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Internationalisation of science and technology parks and the stage of their life: The Central European perspective

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Abstract

Research background: A science and technology park (STP) is an important tool of innovation policy. In order to carry out new tasks in the field of internationalisation of innovative processes, parks have to incorporate completely new ones into their classic roles and activities. There is still a low level of knowledge about the factors that limit this process. The identified research gap provided the rationale for addressing the issue of the internationalisation of parks in Poland, which is an original treatment of the issue and probably one of the first such studies in Central Europe.

Purpose of the article: The purpose of the article is to diagnose the stages through which the internationalisation of science and technology parks takes place in the context of the phases of the life cycle of these organisations, as well as to identify and assess the importance of obstacles limiting the internationalisation process.
Methods: A critical analysis of the literature and direct research was carried out using the survey method, according to the author's questionnaire. The research was carried out in 2022 among 18 STPs in Poland (55% of all Polish parks). The diagnosis of internationalisation was made on an institutional level. Three phases of the park life cycle were defined and operationalised based on the criteria identified by J. Allen (2007): creation, consolidation and maturity phase. Ward's agglomeration method (Ward, 1963) was utilised to group the parks based on the level of actions realised in their life cycle and their degree of internationalisation. In the identification of the number of groups, the Duda-Hart (Duda *et al*., 2000) Je(2)/Je(1) index-stopping rule was used. Thirteen of the most important obstacles to the internationalisation process were identified. In order to examine the internal consistency of variables describing the internationalisation of parks, Cronbach's Alpha reliability index was calculated. In order to find out the strength and direction of the existing relationship between obstacles and the internationalisation index of the studied parks, Kendall's τ test was used.
Findings & value added: The sequential development of parks at the national level is in line with the assumptions indicated in the literature. The problem, however, is the internationalisation of parks. Not only is it characterised by a low level, but its course also does not indicate that it is the result of the successive implementation of previously assumed activities. The processes of development and internationalisation are interrelated, but this is not a significant interdependence. The problem is also indicated by the results of studies relating to obstacles to the internationalisation process. This is because the most significant ones are diagnosed only at an advanced level of internationalisation. Such an important activity of parks is undertaken without a prior in-depth diagnosis of the international situation. This can result in limited effectiveness of the activities undertaken in the direction of internationalisation and generate related problems. The results of the study provide a basis for indicating the type of activities aimed at activating parks in the international arena. Such activities should be undertaken at a higher level than the parks themselves since they do not have sufficient procedures and resources to guarantee increased internationalisation. One desirable course of action could also be the creation of cooperation networks at different territorial and entity levels.

Introduction

The analysis of contemporary international trends shows that the effective development of science and the creation of competitive, innovative products is impossible without deep integration of the national scientific and industrial spheres into global research and innovation networks (Compagnucci *et al.*, 2020; Skuratovich, 2022). This is the only way to ensure an inflow of foreign investment, highly effective human resources and new technologies (Skuratovich, 2022). Recently, there has been an intensification of international scientific and technological cooperation in various forms

(Polyakov *et al.*, 2020), which is reflected in the dynamic growth of publications on this issue.

The literature provides evidence that the topic of internationalisation of research and science is currently the subject of numerous studies and research undertaken around the world, in particular: the internationalisation of corporate R&D activities (Leung & Sharma, 2021; Li *et al.*, 2021; Li, *et al.*, 2023; Rahko, 2021; Vrontis & Christofi, 2021); internationalisation of universities (Blithe & Carvalho, 2023; De Wit & Altbach, 2021; Labraña *et al.*, 2023; Mittelmeier *et al.*, 2021); international collaboration among researchers (Alamah *et al.*, 2023; Feitosa *et al.*, 2023; Kwiek, 2015; Liu *et al.*, 2023; Zhang *et al.*, 2022), as well as the internationalisation of university spin-offs (Peces & Trillo, 2023; Pérez-Hernández *et al.*, 2021; Prada-Villamizar & Sánchez-Peinado, 2021; Walter, *et al.*, 2022). On the other hand, despite the fact that in most countries, R&D activities are carried out in public research institutions, such as universities and public research organisations (Soete *et al.*, 2021), the issue of internationalisation of the latter (Cruz-Castro *et al.*, 2015; Geng *et al.*, 2022; Zacharewicz *et al.*, 2017), including in relation to science and technology parks (Compagnucci *et al.*, 2020; Eckardt, 2017; İmer *et al.*, 2021; Martínez-Vela, 2016; Tomelin *et al.*, 2018) is still an underresearched topic. To this end, researchers highlight the need to expand the research to revise the first existing results and fill the gap in the literature.

