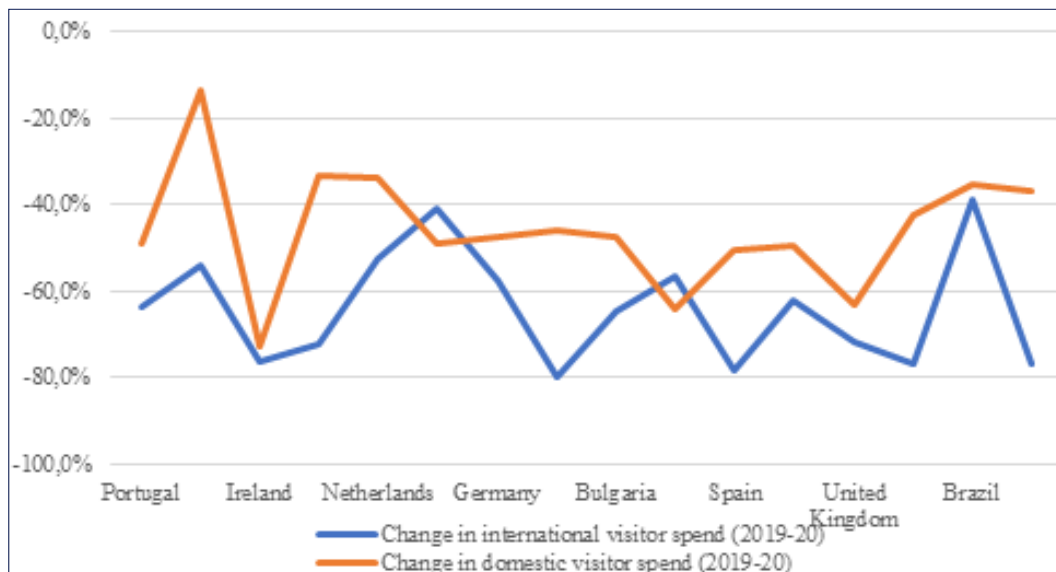


Source: WTTC (2021)

Figure 2. Total contribution of travel & tourism to GDP 2019-20



Source: WTTC (2021)

Figure 3. Comparison of international vs. domestic visitor spend (2019-20)

Source: WTTC (2021)

However, this crisis was also viewed as a catalyst toward pushing global sustainability forward and promoting the fight against climate change. Is this an optimistic view applicable to tourism, i.e., will the Covid-19 crisis push tourism forward? In the recent webinars of *The Economist - Sustainability Week* (The Economist, 2021) there is a conventional belief that social and environmental concerns drop down the pecking order when the economy is in contraction. But recent data suggest that sustainability is a core value that does not get side-lined even in the face of economic and health related crises.

2.1 The systems theory

The global scale and interlinked economic and health nature of Covid-19 crisis demand new approaches in tourism studies. Systems Theory (ST) offers a general framework for integrating different fields (Baggio, 2008; Bertalanffy, 2015; Choi, Song, Kim & Lee, 2017; Higham & Miller, 2018). Thus, it can help the integration of tourism theory with other scientific fields to study appropriate ways to rescue the tourism industry from this unprecedented crisis. An important contribution of ST to tourism research is in its differentiation between open and closed tourism systems: "Closed tourism systems consist of systematically connected functions, such as those that are related to tourist attractions, services and facilities, transportation, information and directions, and tourists." (Choi et al., 2017, p. 3). Other researchers conceptualized tourism as "an open complex system with all its elements, and an optimal methodology to explain the relations among them." (Jakulin, 2017, p. 208).

Such work generated explanations of the tourism system and its subsystems through a causal loop diagram and a simulation model in conjunction with the system dynamics. The ST tool thus could be said to support systemic solutions which could strengthen decision-making. Roxas, Rivera and Gutierrez (2018) added that tourism is an entire system of its own, characterized as complex and dynamic requiring sustainability considerations.

