

## ORIGINAL RESEARCH ARTICLE

# Smart beach management from the visitor's perception: Case of Rosarito, Baja California, Mexico

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### ABSTRACT

Beach management presents options for applying technological systems to facilitate decision making as tourist destinations. Therefore, the objective of this article is to analyze the opportunities for intelligent beach management in Rosarito, Baja California, Mexico, from the visitor's perception, considering the use of technologies to support social distancing measures, capacity control and ICT to interact with people. The methodology is quantitative, based on a non-experimental, transactional field design. A probabilistic sample was calculated with 95% confidence and 4% error, obtaining the number of 595 visitors, to whom a questionnaire was applied, through the Internet, between July and October 2020. The results of the multiple regression analysis indicate that the variables technologies to comply with the recommendations of social distancing from the COVID-19 pandemic, technologies to control access to the beach and ICT to know the conditions of the tourist area, are related to the dependent variable perception of confidence to visit the beaches of the municipality. The adoption of these technological elements will allow the tourist activity to remain, complying with the necessary health safety protocols in the current tourism environment.

**Keywords:** smart management; beach access; POSCOVID-19; beach management; tourism activity

## 1. Introduction

Innovation has become a transversal axis of business models in organizations<sup>[1]</sup>, being considered a necessity in the face of the events that have transcended and tested the economy of all countries on the planet, originated by the COVID-19 pandemic<sup>[2]</sup>. Unfortunately, the effects of the health crisis in Latin America have taken on important relevance, exposing the fragility of government institutions to meet public health needs, and have caused changes, both socioeconomic and political,

that will be persistent in the following years, decreasing the quality of life of the population<sup>[3]</sup>.

During the COVID-19 pandemic, Information and Communication Technologies (ICT) became a fundamental means of access to services in cities, both for residents and visitors<sup>[4]</sup>, taking into account the measures recommended by health authorities to reduce mobility through the use of technological means<sup>[5]</sup>. Therefore, for the development of organizations and cities, it is necessary to promote, insistently, the maintenance of a more open and collaborative mentality that allows the inclusion of solutions with high added value in their processes,

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with the support of internet connectivity<sup>[1]</sup>.

In this context, today's society has been facing new challenges around the organization, use and exploitation of areas in various regions of the world, as well as in the communities themselves, which is why the study of the construction of smart and sustainable cities was initiated, allowing to offer answers and solution to urban problems, as well as territorial ones<sup>[6]</sup>.

Likewise, the increase of population in large cities propitiates the need to adopt technological tools in the strategy of sustainable development of smart cities, called Smart City<sup>[7]</sup>. Therefore, it is essential to consider good ICT practices in environmental control, access to government services, home services, mobility, health services and tourism<sup>[7]</sup>, all of which contribute to solving present needs, for the inhabitants and visitors of cities.

In this scenario, the adaptation of Smart City to the concept of Smart Tourism Destination (ITD) refers to populations that, through the use of new technologies, efficiently manage the resources available in their territory<sup>[4]</sup>. Likewise, ITDs are characterized by having cutting-edge technological infrastructure that guarantees the sustainable growth of the tourist territory, promotes accessibility for all and, in addition, makes possible the interaction and integration of the visitor with the environment, which translates into improvements in the tourist experience<sup>[8]</sup>.

For the tourism industry, the COVID-19 pandemic has represented a notable challenge that directly affects people's demand and trust towards the services offered by companies in this sector<sup>[3]</sup>. The pandemic caused a drop in world tourism, which also had a considerable impact on Mexico, given the economic importance of this sector and the large number of entities related to it. In this regard, the Ministry of Tourism<sup>[9]</sup>, noted that air operations, hotel occupancy and other activities such as those concentrated on Mexican beaches, decreased significantly.

Thus, the study aims to analyze the opportunities for intelligent beach management in the municipality of Rosarito, Baja California, Mexico, based on

visitor perception in relation to the use of technologies to support the social distancing measures recommended by health authorities during the COVID-19 pandemic, control of the capacity of people at the different beach accesses, and ICT to interact with people who demand information about the destination.

