Chapter 11
Innovation Infrastructures Assessment Through Knowledge Management Models

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11.1 Introduction

Most authorities and professionals agree that if companies play a key role on Innovation Systems in recent years it is because of their ability to transform R&D activities in economic development and wealth. That is why most governmental innovation policies focus on the participation of companies in the innovation process as a key factor in the competitiveness of different regions and countries. Of the various innovative infrastructures developed to facilitate this type of business activities, one is the Scientific and Technology Parks (STPs). STPs act as engines of innovation, as agents for economic development, and as a crucial link between companies and university researchers. They can be considered to play an important role in innovation processes and in generating the corresponding synergies.

Taking into account the above considerations, what are the key factors in the success of STPs? Is it possible to design and implement a model to help policy-makers and managers in their decision-making process in order to predict the probability of success of these infrastructures in advance and avoid failed investments? Not many references in the literature focus on this specific issue for the Spanish case. Among them, Lopez (2003) analyzes the functional elements and the criteria for sizing, designing and managing STPs, which is eminently based on

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town planning aspects. Gonzalez (2004) studies business networks of technology based enterprises, focusing on research cooperation, development and innovation in the field of dissemination and technology transfer in order to obtain the factors or variables that affect the performance of such networks. Ruiz (2002) presents a theoretical model based on the concept of innovation systems. Two types of models have been proposed for regional innovation systems assessment, based on two types of analysis variables: available resources and obtained results, two factors which are closely linked (Landabaso 1997; Landabaso et al. 1999; Morgan and Nauwealers 1999). Following that trail, Heijs et al. (2002), presented a classification and characterization of the different Spanish regions with respect to their innovation systems.

11.2 Research Methodology: Proposed Model and Results

This paper seeks to provide a transversal model, future-oriented, to evaluate STPs and thus help in the decision-making process of public authorities and regional councils. Our model is based on experience, knowledge, opinions, intuition and tacit knowledge from experts in the field of STPs belonging to different areas of knowledge (managers and researchers of scientific and technological parks, business people who have worked on or have established their businesses in these parks, as well as university professors and researchers), and who have been working and researching collaboratively in such initiatives. We based our work on the following tools: (1) the European Innovation Scoreboard, in order to determine the key indicators of success; (2) the Likert scale, used for the assessment and quantification of different parameters, aspects and criteria; (3) the EFQM quality model, used to design the structure of our model; and (4) the Delphi model, crucial in the development of this work, for collecting and identifying the tacit knowledge and professional experiences of experts in this field. We collected additional data from the Territorial Statistical Analysis System of Andalusia, and processed it using the statistical software SPSS.

11.2.1 Proposed Model

In order to collect and use the knowledge, experience and intuition of experts on STPs, we directed our efforts towards the Delphi methodology against other possibilities, such as the Balanced Scoreboard, neural networks or fuzzy logic, which usually avoid or bypass the underlying intermediate processes. Table 11.1 shows the main details of our Delphi process, and Table 11.2 shows the questionnaire sent to the experts, to assess each criterion and establish the corresponding weight. The weights were set for each aspect of each criterion in a similar way. Finally, our Delphi team, in correspondence with the data gathered

Table 11.1 Description of the Delphi experiment

Panel members	No	1st round responses	% of success in the 1st round	2nd round responses	% of success in the 2nd round
Scientific experts	35	29	83	20	57
Entrepreneurs	19	16	84	9	47
Administration experts	15	15	100	10	67
Total	69	60	87	39	57

and the opinions expressed by the experts, proposed the criteria and aspects shown in Table 11.3 as the main evaluation parameters of the synthetic index. As a final result, the team proposed the model structure shown in Fig. 11.1, where the synthetic indicator is set according to environmental, technical and strategic criteria, and their weights correspond to the results of the Delphi process.

11.2.2 Application of the Proposed Model

In order to validate the model, our team applied this model to a set of STPs in different development stages: Cartuja'93 (Seville), PTA (Málaga), Geolit (Jaén), Velez-Málaga (Málaga), Agroparc (Avignon) and Bioindustry (Piemonte). The results gathered are showed in Table 11.4. In this table, for each STP, the first column shows the calculated Synthetic Index measured in percentage probability of success, and the remaining columns show the values obtained for the three main criteria conforming the Index and the aspects contemplated in the calculations for each criterion. The main aspect that requires improvement in each STP has been shown in italics.

According to the results, Cartuja'93 is a clear example of success. It was built using the infrastructure from the Expo'92, with a very favorable economic and financial plan. Its economic viability is practically assured. The model shows that only small improvements can be sought in aspects that are difficult to improve because they depend on improvements of private business networks, which can only be achieved in the long term.

In the PTA case, it is a more recent initiative, based on experience and knowledge acquired in Cartuja'93. In both cases, the government support was essential, and their strengths and weaknesses are similar. Some aspects such as socioeconomic and environmental aspects should be improved, but the main difficulty lies in their complexity. However, other aspects like transport have been recently improved (road network and railway), which will hopefully further improve the future performance level. Other clear improvements can also be seen in the recent inter-university agreements (Andalucía Tech) in search of synergies in the field of innovation.