Exploring global trends has continuously shaped the future of tourism, shifting travel habits and tourist expectations. These elements and relationships include the impact of external shocks such as natural calamities, security threats, technological growth, and infrastructural developments (Werthner & Klein, 1999; Prideaux, 2000; Knowles, Diamantis & El-Mourhabi, 2004; Cooper, 2006; Horner & Swarbrooke, 2007; Palom, Calbó, Llausàs & Lopez-Bustins, 2010). ST can help discern new approaches to key policies for tourism crisis management. These include restoring traveler confidence, providing clear information to travelers, supporting tourism businesses to adapt, promoting domestic tourism, supporting safe return of international tourism, developing measures to address gaps and maintain capacity, and strengthening cooperation within and between countries (OECD, 2020a).

Based on the previous insights, the pandemic crisis will be analyzed in Portugal to discover which dynamic problems affect the tourism sector. These can be explored via the identification of balancing and reinforcing loops. Data from official documents and interviews with European experts (considered as a panel of experts), who participated in the referred event (*The Economist - Sustainability Week*), were gathered to study the variables involved and their effects.

2.2 The tourism system

Beyond the tourism economy, the pandemic has triggered a global economic crisis which in turn will have consequences on tourism recovery. The road ahead seemed brighter as progress on vaccines lifted hopes but darkened when the new Omicron variant emerged towards the end of 2021, and tighter safety measures were reintroduced. Therefore, challenges remain because recovery can be uneven across countries and sectors and the problem may be continuous.

Schiefloe (2021) analyzed the pandemic crisis from the perspective of wicked problems theory. His work was based on an observation of national and global effects of the pandemic and a study of relevant theoretical contributions. The author confirmed that this crisis fits to the main characteristics of wicked problems theory and cannot be approached by standardized analytical techniques. As with other wicked problems, it represents a challenge where all possible solutions may lead to unknown negative consequences. The concept has thus become extensively used in policy analysis and research on safety and vulnerability. Several emerging problems do not fit into established functional sectors and then cannot be defined and controlled through formal regulations or increased funding.

Another issue to consider is that tourism has a multi-sectoral dimension, with linkages to a myriad of other economic activities along its value chain (Kampel, 2020). The pandemic crisis has highlighted the inter-relation between various stakeholders and sectors including private enterprises, protected area visitors, communities, etc. Tourism services are often interdependent and a crisis in one sub-sector (such as aviation) can have follow-on effects on the tourism value chain. A key challenge as the sector looks to re-open is how to get all these interlinked parts working together again. Recovery will require they work together toward thriving businesses, healthy ecosystems, resilient livelihoods, and sustainable tourism economies. The role of local communities is critical in this journey, as the restrictions on international travel may stay longer than anticipated.

Tourism does not have to be only a trip across the country or flying abroad. It can be visiting a local farmer's market, eating at a restaurant close to home or hiking at a state park on the weekend. Thus, it remains a goal to promote safe and natural destinations to attract more tourists in the current context. These issues should be understood to increase safe tourism in order, not only to stimulate it, but also to relaunch the regional economy. Even if the negative impacts of this crisis are inevitable, it opens a window of opportunity to create new models of tourism activities (agritourism, ecotourism, cultural tourism, sport tourism, etc.). There is a considerable potential for the growth of rural and slow tourism, as ways to achieve sustainable tourism development (Ulucak, Yücel & Koçak, 2019).

3. Methodology

3.1 The system thinking approach

A system can be described as a group of multiple factors that interact with each other. For researchers with qualitative backgrounds, engaged in structural development of models, ST provides a framework for grasping complexity and change. Systems thinking, through causal loop diagramming, can support researchers to evolve from conceptual understanding of unidimensional problems to systematically testing policies and proposing scenarios. Homer and Hirsch (2006) used system dynamics to study healthcare delivery, interacting diseases and risks to provide a realistic sight of overall epidemiology and policy implications when addressing problems of managing capacity and patient flow.