In addition, we seek to identify the correlation between the use of these technologies that can improve the tourist experience, in the opinion of the regional beach visitor of this city, with the perception of confidence to visit the beach area, considering the restrictions that have been imposed during the pandemic.

The city of Rosarito, Baja California, is located in the Tijuana-Ensenada tourist corridor, 27 kilometers from the city of Tijuana, Baja California, Mexico, has a population of 108,935 inhabitants. Among its main attractions are sport fishing, surfing and beaches where various recreational activities take place, which generate significant tourism and economic activity for the municipality's micro, small and medium-sized enterprises (MSMEs)<sup>[10]</sup>.

According to the occupancy monitoring system for tourist lodging services, the city of Playas de Rosarito received an average of 58,784 tourists per month in 2019<sup>[11]</sup>. In this beach destination, national and international tourists have the opportunity to enjoy gastronomic options, such as Puerto Nuevo lobster, sporting events, ranging from beach volleyball and athletics tournaments, mountain bike races, motocross, off-road cars, sailboat regattas<sup>[12]</sup>.

For the development of the research, literature was reviewed based on the affectations of the COVID-19 contingency to tourism, and components of ITD and smart beaches; therefore, hypothesis H is proposed: there is a relationship between the need for the use of technologies, in the opinion of regional visitors (social distancing measures, capacity control and ICT), with the perception of confidence to visit the beaches of the municipality of Rosarito, Baja California, Mexico, considering the experience of restrictions derived from the COVID-19 pandemic.

## 2. Effects of the COVID-19 pandemic on tourism

In the last days of 2019, the whole world was shocked by the news of the appearance of a new coronavirus (SARS-COV-2) called COVID-19. The virus spread across much of the planet affecting productive activities and health systems, paralyzing the world's economy<sup>[13]</sup>. The Economic Commission for Latin America and the Caribbean (ECLAC), states that in this region of the world the pandemic has produced a health, economic and social crisis, due to the economic weakness and macroeconomic vulnerability present in recent years, where the growth rate of the Gross Domestic Product (GDP) in the period 2010–2019 decreased from 6% to 0.2%.

Similarly, the World Tourism Organization<sup>[14]</sup> indicates that tourism operations have had a negative impact during 2020, since in the month of May, 100% of the destinations implemented travel restrictions due to the pandemic, 47% totally or partially closed their borders to visitors, 30% totally or partially suspended international flights, and 18% implemented border closures in a differentiated manner, prohibiting access to people coming from countries identified as the most affected by the pandemic. This situation demonstrated the weakness of the tourism industry to face the health crisis, which is evident in some regions of the world that depend, to a greater extent, on tourism as the engine of their economy<sup>[15–17]</sup>.

The effects that the tourism industry has had, have represented greater difficulty for micro and small businesses (hotels, restaurants, travel agencies, event companies), which did not have a plan to interrupt or reduce their operations, complying with the indications of local and federal authorities seeking to contain the pandemic (ECLAC). This scenario caused companies to innovate in order to adapt their operations, adding new processes and technological elements that would allow them to bring the service closer to consumers<sup>[18]</sup>.

The tourism industry has an important participation in the Mexican economy. Before the pandemic, its contribution in GDP represented, on average, 8.7% of the country's total<sup>[19]</sup>. According to figures corresponding to the month of July 2020, foreign exchange income from total spending by international tourists reported a variation of -77.4%; by visitors from abroad represented a drop of -82.4%; in addition, the average expenditure made by inbound tourists who entered by air decreased by -5.2% with respect to the same period of 2019<sup>[20]</sup>.

The effects of the pandemic paralyzed tourism activities in Mexico through the closure of resorts, beaches, hotels and flights, causing a severe crisis in this sector, with effects that will extend at least in the medium term<sup>[5]</sup>. In the northern border of the country, where the present study is being conducted, the effects of the pandemic on the flow of visitors are similar to what is registered throughout the Mexican Republic, where international tourists who stay overnight and go on excursions decreased their presence significantly as of April; this drop is associated with the temporary closure of the border for activities considered non-essential to contain the spread of the coronavirus<sup>[21]</sup>.