Geolit can not be considered a success case, such as its Synthetic Index shows. It is an even more recent initiative, and with a more specialized bias towards the

Table 11.2 Questionnaire sent to the participating experts

Questions	Weight o f aspects P_{ij}… P_{ij}… P_{ij}…… P_{ij}
Interest in R&D in general	
Need to integrate new agents in the Andalusian innovation system	
Adequacy of research with industry needs	
Current availability of resources from the public administration	
Coordination between the interface, the Andalusian public administration and private agents	
Level of cooperation between business firms to develop projects of I+D I	
Knowledge by firms in the supply and demand for services	
Availability of information on business opportunities in international markets	
Appropriateness of the specialized services (logistics, reengineering, special consulting…)	
Availability of financial instruments to promote innovation	
Offer specialized technological infrastructures (science parks)	
Knowledge of the industry by tax incentives	
Existence of measures to support the creation of new technology-based companies	
Level of information received by consumers on aspects of processes	
Existence of mechanisms to inform the company on consumer preferences	
Level of attention from companies to consumers' demands	
Current presence of automation and robotic technologies in the sector	
Degree of incorporation of new conservation technologies and packaging	
Degree of implementation of information technology and communication	
Importance attached by firms to knowledge management and optimization	
Ability of firms to manage innovation projects	
Human capital capacity of firms to innovate	
Degree of implementation of environmental management (waste and byproducts)	
It is better to build PCT no focus in specific sectors	
Andalusian food industry has the capacity to have enough viability	

(continued)

Table 11.2 (continued)

Questions	Weight o f aspects P_{ij}… P_{ij}… P_{ij}…… P_{ij}
Importance of creating a network specialized in specific sector parks	
STP are considered more appropriate as multi-sector focus	
Would choose to implement these infrastructures in depressed areas	
Would choose to implement these infrastructures in dynamic areas where the viability is higher	
Importance of entrepreneurship in these initiatives	
Importance of management	
Importance of human resources available in the region	
Importance of dynamic and innovative business network for success	
Importance of territorial scope (character of the area where it is located)	
Importance of the technical proposal (plot, cost…)	
Importance of the existence of interface agents to influence the success of the CIT and research groups considered adequate agricultural region as the geographical unit of study	
Importance of the distance between SIP	
% of Weight of aspects	

Table 11.3 Main criteria and aspects chosen for the calculation of the synthetic index

Criterion	Aspect
Environmental	Socioeconomic
	Innovation
	Environmental Aspect
	I+D+I supply and demand
	Support structures
Technical	Land transport
	Supply
	Services
	Land and property law
	Plot characteristic
	Economic
	Financial
Strategic	Sector
	Science and technology
	Model