The ST approach has been applied to tourism since the beginning of the 1980s. Leiper (1979) used ST to develop a holistic framework for understanding and managing tourism. In his view, the tourism system

comprises geographic and social elements. Geographically it consists of tourist-generating places, transit routes, and destinations. Socially it includes the tourists themselves, tour operators, and service providers at the destination. These supply-side components have been considered as the destination functioning system. It means that a change in a component will condition the behavior of the others by means of feedback cycles and delays, resulting in nonlinear outcomes (Jafari & Xiao, 2016).

Tourism has been understood as an open system, connecting human and environmental subsystems in interaction (Leiper, 1990). A tourism system is “an arrangement of people, places, and organizations in certain roles...identified by naming the geographical extremities” (Pearce, 1991, p. 540). In this perspective, the tourism system evolves toward an increasing state of complexity whilst keeping and reinforcing its differentiation. Models with focus on tourism destination reveal that economic benefits are frequently affected by negative social and environmental effects on the host communities.

For tourism management, the ST functionalist approach may be suitable in an operational sense. System thinkers are committed to a holistic understanding of a phenomenon and equipped to identify the variables and structures of the current crisis and find strategic insights to solve the matters at hand. It can be an appropriate research methodology leading to alternatives that will stabilize the tourism system via identification of feedback loops (reinforcing/balancing). In the case of reinforcing loops, the values of all the variables in the loop change in the same direction. This type of connection implies that the variables in the loop continuously change, either in a virtuous cycle or in a vicious cycle (Choi et al., 2017).

3.2 Feedback loops

A complex system is an interlocking structure of feedback loops. This loop structure surrounds all decisions, public or private (Jakulin, 2017). The interaction among its components, and between the system and its environment, allow an understanding of the whole system. Interdisciplinary system dynamics has helped several researchers (Sterman 2001; Richardson 2011; Lin, Palopoli & Dadwal, 2020) to explain complex systems using causal loop diagrams as an analytical tool to support the recognition and visualization of crucial variables and their connections. Lin et al. (2020) explained that causal loop diagrams (CLD) contain two basic qualities. They comprise both variables and directional links representing causal interactions. The links demonstrate a “cause and effect” relationship such that the root variable will influence another variable in a relation.

Causal linkages can display two polarities: positive (uniform direction) and negative (contrary direction). A positive causal link, such as ‘innovation in tourism will attract new tourist markets’, indicates that two connected variables will increase or decrease jointly (in the same direction). A negative polarity amid two variables entails a diverging relationship (in opposite direction), such as ‘growth in Covid-19 infection risk reduces income from tourism and consequently represents a threat to jobs in the hospitality sector’.

In this study, the problem can be resumed as ‘Covid-19 pandemic affected the tourism businesses in Portugal and policy solutions are required to recover it’. One of such solutions was the ‘simplified lay-off’ (in Portugal Decree-Law No. 10-G/2020 with subsequent amendments, consolidated legislation) that established an exceptional and temporary measure for the protection of jobs, within the scope of the Covid-19 pandemic. The next stage is to identify what other variables affected tourism during the pandemic. In addition, there is the identification of variables of the adjoining systems that affect the primary variables. Then, all relevant variables will be brought together in a graphical representation as nodes and links. When all these are represented, the feedback loops can emerge in a meaningful way. Then, a narrative about the impacts of Covid-19 on tourism industry can be defined, with its consequences and prospects being discussed.

A debate on threats and possible scenarios depends on discerning the feedback loops into two categories: reinforcing loop, if an action produces a result that influences more of the same action resulting in growth or decline; and balancing loop, if there is an attempt to change some current state (the way things are) to a desired state (goal/objective) (Kim 1992; Kirkwood, 1998). Reinforcing and balancing loops are the two foundational structures of systems thinking.

A balancing loop tends to counteract changes to systems. Whilst seeking goals, balancing loops provide stability and push towards equilibrium. After drawing a CLD by exploring and combining these archetypes, researchers are encouraged to analyze the structure and behavior of a complex system (Akers,

2015). The methodology is also used here to examine the decrease of tourism growth in Portugal due to this unforeseeable pandemic.