The WMO<sup>[22]</sup> suggests the need to transform tourism, based on the experience gained from the COVID-19 pandemic and, in coordination with governments, to create public policies that achieve transcendence beyond territorial boundaries, to ensure safety and health for both residents and tourists who continue to travel for various needs. The current situation has brought into discussion sociocultural, urban and tourism issues due to globalization, mass consumption and mobility, which had been pending on the agenda of some nations, resulting in the absence of strategies to deal with a contingency such as the one currently being experienced<sup>[16]</sup>.

### 2.1. Components of smart destinations and beaches

The ITDs arise from the proposals of smart cities, which appear to provide solutions to specific

problems related to climate change, energy efficiency, decision-making processes and health services, assuming as a point of agreement the integration of ICTs and improvements in the quality of life of residents<sup>[23]</sup>. A Smart City is linked to the sustainability component focused on meeting the needs of people and communities in the region<sup>[8]</sup>, to achieve this denomination should contemplate investment in social and human capital, transportation and necessary technologies, to cause sustainable economic growth and improve the conditions of the population, accompanied by the intelligent management of natural resources, through participatory governance<sup>[24]</sup>.

Likewise, ITDs emerge in the tourism sector worldwide, under the pillars of innovation, technology, accessibility and sustainability, taking into account the environmental, social and economic factor<sup>[25]</sup>. A tourist destination is considered smart, “when the intensive use of the infrastructure provided by the Smart City, improves the experience of visitors, it also empowers businesses for destination management”<sup>[26]</sup>. Local institutions and businesses in the sector make decisions based on data produced in destinations, which are managed and processed through the available technological infrastructure<sup>[27,28]</sup>. **Table 1** shows a synthesis of the main dimensions that make up ITDs.

**Table 1.** ITD dimensions

Dimensions	Description
Objective	Environmental, social and economic development. Resident and tourist satisfaction.
Physical Limits	Allows an improvement in the assimilation and implementation of the principles of intelligence.
Offer	Adapts to changes in the market and tourists, but not only in relation to consumption habits, but also to the ethical values of consumers.
Demand	New customers are looking for experience and not only to consume a product.
Resource management	Responsible, intelligent and sustainable resource management. Management innovation and efficiency.
Population	Democratic governance and involvement of residents as protagonists in development.
Public sector	Responsible for the smart development process.
Private sector	Become protagonists in the process of intelligent development of the community where they operate.
New technologies	They are a key element, since they facilitate the management of the territory, the treatment of information and knowledge.
Information processing	Big data techniques, new ICT, intelligent data and knowledge processing.
Orientation of actions	Actions must have a tendency towards the achievement of common benefits.
Results	There must be a transformation and enrichment of results: quality, efficiency, accessibility, innovation.

Source: Own elaboration, 2021 based on Flores, Perogil and Miedes<sup>[29]</sup>; Femenia-Serra et al.<sup>[30]</sup>; Pinon and Cartillejos<sup>[27]</sup>.

The balance between the social, economic and environmental pillars, begins to be a factor for travelers when making a decision about the place they wish to visit, this should become a motivational component for cities that are in the process of transitioning to ITDs<sup>[25]</sup>. Each need to develop a DTI can be different, businesses depend on the structure and specialization of the place, the typology of businesses present in a sun and beach destination is different for rural tourism or cultural tourism, but always under the elements of competitiveness, sustainability, accessibility and governance.

Generally, tourism intelligence projects are attached to the development of innovation, sustainability, improvement of quality of life and modernization

of technologies. The most important agents of the process are the public administration and the business fabric, being essential to encourage the participation of the population and organizations in the transformation<sup>[29]</sup>. Given the POSCOVID-19 scenario, it is necessary to strengthen the ITD network, taking into account the fragility of tourism in the face of threats to public health and safety. Consequently, technology and innovation should not only be at the service of sustainability and universal accessibility, but also at the service of public health and safety, in order to regain confidence in the sector<sup>[18]</sup>.

An important part of tourist destinations is made up of coastal towns and cities, where there is a great deal of tourist activity around their beaches,

which are their main tourist attraction. The smart transformation in these places has a great incidence, starting from innovation throughout the city, towards the sustainable management of beaches<sup>[31]</sup>. For the management of natural resources in tourist areas, technological means are important to monitor elements such as pollution in coastal areas, hazardous waste for inhabitants and tourists, gauging capacity, as well as to create the conditions of physical and digital accessibility for users<sup>[32]</sup>.