Science and technology parks (STP) are seen as an important instrument of contemporary regional and innovation policy (Albahari *et al.*, 2017; Almeida *et al.*, 2020; Amoroso & Hervàs Soriano, 2019; Gomes *et al.*, 2022; Martínez-Vela, 2016; Unlü, 2022). As Berbegal-Mirabent *et al*. (2020) emphasise, the mission of modern STPs should focus on: customers, service offerings, geographic coverage, investors and society to improve their performance. Science and technology parks can, therefore, play a key role in enhancing industrial competitiveness, creating jobs and promoting innovation-driven economic development, contributing to Agenda 2030 for inclusive, sustainable development (UNIDO, 2021).

Undeniably, in order to fulfil their core mission in an ever-changing environment, as well as to carry out new tasks in the sphere of internationalisation of innovation processes for sustainable development (Álvarez Ruiz *et al.*, 2023; Wei *et al.*, 2023), today's science and technology parks need to incorporate completely new roles and activities into their classic ones, provide new services and create new business models that enable the devel-

opment of new activities and sectors (ESCAP, 2019; IASP, 2022; Makhdoom *et al.*, 2022; Mondal *et al.*, 2023).

An example of a new area of STP activity is internationalisation, as emphasised by both academics (Albahari *et al.*, 2019; Franco *et al.*, 2020; İmer *et al.*, 2021; Martínez-Vela, 2016; Tomelin *et al.*, 2018; Zacharewicz *et al.*, 2017) and practitioners[1] (EARTO, 2017; IASP, 2017/2018; IASP, 2023).

The few empirical studies conducted in science and technology parks in Europe provide evidence that, in general, the international activities undertaken by parks bring benefits at the regional, institutional and business-tenant levels. At the same time, there is a perceived variation in this area of activity of these organisations — internationalisation is not a common feature of STPs (Błaszczyk *et al.*, 2023; Sobol *et al.*, 2023), and there is still a low level of knowledge about the factors that limit this process, especially in the different phases of the park life cycle.

The identified research gap provided the rationale for addressing the issue of internationalisation of science and technology parks in Poland at the institutional level in the context of their life cycle phases, which is an original treatment of the issue and probably one of the first such studies in Central Europe.

The basic research problems are as follows: What phases of the life cycle do science and technology parks go through, and what stage are they currently at? In what phase of the internationalisation process are the STPs, and what measures are they taking to strengthen their activity? What obstacles limit the internationalisation process of parks?

The purpose of the article is to diagnose the stages through which the internationalisation of science and technology parks takes place in the context of the phases of the life cycle of these organisations, as well as to identify and assess the importance of obstacles limiting the internationalisation process. The realization of the goal formulated in this way was evaluated using the example of the above-mentioned organisations operating in Poland as a representative of Central Europe. Conclusions from the study also gave rise to recommendations relating to the need for obstacles to the in-

[1] The theme of the ERATO Innovation School event organised by the European Commission's Joint Research Center was the internationalisation of Research and Technology Organisations in Europe (Brussels, 31.01.2017), while the 34th IASP World Conference discussed the internationalisation experience of Brazilian science parks (Istanbul, 26-29.09.2017). Internationalisation was also one of the topics discussed at the 40th IASP World Conference, whose theme was megatrends in innovation ecosystems (Luxembourg, 12-15.09.2023).

ternationalisation of parks, which also indicates the applied nature of the research results.