3.3 Research design and new challenges to tourism

New tourism dynamics and companies were created in recent years, increasing the diversity of this sector's offer. This can be continued, considering the intention of many residents to take vacations within the country. Domestic tourism, which accounts for around 75% of the tourism economy in OECD countries (OECD, 2020b), is expected to recover more quickly. Several practical and administrative resolutions could promote the investment in this type of tourism and, in the medium-term, reshape territorial public policies. Main actors and regional decision-makers should use this opportunity to build a more sustainable future to tourism. It offers the main chance for driving recovery, particularly in countries, regions, and cities where the sector supports many jobs and businesses. This also envisions a shift towards additional digital offerings, for a better balance between local, national, and international visitors.

More destinations and events are now hosted online, for consumers to stream, rather than visited in-person. With the help of companies like Airbnb, short-term rentals are on the rise. Vacationers feel safer staying at a private house than a hotel. Mountain and river destinations provide easier access to socially distanced outdoor activities (Bryant, 2020). While air travel declines, many Portuguese people say they will be more likely to travel by road than plane this year. Another impact of this crisis is that it takes time for travelers to return to their old mobility. People are affected by anxiety and insecurity for a long time, so they become used to staying still and local. This trend further extends the tourism industry's re-instatement time.

When it comes to restoring confidence and stimulating demand, countries are in different phases. While some are adjusting policies to address the gaps and tourism businesses' needs, others recognize the need to start preparing tourism recovery plans. For example, *Turismo de Portugal* transformed its destination's communication from #CantSkipPortugal to #CantSkipHope, a message adjusted to the present context of uncertainty. There has also been a focus from marketing departments in collecting more information on the markets and providing it to companies on a weekly basis, developing digital contents and training the national operators in each market.

3.3.1 Application to the Portuguese tourism system

In the field of policy analysis, the multiple-streams theoretical approach (Farley, Baker, Batker, Koliba, Matteson, Mills & Pittman, 2007; Brunner, 2008; Djordjevic, 2020) explains how issues find their place in the governmental agenda. From such perspective, in Portugal, as in other countries in the European Union the future of tourism industry depends on agendas, alternatives and public policies when a "policy window" opens (un)predictably due to a new problem or problem definition. The Covid-19 crisis was a classical unpredictable policy window that swept over society pushing aside everything stood in its path. In Djordjevic's view, the pandemic led to the identification of problems in several affected industries, followed by policy propositions as well as public support for action. The European Commission (via the European Parliamentary Research Service) and other agents such as the European Travel Commission and the National Tourist Organization (Tourism Portugal), exerted a role on how the EC should behave in the aftermath of this pandemic. Based on diverse influencers such as the Association of Hotels, Restaurants and Similar Services of Portugal and IAPMEI (Institute for Support to Small and Medium Industrial Enterprises), the EC should define the recovery fund with 10 to 20% of it allocated to tourism. Yet Portuguese representatives felt uncertainty regarding this financial support.

The OECD (2020a) issued its views on documents such as "Rebuilding tourism for the future: COVID-19 policy responses and recovery" which supported the sustainable recovery of tourism and promoted a digital transition and move to a greener tourism system. It was favorable to a sustainable tourism, green and independent from mass tourism, to be implemented after the pandemic. Yet a new tourism paradigm should keep tourism offers alive and maintain jobs. What mattered more was that jobs would have to be kept open until the end of the crisis. Problems were not managed in a timely fashion and there was a lack of policies implemented at the European level. Euro deputies valued economic diplomacy and policy makers should be more preventive and less reactive, with steps taken in favor of tourism sustainability.