It should be noted that, beaches integrate a multidimensional system that is within a broader one, formed by the coastal zone, where other subsystems are included, which interact with each other, these being the natural physical, sociocultural and management environment<sup>[33]</sup>. It is necessary to strengthen ICT-supported governance structures in order to achieve greater coordination and information exchange in tourism zones, considering the current conditions of the pandemic. The emergence of COVID-19, has boosted the intelligent management of the active beach area, to meet the current

challenges and future scenarios in which it is necessary to comply with elements of cleanliness, safety, health care, monitoring of capacity, hygiene, and signaling and dynamic information measures<sup>[4]</sup>.

With this scenario, it is essential to make use of different technologies in the management of beach tourism destinations that allow the following results: Effective and transparent communication; generating confidence and security, both for residents and visitors; identification and location of resources, facilities, equipment, availability and knowledge of capacity or condition of the beaches; identification and location of affected areas and population; parameterization of objectives georeferencing, situation analysis and modeling; and trend analysis.

**Table 2** shows a synthesis of technologies used for smart beach management, considering the conditions and recommendations during the COVID-19 pandemic.

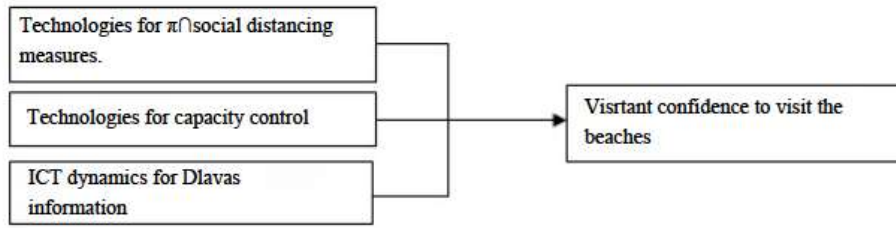
**Table 2.** Technological elements in smart beach management

Social distance	Access control	Real time communication
Web cameras	Video metrics for capacity control	Destination App to know the available capacity.
Drones with camera	App to count people	MUPI with real time information
Video sensors, heat map	Access traffic lights	Visual panels
IoT with heat map	Appointment App	Web connected to the smart destination platform
Information panel	People counting sensors social network monitoring	Call center + instant messaging platform

Based on the needs that arose during the COVID-19 pandemic, it is necessary to adopt technological elements that contribute to the security and confidence of residents and visitors to tourist destinations in the post-COVID scenario. Therefore, the hypothesis of this study is oriented to analyze the relationship between the need for the use of technologies to support social distancing measures, capacity control and ICT, in the opinion of regional visitors to the beaches of the municipality of Rosarito, Baja California, with the perception of confidence to visit the beach area, considering the experience obtained from restrictions derived from the sanitary contingency (see **Figure 1**). It should be noted, the present

hypothesis starts from the opportunity that the destination has to innovate, thus achieving a positive experience in tourists.

For the selection of technologies that can be incorporated in beach tourist destinations, it is necessary to analyze the economic and human resources available, the infrastructure, as well as the particular characteristics of each area. It does not have to be the latest generation devices at the beginning of the transformation, it should follow a gradual process, where significant changes are presented for the coverage of basic communication needs for residents and visitors as one of the first objectives, so that other technological components will be incorporated



**Figure 1.** Technologies for smart beach management in relation to visitor satisfaction.

Source: Own elaboration, 2021.

which define the level of intelligent management of the beach territory.

### 3. Methodology

For the development of the work presented, a quantitative approach was chosen; to achieve this procedure, a questionnaire was designed, from which descriptive and correlational results are obtained based on the hypothesis, which requires analyzing the relationship between the need to use technologies in support of social distancing measures, capacity control, and ICT, in the opinion of regional visitors to the beaches of Rosarito, with the perception of confidence to visit the beach area.