To achieve the goal, a review of the literature on the subject was carried out, while in the empirical layer, a quantitative and qualitative study was conducted aimed at obtaining primary data.

The article is organised as follows. The following section provides a brief general review of the literature on the nature and internationalisation of science and technology parks, in particular: motives and obstacles, strategies, phases and activities undertaken in this area. Next, the methods used in the research are presented. Subsequently, the results of the research and their discussion are provided. Finally, general conclusions are presented with an indication of some of the limitations the authors encountered, along with recommendations and useful insights for future research.

Theoretical framework

While in the United States and other countries around the world, research universities are considered to be key actors in the eco-systems of innovation, in Europe, this important role is assigned to research and technology organisations (RTO) (Cruz-Castro *et al.*, 2015). This term refers to the diverse and developing group of entities concentrated on applied research and the progress of innovation (RD+I). Despite their heterogeneity, they are characterised by common functional features and modes of operation, which distinguish them from other R+D organisations. The basic mission of an RTO is to "harness science and technology in the service of innovation (…), to improve the quality of life and build economic competitiveness in Europe" (EARTO, 2015, p. 3).

Science and technology parks (STP) are an example of research and technology organisations whose dynamic development was seen in the 1980s owing to the experience of the pioneer park, Stanford Research Park, in the USA. Even though the idea of science and technology parks[2] has spread around the world and has seen its growing importance from a socio-economic and business perspective (Albahari *et al.*, 2022; Hobbs *et al.*, 2017; Lecluyse *et al.*, 2019), no standard and widely accepted definition of this concept has been adopted yet (EARTO, 2015; UNCTAD, 2018; UNIDO,

[2] Parks are given different names around the world, like „technology park, technopole, research park or science park" (Link & Scott, 2018).

2021). This article follows the definition by the International Association of Science Parks and Areas of Innovation (IASP), which stipulates that "a science park (science, technology, STP)[3] is an organisation managed by specialised management, whose main aim is to increase the wealth of its community by promoting the culture of innovation and competitiveness of its associated businesses and knowledge-based bodies[4]".

European science and technology parks are seen as an important instrument of contemporary regional and innovation policy (Albahari *et al.*, 2017; Almeida *et al.*, 2020; Amoroso & Hervàs Soriano, 2019; Gomes *et al.*, 2022; Martínez-Vela, 2016; Unlü, 2022). However, their contribution is not fully understood and requires further research to fill theoretical and methodological gaps (Amoroso & Hervàs Soriano, 2019; Lecluyse *et al.*, 2019).

Each park operates under specific geographic, social, economic and institutional conditions, so there is no universal model for its operation (Allen, 2007; Ng *et al.*, 2019), and the success of a park largely depends on the supporting environment (Glittová & Šipikal, 2022; Yang & Lee, 2021). There is also an evolution of the operating models of science and technology parks, which is a consequence of the variability of the environment (so it is shaped by external conditions) but also results from the natural development of the park itself (including internationally) (Allen, 2007; Correia & Da Veiga 2019; Ruiz *et al.*, 2017).

Regardless of the management model adopted, each STP undergoes certain life cycle phases, such as initial planning and development, stable growth and the mature phase (Allen, 2007).

Undeniably, in order to fulfil their core mission in the contemporary globalised and digitalised world (Lewandowska *et al.*, 2023; Sun *et al.*, 2022a; Sun *et al.*, 2022b; Turek *et al.*, 2023; Civelek *et al*., 2023; Cramarenco *et al*., 2023), as well as to carry out new tasks to internationalise science, technology and innovation enabling sustainable development (Álvarez Ruiz *et al.*, 2023; Wei *et al.*, 2023), contemporary science and technology parks that are important actors in the Triple Helix model should integrate more into foreign contexts (Compagnucci *et al.*, 2020; Świadek et al., 2022).

Cruz-Castro et al. (2015, p. 4) define the internationalisation of research and technology organisations (RTO), which include science and technology

[3] For the sake of this article, the authors follow the definition by the IASP Society, which refers to all of the mentioned organisations, and the STP acronym is used with regard to all of these designations.