4. Results and discussion

In 2020-2021, the Covid-19 pandemic was possibly the worst scenario known of disruptive effects on the tourism system in Portugal (Organization for Economic Co-operation - OECD, 2020c). Considering the first objective – *explore the cause-effect relationship between and among the variables involved* – and knowing the views of Portuguese Euro deputies and OECD key messages for rebuilding tourism, table 1 identifies the main factors for tourism system thinking. It identifies two categories of feedback loops: (A) *Reinforcing* if an action produces a result which influences more of the same action thus resulting in growth or decline, and (B) *Balancing* if there is an attempt to change some current state (the way things are) to a desired state (goal/objective) though some action (to reach a desired goal). It is to note that reinforcing and balancing feedback loops can be either positive or negative (Kirkwood, 1998). Yet, a reinforcing loop is composed of all positive polarities in the same direction and/or an even number of negative polarities in the opposite direction (Kim, 1992). However, reinforcing loop systems lack nontrivial equilibrium, rendering them unstable. As seen in table 1, during the Covid-19 crisis Algarve's tourism system could be explained by four negative forces (A) and four balancing forces (B) identified by means of statistical data, public opinion, policy makers assessments and corporate actors.

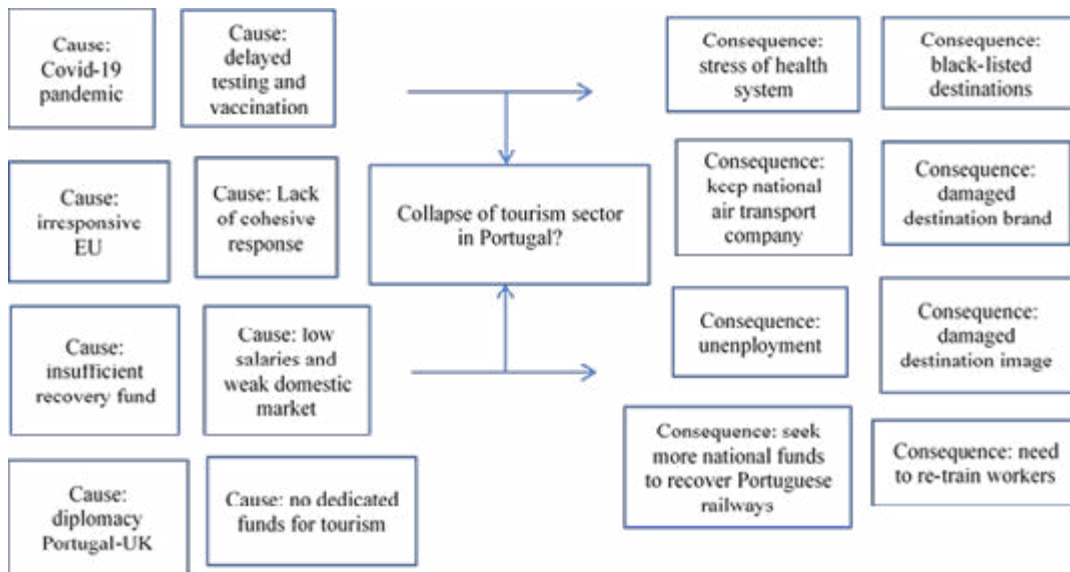
Table 1. System thinking of the pandemic impact on tourism (Portugal)

Construct	A) Reinforcing (negative) Tourism Decline factors	B) Balancing (corrective) Tourism Improving factors
Statistical data	1 billion fewer international arrivals in 2020. Lack of income in tourism industry Covid-19 public health crisis and impact on the hospitality businesses Algarve overnight stays in 2020 (-74.2% compared to 2019) Pandemic spread over the world	Between 2020 and March-April 2021, new hopes for Portugal's tourism destinations when contamination, hospitalization and death rates declines in the UK (main tourists' supplier to Portugal)
Public opinion	No jobs; awareness of new strains of virus Lockdown; prolonged crisis Barriers to travel (vaccine passport and airport testing as added costs)	Cooperation with government advise on social distancing, hygiene measures, isolation, and vaccine adoption
Policy makers' views	EU financing system is slow EU member states, including Portugal, suffered with delayed testing and vaccination Lack of coordinated actions at global, national and European levels Country brand challenged by diplomatic issues during Covid-19 crisis (black-listed tourism destinations)	Policy frameworks required for sustainable tourism development EU to work on the 2021-2027 Multiannual Financial Framework with a pro-tourism attitude Mitigate threats to the sustainability of tourism businesses Invest in employees' training Improve communication Need of uniform epidemiological criteria; uniform policies in airports across Portugal on the arrival of tourists; stimulate internal tourism market by raising salaries of workers Propose a new paradigm for tourism (quality, green, independent from mass tourism)
Corporate actors	Lack of homogeneous systems across Europe Challenges to the Europe brand	Covid-19 disruption has accelerated digital transformation Tourism toward testing new culture, organizational structure, and business models