Taking into account the record of 58,784 tourists per month until before the pandemic<sup>[11]</sup>. The formula (1) that determines the sample size for finite populations was used, considering 95% confidence and 4% admitted error<sup>[34]</sup>. The sample size is 595 regional visitors (Tijuana, Mexicali, Ensenada and Tecate, which are municipalities in the State of Baja California; and southern California, United States), to whom the questionnaire was applied via internet, during the months of July—October 2020. The team of interviewers was made up of eight students in their seventh semester of their bachelor's degree in marketing, who are doing professional social service at the Autonomous University of Baja California (UABC), Mexico.

$$n = \frac{N \cdot z^2 \cdot p \cdot q}{(N-1) \cdot e^2 + z^2 \cdot p \cdot q} \quad (1)$$

The search for information and application of

the instrument was done through the Internet (tourism social networks, e-mail, instant messaging), given the conditions of the pandemic, which did not allow face-to-face fieldwork in the beach area<sup>[35]</sup>.

The questionnaire applied consisted of six dimensions using a Likert scale. In the first dimension, the level of agreement of the visitor on the need to use technology to improve the results of social distancing measures in the beach area was obtained; the second section refers to the level of agreement on the use of technology to control access to the beach; the third dimension indicated the level of agreement on the use of ICT to effectively inform visitors about the conditions of the beaches; in the next set, the importance of technological elements to increase confidence in visiting the beach was ascertained; the fifth dimension evaluated the satisfaction obtained in the last visit, considering the experience under the restrictions derived from the pandemic; finally, sociodemographic information was obtained.

To validate the reliability of the instrument, the main dimensions were subjected to a reliability analysis by means of Cronbach's Alpha using the SPSS 20 program. **Table 3** shows the results, which indicate a good reliability of the applied questionnaire<sup>[30,36–40]</sup>.

### 4. Results and discussions

The results begin with a descriptive analysis of the opinion expressed by regional visitors to the beaches of Rosarito, Baja California. Likewise, a multiple regression analysis is presented, indicating the importance of technological elements to increase

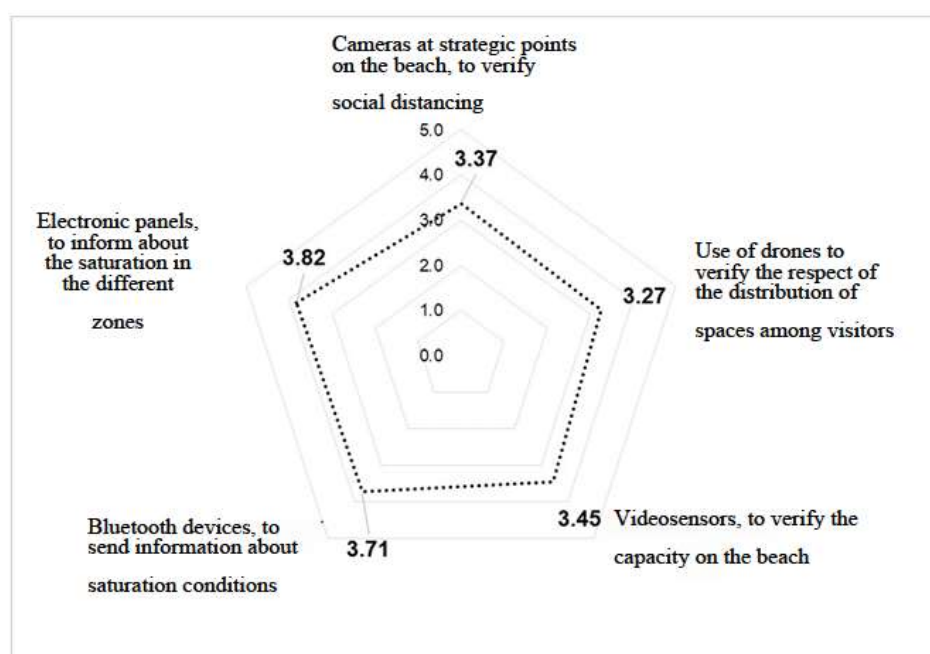
**Table 3.** Cronbach's alpha result

Reliability statistics							
Assistive technologies to improve distancing		Technology to improve access control performance in beach areas		ICT to improve communication with visitors to the sites		Technological elements to increase confidence visiting the beach	
Alpha of Cronbach's	N of items	Alpha of Cronbach's	N of items	Alpha of Cronbach's	N of items	Alpha of Cronbach	N of items
0.877	4	0.896	5	0.904	4	0.937	3

the confidence of visitors to this tourist area of Mexico. The age of the respondents ranged from 18 to 56 years old, 40% were men and 60% were women.