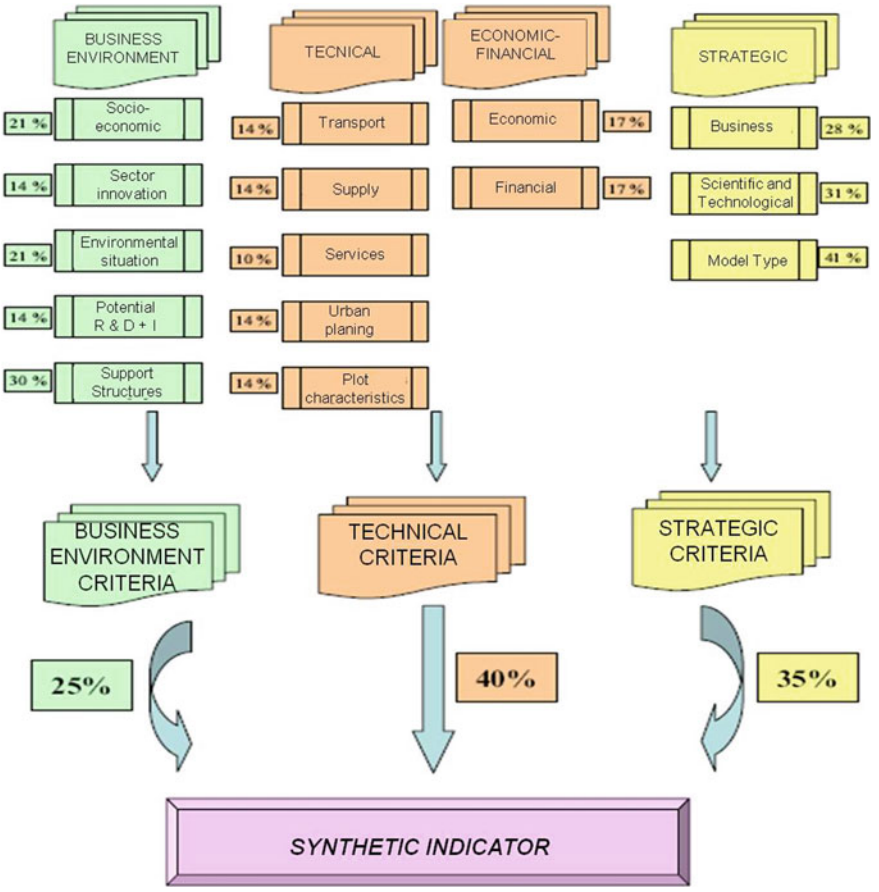

Fig. 11.1 The proposed model

Table 11.4 Results after applying the model to different STPs

	Synthetic index %	Environment criterion	Socio economic	Innovation	Ecological	I + D + i	Structural	Technical criterion	Transport	Supplying
Cartuja 93	75.0	3.90	*2.86*	*2.75*	5.00	5.00	4.00	4.02	4.00	4.00
PTA Málaga	71.0	3.65	*2.71*	3.50	*2.00*	3.50	3.00	3.44	3.50	*2.00*
Geolit Jaén	59.7	3.69	3.00	1.75	4.00	5.50	4.50	3.45	3.00	2.67
Yélez Málaga	37.0	3.27	4.17	2.75	4.00	2.50	2.75	2.62	2.50	*1.17*
Agroparc Avignon	72.6	4.16	4.14	4.71	5.00	4.17	3.33	3.16	3.00	4.50
Bioindustry Piemonte	81.3	4.51	4.14		5.00	4.33	3.33	4.07	3.50	4.20

	Services	Town planning	Ground	Economic	Financial	Strategic criterion	Business	Technical	Model
Cartuja 93	5.00	3.60	3.33	3.67	4.75	4.09	4.25	4.50	3.67
PTA Málaga	2.33	2.80	4.00	3.67	3.00	4.48	4.25	4.00	5.00
Geolit Jaén	4.00	4.00	3.67	3.67	3.25	3.13	2.50	3.00	3.67
Yélez Málaga	*2.00*	2.40	2.33	3.00	4.33	1.95	*2.00*	2.50	*1.50*
Agroparc Avignon	6.67	3.00	3.67	*2.75*	*2.00*	4.57	4.50	4.50	4.67
Bioindustry Piemonte	4.33	5.50	4.33	*3.50*	4.25	4.28	4.75	4.00	4.17

oleic sector. The regional authorities have tried to promote R&D and value-added activities oriented to manufacturing processes in the industry, but this is a complex task because the international business dealers are agents with socio-political interests far beyond the regional one. Among the weaknesses, we may highlight those related to socio-economic and finance, socio-economic conditions and the weakness relative to the entrepreneurial sector that needs a great improvement. It also has a nearby university, but with a lower potential and research capacity compared to the two previous cases.

Velez-Málaga can be considered a great failure without any doubt, according to its Synthetic Index. Its technical and strategic criteria are too low, possibly due to its proximity to the PTA. We believe that it would be necessary to change the model and reorient the concept in order to exploit the synergies of the proximity of this successful initiative (PTA) and its potential.

The Agroparc D′Avignon is a great success, as shown by its Synthetic index. Its main weaknesses are those concerning economic and financial aspects, but these can be considered secondary problems. It is, as its name implies, a STP focused on the agribusiness sector, and this is a key criterion in the success of the park because it is installed in a region with a clear commitment to the food industry where there is a great tradition in the R&D sector.

The Bioindustry Park is without any doubt the greatest success among the analyzed STPs. The results obtained after applying the model to it present a very high score for the synthetic index and the rest of criteria and aspects. This STP does not really need any specific improvement, since the lowest values, basically related to economic and financial aspects, are significantly high.

11.3 Conclusions

We have developed a transversal model for the evaluation of the success of STPs, following a Delphi process involving a relevant number of experts in the field. Innovation processes represent a rupture with the past trend, in the way of seeing and/or perform the different processes, activities, etc. Therefore, the use of historical data to validate models concerning future expectations should be avoided when possible, and use instead the previously mentioned "future data" based on the knowledge, experience and intuitions of the different knowledge stakeholders mentioned above, for the validation of such models.

According to our Delphi team, other professionals involved in the project, and other users who have used the model (Technological Corporation of Andalusia, regional and national authorities), the results of the evaluation provided by model, as applied to the different parks analyzed, present a fair and sound assessment. They all agree in considering it a valuable tool to analyze the possible future implementation of a STP or to assess the current status of existing STPs.

Another interesting aspect highlighted by its users is the ease of use and understanding, and the reliability shown by the model. Users believe that having

access to information of the intermediate levels of the model allows them to interpret this information in order to suggest improvements or carry out simulation processes which would result from the modification of the input data.

In this model, tacit knowledge and experiences and personal views of expert professionals are embedded in its structure and relative weights, which were obtained according to the different criteria and aspects proposed by the experts. This limits the possible sensitivity analysis, since this structure and weights should not be modified because the essence of the knowledge of the expert group would be lost. A correct application of a sensitivity analysis should be limited to possible changes in some of the input data [e.g. what would be the result if a particular initiative improves technological infrastructure (cable network) or access infrastructure?], without affecting the model structure.

Others analytical and more conventional approaches used in the past, based on economic and financial viability, represent in our opinion a narrower framework. Our model tries to take into account all the relevant factors, incorporating criteria and aspects concerning the environment, technical and strategic issues, that we consider are more complete and demanding from the perspective of the expert group knowledge that permeates the model structure.

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