[4] IASP, https://www.iasp.ws/our-industry/Definitions (1.08.2022).

parks, as "a process of increasing involvement in international (non-nationally based) operations and actions by the PRO, its sub-units or its employees and an increasing openness of the PRO to 'non-national' influences, with the effect of transforming the attributes of the organisation and of modifying its resource dependence features (for example, funding composition)".

To complement the above definition, phasing of internationalisation can be included, which, with regard to science and technology parks, can be examined at four levels: systemic (internationalisation of a region, STP, and technological specialisations which constitute the brand of the region, a network leader e.g. in international projects); institutional (internationalisation of the STP); micro-level (internationalisation of enterprises-residents) and behavioural (international occupational mobility, relations of STP managers and their residents, level of life, culture) (Sobol *et al.,* 2023).

The issues related to the internationalisation of these organisations can be analysed in several areas[5]. These include the financing of STP internationalisation activities, STP membership in international innovation and internationalisation support networks, the size of the population of international companies located in STP, the scope of STP internationalisation support, and marketing activities in the area of internationalisation support for companies (IASP 2010).

The most important drivers for the engagement of an STP in international operations include: access to the foreign body of knowledge and cooperation partners, access to new markets, clients and foreign financing, as well as strengthening the domestic customer base and the park's own brand. At the same time, examples of external factors stimulating such activities include: the globalisation of research, changes in the institutional environment, growth in the potential of the ICT sector and international mobility (Cruz-Castro *et. al.,* 2015; Compagnucci *et al.,* 2020; Eckardt, 2017; Zieliński *et. al.,* 2014). Tomelin *et al*. (2018) provide evidence that coherent internal and external linkages, networks, and the level of specialisation are key drivers of the internationalisation process of science and technology parks (both at the institutional and micro level).

On the other hand, the internationalisation of STPs faces various obstacles. External barriers refer to various factors of the macro-environment

[5] The areas of internationalisation mentioned here were presented in the only report by the IASP to date, *Strategigram Analytical Report 2010,* which show research results based on 56 STP's in 29 member countries of IASP.

which may restrain the potential of the park to engage in international operations, like political, legal and fiscal aspects in the foreign market, lack of a cooperation framework at the international level, and specific characteristics of the domestic market. In turn, the internal barriers relate to the particular situation and the ability of the STP to internationalise, among others, the mission, the level of autonomy, the strategic orientation, a lack of sufficient competence and resources, and the high cost (Berger & Hofer, 2011; Charles & Ciampi Stancova, 2015; Compagnucci *et al.,* 2020; Cruz-Castro *et al.,* 2015; Zacharewicz *et al.*, 2017). Therefore, the contextual conditions and the role and character of these organisations determine the selection of the route and effects of internationalisation (Guadix *et al.*, 2016).

Although internationalisation is not necessarily a priority for all parks (Lizińska & Sobol, 2023; Zacharewicz *et al.,* 2017), it is almost unheard of today to have a park that is exclusively "domestic" and completely ignores the international dimension in its strategies and activities (Lund, 2019).

Regardless of the internal motivation, one of the necessary determinants of a successful adaptation of a science and technology park to the international environment is the incorporation of an international dimension to the strategy or even an elaboration of a program or strategy for the internationalisation of the park (Imer *et al.*, 2021; Tomelin *et al.*, 2018; UNIDO, 2021; Zieliński *et al.,* 2014).

Cruz-Castro *et al.* (2015) distinguished three basic internationalisation strategies: a network approach to build a critical mass at the transnational level, a specialisation approach to become one of the world leaders in a specific market niche and a geographic approach with a strategic choice of countries in which RTOs choose to internationalise their activities. On the other hand, with regard to internationalisation at the micro level, STP managers can adopt the following strategies for implementation: defensive (attracting foreign-invested companies to the park, which creates opportunities for cooperative relationships with tenant companies) or offensive (activating and supporting tenant companies for internationalisation). In practice, park managers usually choose to implement both of these strategies, but they do so with different intensities or focus (Lund, 2019). This choice carries important implications regarding, among other things, the portfolio of innovative services on offer in the park.