The measurement scale for the results is based on an evaluation from 1 to 5, based on the level of agreement on the need for the implementation of technologies to support social distancing measures (see **Figure 2**). The elements considered most neces-

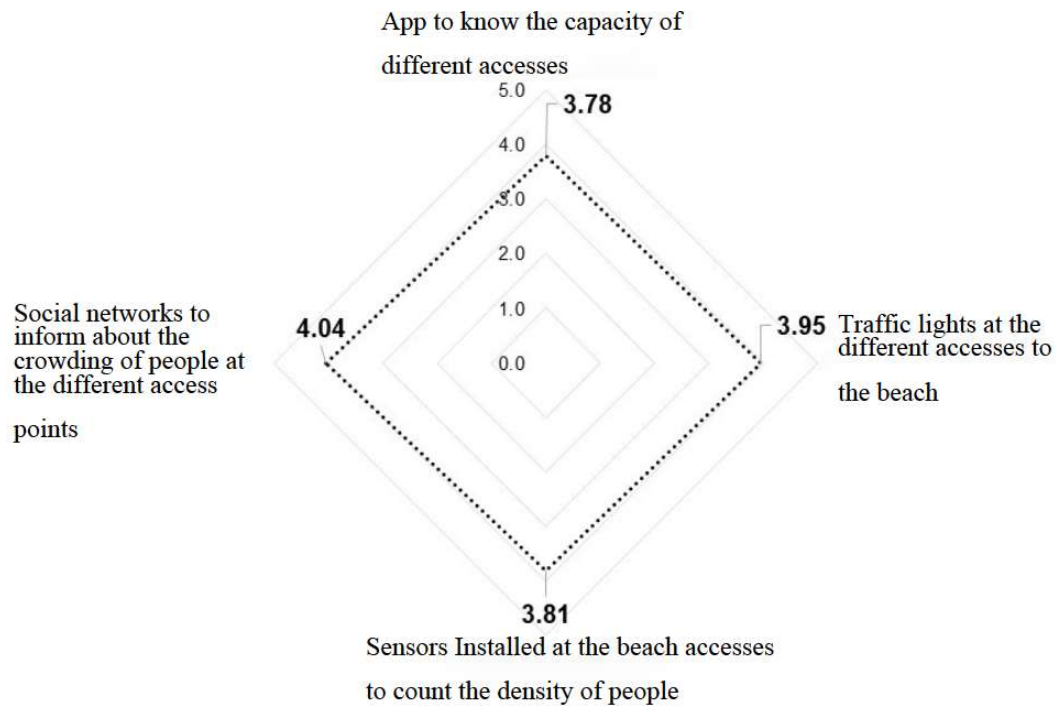
sary, are the installation of electronic panels at strategic points in the city, to inform about saturation in the different beach areas (3.82); followed by receiving via bluetooth information about saturation conditions on beaches (3.71); video sensors, to control the capacity on the beach (3.45); and, the installation of cameras at strategic points to verify social distancing (3.27), have good acceptance, but with lower valuation.

**Figure 2.** Technologies to support social distancing measures.

Source: Own elaboration, 2021.