Source: Own Elaboration

Regarding the second objective – *develop a causal-loop diagram (CLD) that explains how tourism participants respond to the complex structure of tourism policy making* – next figure illustrates the causal links between main variables involved. A holistic CLD of nodes and links, emerged from the main factors identified (table 1), can represent the Portuguese tourism system pitfalls (figure 4).

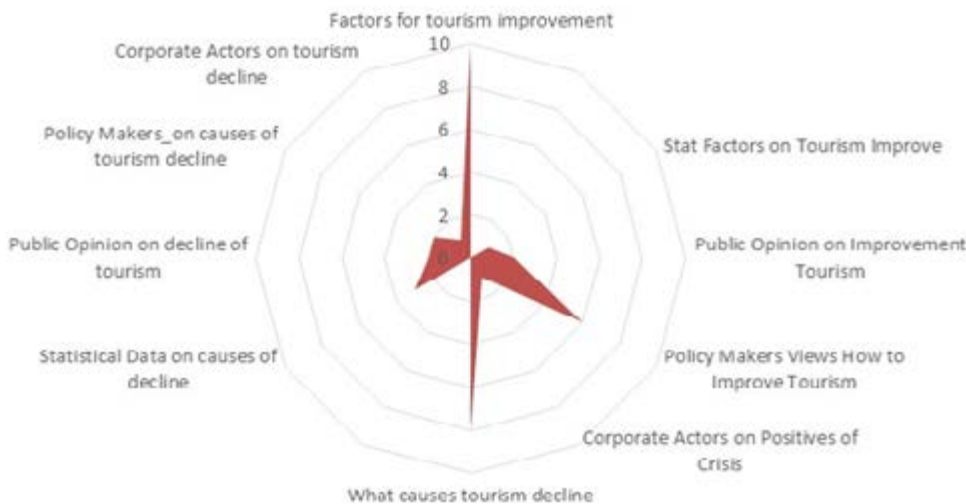
Figure 4. Portuguese tourism system pitfalls



Source: Own Elaboration

The next figure graphically displays how crucial are the policy making activities (here understood as rebalancing measures) counteracting the causes and negative consequences of the problem (the sanitary crisis, the lockdown, and unemployment.) to establish a rebalancing plan. This chart is an output from a qualitative analysis applied to the data gathered, using the software *Nvivo v.12*.

Figure 5. Factors of tourism improvement in Portugal



Source: Own Elaboration

The Portuguese tourism sector took the corrective actions needed when adopting the Safe & Clean seal of quality. With the vaccination rollout in the UK (one of Portugal’s best sources of tourists) the country needed to reinforce its positive branding campaign with an early vaccination as well. But as global cooperation on vaccines was not robust, the system was not rebalanced as early as it could be.

Considering the third objective – *identify policy outcomes required to enhance sustainable tourism in Portugal and mitigate threats to it in post Covid-19* – Portuguese Euro deputies identified other systemic problems related to the rebalancing of the employment crisis. A time restricted simplified lay-off policy was partially effective to address the lack of economic activity and the loss of income that workers endured in connection to the collapse of tourism sector.