Considering internationalisation in the practice of science and technology parks and using the process approach, the following phases can be distinguished: evaluation of the park's ability, market discovery, and market

consolidation. An accurate risk assessment and an evaluation of the STP's ability to develop in the international environment are key indicators of successful and sustainable internationalisation. The second phase consists of exploring the foreign market, building skills that are characteristic of the particular country, elaborating on the internationalisation strategy, and adopting the first projects. Finally, the market consolidation phase involves operations towards the enhancement of the STP position in the foreign market (Zacharewicz *et al.,* 2017).

Such an approach to the internationalisation of a science and technology park corresponds to the concept of a traditional, sequential model of internationalisation (Johanson & Wiedersheim-Paul, 1975; Johanson & Vahlne, 1977), but also to updated concepts of the original approach, like the extension of the model by the service sector and the importance of external relations (Sharma & Johanson, 1987), as well as incorporating elements of the firm's behavioural theory and the concept of business networks (Johanson & Vahlne, 1990).

Among the activities undertaken by park managers (at the institutional level) as part of this process are: increased communication and formal cooperation with foreign counterparts, networking activities, personnel mobility, joint R&D projects, "export of knowledge", (technological) products and services, "foreign direct investment" in the form of establishing a representative office or investing in R&D facilities outside the park's home country, or organising conferences, visits and meetings with foreign entities (Guadix *et al.,* 2016; IASP, 2022; Zacharewicz *et al.,* 2017). At the micro level, the manifestation of STP activity in this area is also the support of the internationalisation process provided to company-locators through various channels (Albahari *et al.,* 2019; Błaszczyk *et al.,* 2023; Engelman *et al.,* 2015; Franco *et al.,* 2020; IASP, 2022; İmer *et al.,* 2021; Laspia *et al.,* 2021; Lecluyse *et al.,* 2019; Lund, 2019; Ng *et al.,* 2021; Sobol *et al.,* 2023; UNIDO, 2021).

The few empirical studies carried out among the science and technology parks provide evidence that, in general, the international operations undertaken by these parks have a positive impact on their development and their business performance (Albahari *et al.,* 2017; Guadix *et al.,* 2016; IASP, 2022; Imer *et al.*, 2021; Tomelin *et al*., 2018), as well as on the extent of support for the internationalisation process provided to STP tenants (Albahari *et al.,* 2022; Błaszczyk *et al.,* 2023; Sobol *et al.,* 2023).

There are also few studies aimed at recognising the interdependence between key characteristics (attributes) of public research organisations, e.g.,

the life cycle phase and internationalisation stage of these entities, as pointed out by Cruz-Castro *et al.* (2015). There is also a lack of proposals for indicators to measure the internationalisation of these organisations that would make it possible to analyse and evaluate the effectiveness of this activity of parks.

It should also be noted that most of the completed studies on STPs analyse their development and activities from the perspective of business tenants (demand side), and only a few take into account the perspective of park managers (supply side) (Albahari *et al.*, 2019, Tomelin *et al.*, 2018). At the same time, no such studies conducted in Central European countries have been found.

The briefly presented circumstances became the rationale for addressing the issue of internationalisation of Polish science and technology parks (at the institutional level) in the context of the life cycle phases of these organisations, which is an original approach to this issue. It was also the intention of the authors to identify the most important obstacles limiting the internationalisation of STPs. Such a diagnosis, combined with an assessment of the degree of internationalisation, made it possible to formulate recommendations relating to the necessary measures aimed at intensifying internationalisation.

Methods

The main objective was to carry out a diagnosis of the status of the internationalisation of science and technology parks in Poland in the context of their life cycle. To this end, the following research questions were posed to pinpoint the issue under investigation:

1. What stage of internationalisation are the parks in?
2. Does this phase differ between parks?
3. In what life cycle phase are the parks in?
4. Does the realization of activities by parks differ depending on their life cycle phase?
5. Is the stage of internationalisation related to the life cycle phase of the parks?
6. What obstacles and to what extent limit the process of internationalisation of parks?