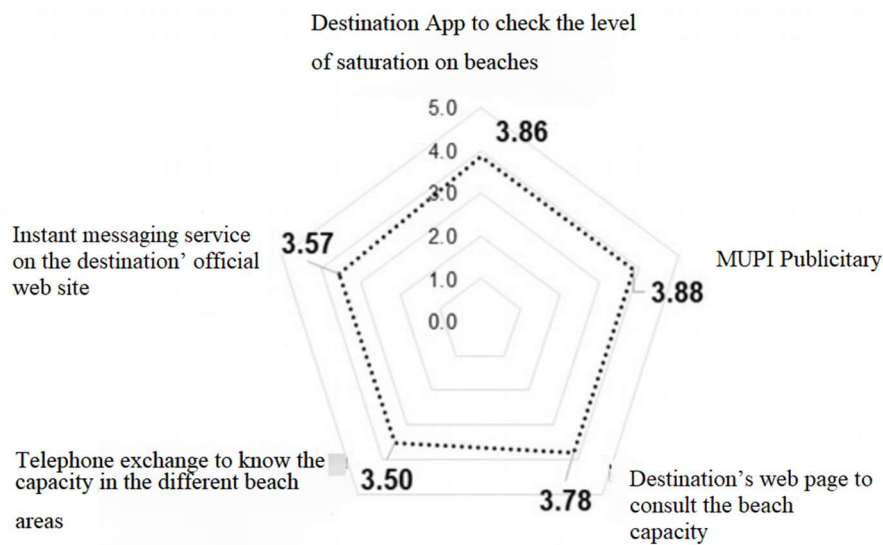
**Figure 3** shows the level of agreement, on a five-point Likert scale, with the use of technology to improve capacity control in the different beach areas. Visitors prefer the use of social networks to inquire about crowding in the different areas (4.04); followed by the traffic lights of the different entry ways (3.95); the use of App is the least valued in this dimension, which represents knowing the situation of the available areas (3.78).

The most valued ICT channels on the 5-point Likert scale are the use of advertising MUPIS in strategic points of the city (3.88), where preventive and safety recommendations are presented; likewise, they are in favor of the need for an App of the destination (3.86); being the telephone exchange to obtain information on the different areas of the beach (3.50) the least attractive to visitors (see **Figure 4**).



**Figure 3.** Technology for capacity control at beach accesses.

Source: Own elaboration, 2021.

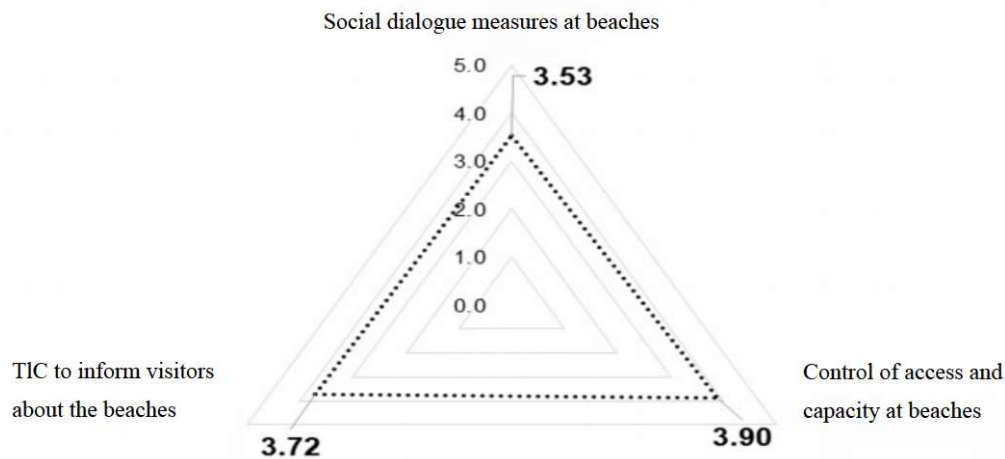


**Figure 4.** ICT for communication with beach visitors.

Based on the dimensions reviewed, on the 5-point Likert scale, on the need to implement technologies in the beach area, **Figure 5** shows that the component with the highest acceptance is access control and gauging measures (3.90); followed by ICT to establish a dynamic of access to information on conditions on the beaches (3.72); and the element with the lowest acceptance is technologies to improve the results of the social distancing recommendation suggested during the COVID-19 pandemic (3.53).

Regarding the level of satisfaction of regional visitors to the beaches of the municipality of Rosarito, Baja California, 20% are very satisfied; 34% are satisfied; 36% of those surveyed qualify this experience as indifferent; 7% are not very satisfied; and 3% are not satisfied at all. It should be noted that this result is presented considering the restrictions of the pandemic without the support of technologies, which could serve to improve the experience during their stay.