The system archetype *shifting the burden*, referring to a short-term solution, characterized this strategy. A longer-term solution would better protect the tourism industry. A new conception of the sector in Portugal, with specific funding to provide education and training for affected workers in the long run, would rebalance the system. Training could equip employees with new skills, ready to seek new careers in the eventuality of a prolonged crisis (Tiwari, Séraphin & Chowdhary, 2020). As the simplified lay-off correction was seldom used, more fundamental long-term solutions would need to be used to tackle unemployment.

The archetype *growth and underinvestment* could also be mentioned as the Covid-19 crisis in Portugal exposed the fact that, although a large bulk of tourism and hospitality businesses are classified as micro, small or medium-sized, they need dedicated investment to diversify and adapt to a new paradigm for sustainable tourism.

The *escalation and tragedy of the commons* archetypes also translate well the fight for limited EU resources in the tourism industry during this pandemic crisis. With member states wanting to maximize their individual gain from the EU shared fund, representatives from Portugal observed that whereas some states invested a great deal of national funds in the recovery of their tourism sector from the pandemic shock, Portugal depended on EU funds. Consequently, the competition in the post-pandemic era could prove unfair. The importance given to EU solutions also denoted a further system archetype known as *addiction* whereby agents become addicted to external forces to maintain the system. Policy makers would need to keep in mind that the addictive behavior is the opposite of a self-sustaining system.

5. Conclusion

Experts have generally considered that the pandemic taught lessons for a more sustainable world. In their view, there is not enough global cooperation to cope with a recurrence, particularly with regard to the handling of vaccine production and distribution. This factor was identified as immensely valuable at the level of global change. As raised by this study through the ST approach, besides the weak global cooperation, a series of problems compounded the impact of Covid-19 on Portuguese tourism. That is why this and other related sectors were slower to bounce back, impacting on the recovery of a country that strongly relies on tourism. This reinforces the need for a systemic approach to guide tourism improvement.

Existing knowledge might be subject to a paradigm-shift due to the pandemic disruption (Zenker & Kock, 2020). The outbreak of Covid-19 has changed attitudes and behaviors, and tourism models need to be dynamic and adaptive to cope with these and other disruptors. New models require other approaches such as neural networks, i.e., learning models that perform 'variable engineering' in the system considered (Namasudra, Dhamodharavadhani & Rathipriya, 2021). Therefore, more studies are needed with basis on the inclusion of behavioral theory and computational power. This computational cognitive modelling is, either for analytical goals, or for smartness and contactless enhancement of products/services.

Regarding the more dynamic and complex challenges in the field of sustainable tourism, it is necessary to see further what factors influence the plan for implementing tourism intelligently and the strategies needed. Also, analyze the relationship of dynamic causes of those factors using methods which use the Causal Loop Diagram system (CLD). This can identify the root causes of complex problems and the effects of a sustainable tourism development system so that it can be used to develop and test alternative management policies in making smart planning decisions (Husain, Zarlis, Mawengkang & Efendi, 2020). An impact grid can then be constructed to follow their effects and interventions on tourism objects and subjects. As showed in the present study, a systemic approach could help to identify and study disruptors to forecast the appropriate policies. This can help in overcoming conflicts among stakeholders through system thinking approach with the CLD model.

Tourism policies need to be more preventive and move to more flexible systems, able to adapt faster to changes in policy focus. Today there is a view that sustainability may become more prominent in tourism choices, due to greater awareness of climate change and adverse impacts of tourism. Natural areas, regional and local destinations are expected to drive the recovery, and shorter travel distances may result in a lower environmental impact.

The present work explored a real case of system thinking application to tourism. It extended the use of ST modelling to promote a holistic understanding of the complex issues faced by the sector and assist in

the development of more effective policies. Future work may depend on how tourist behavior evolves in a post-Covid context. This requires studies with innovative mixed methods, combining systems theory with new methods for data collection and analysis. Some relevant questions for future research are: In which ways will consumer trends reshape? Which new market segments will emerge?

Studies with greater focus on contactless tourism experiences will also be interesting. Other topics for further research can relate to the following questions: What kind of businesses will survive this crisis? What policies can restore investments in the tourism sector? and Which uses of digitization will tourism experiment?

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