**Figure 5.** Technological components in beach areas.

**Table 4** shows the bivariate correlation coefficients significant at the 0.01 level, of the variables technologies for social distancing (TEC\_DS); technologies for access control to the beaches

(TEC\_CAP); ICT to communicate with beach visitors, with the component of confidence to visit the beaches with the support of technologies (CONF\_VISITING\_BEACHES).

**Table 4.** Bivariate correlation analysis

		TEC_DS	TEC_CAP	ICT	CONF_VISITING_BEACHES
TEC_DS Technologies for social distancing	Pearson's correlation	1	0.727**	0.677**	0.656**
	Sig. (bilateral)		0	0	0
	N	595	595	595	595
TEC_CAP Beach access control technologies	Pearson's correlation	0.727**	1	0.799**	0.733**
	Sig. (bilateral)	0		0	0
	N	595	595	595	595
ICT	Pearson's correlation	0.677**	0.799	1	0.722**
	Sig. (bilateral)	0	0		0
	N	595	595	595	595
TRUST TO VISIT BEACHES Confidence to visit beaches with the support of technologies	Pearson's correlation	0.656	0.733**	0.722**	1
	Sig. (bilateral)	0	0	0	
	N	595	595	595	595

Note: \*\*—Correlation is significant at the 0.01 level (bilateral).

Likewise, in the multiple regression analysis presented in **Table 5**, the consequence of the hypothesis raised in the literature review is obtained, which refers to the perception of confidence to visit the beaches, with the support of technologies to comply with the recommendations of social distancing

from the COVID-19 pandemic, technologies to control access to the beach, and ICT that can be accessed to establish communication and get data on the conditions of the beaches. The result is at the level of a good correlation ( $R = 0.778$ ).

**Table 5.** Multiple regression: Independent variables (TEC\_DS; TEC\_CAP; TIC)

Model summary				
Model	R	R-squared	Corrected R-squared	Standard error of estimation
1	0.778a	0.605	0.603	2.001

Likewise, the result of the ANOVA test, in which the independent variables used in the multiple

regression analysis (TEC\_DS; TEC\_CAP; TIC) were subjected to the dependent variable (CONF\_

VISITAR\_PLAYAS), a significance level of 0.01

was obtained, which indicates the validity of the statistical process (see **Table 6**).

**Table 6.** Significance level by ANOVA<sup>a</sup>

	Model	Sum of squares	gl	Quadratic mean	F	Sig.
1	Regression	3630.591	3	1210.197	302.108	0.000b
	Residual	2367.452	591	4.006		
	Total	5998.044	594			

## 5. Conclusions

The use of technologies for intelligent beach management in Rosarito, Baja California, is indispensable due to the geographical location of the city, which is located a short distance from the city of Tijuana, Baja California, and the border with the United States, where most of the regional visitors who visit this destination come from, and who require technological infrastructure to enjoy access to services during their stay.

The economic consequences and the sanitary crisis of the COVID-19 pandemic, propitiate the need for innovation, being necessary that during the sanitary contingency it is possible to count on tools that support the recommendations to maintain the social distancing, to know the capacity in the different accesses of the beach, and to count on TIC that provide updated information on the conditions of the tourist zone of Rosarito, Baja California, Mexico. The application of these technological elements will allow tourist activity to continue at a moderate pace, complying with safety protocols, which are necessary in today's tourism environment.

Based on the response of regional visitors to the beaches of Rosarito, Baja California, the inclusion of technologies influences the confidence to visit the tourist area of the municipality. The relationship between these variables will continue in the following years, given the need to have security in the face of future health crises that require similar measures for the tourism industry to continue operating, learning from experience, mitigating the effects of new events.

Tourism destinations in Latin America must be

able to incorporate the elements for the safety and benefit of both the inhabitants and local businesses and visitors, in order to avoid the total paralysis of activities, as was the case in the COVID-19 pandemic. Instead, it is necessary to have the technologies that allow them to remain in contact with people who require access to services during this period. Therefore, the pillars of IT D (innovation, technology, accessibility and sustainability) should be adopted to the extent that the economic possibilities, infrastructure, resources and support agencies allow the development of a project with these characteristics.

## Conflict of interest

The authors declare no conflict of interest.

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