The following research hypotheses were assumed:

1. Parks in Poland differ in the level of internationalisation, although a low level prevails.
2. The process of internationalisation of the parks is in line with the concept of the traditional, sequential model of internationalisation.
3. Development of the parks is sequential and differs from park to park.
4. Stage (phase) of the park internationalisation is higher when the level of the development of the park, expressed as a phase in the life cycle, is more advanced.
5. The level of internationalisation of parks depends significantly on the identified obstacles to this process.

The research covered all 33 active science and technology parks in Poland as of 1 June 2022. The number of these entities was established according to the database of innovation and enterprise centres in Poland, elaborated by the Polish Business and Innovation Centers Association (SOOIPP)[6]. The names of the parks are not disclosed to ensure complete anonymity to the respondents and minimise reply errors (Konrad & Linnehan, 1995).

Because of the geographic distribution of the entities investigated in the study and the intention to express the researched phenomenon numerically, quantitative research methods were employed in the empirical part of the study. The empirical study, whose aim was to obtain original data, was carried out with a survey method involving the research technique of an interview based on a questionnaire designed by the authors and composed of three sections and a set of demographic questions. The research instrument contained closed and semi-open questions, allowing the respondents to add their own comments (see Appendix). The questionnaire aimed to obtain information on three types: the status of the internationalisation of a science and technology park, the level of its development expressed as a life cycle phase, and obstacles to the internationalisation process.

In the first instance, an effort was made to obtain information about activities undertaken for the sake of the internationalisation of a park in various timeframes. By collating these data, the level of the park's internationalisation was diagnosed. The internationalisation status of science and technology parks was analysed in four key areas. One of these areas was an institutional analysis, which was detailed in a study by Sobol *et al*. (2023).

[6] The Polish Business and Innovation Centers Association in Poland (SOOIPP) https://www.sooipp.org.pl/baza-osrodkow/en (retrieved: 1.06.2022).

Additionally, a process-oriented approach was utilised which included three phases: phase 1 — evaluating the park's potential, phase 2 — discovering the market, and phase 3 — consolidating the market. This approach was described by T. Zacharewicz et al. (2017). The activities characteristic of the particular phases (stages) of internationalisation are presented in Table 1.

To establish the level of science and technology parks within one of the three phases of internationalisation, the following formula[7] was used:

$$int_{ip} = \sum x_{ij} / \left(k * n_p\right) \tag{1}$$

where:

i	a particular science and technology park,
j	actions undertaken by science and technology parks within one of the three phases of internationalisation (p),
k	maximum level of realisation of these actions in the park (k=3),
n	number of possible actions as part of the p level of internationalisation.

This approach makes it possible to decouple the final result from the various number of actions undertaken in each of the three phases of a park's internationalisation and express values of the calculated indicators in a shared range [0;3], indicating if a park undertakes particular actions towards internationalisation in the past, at present, or intends to realise them in the near future. Next, the average level of realisation of actions for each STP was calculated as the average of the attained levels with regard to the three phases of the park's internationalisation (int_1, int_2, int_3).

In the second case, the study was based on the definition and operationalisation of the three phases of a park's life cycle following the criteria identified by Allen (2007, p. 4):[8]

- phase 1 (creation), which includes planning and designing the concept of the function and development of the park, obtaining agreements from the park's stakeholders and acquisition of funds for current operations;
- phase 2 (consolidation), which consists of the development of the park's technical infrastructure and an offer of consulting services for resident

[7] The applied formula corresponds to the solution proposed by Jaworek *et al.* (2023, p. 389).

[8] Allen was head of Manchester Science Park for many years and was the chairman of The United Kingdom Science Park Association (UKSPA) for two terms of office.

companies, a gradual increase in the effectiveness of managerial and operational actions is observed;
– phase 3 (maturity) features a distinct change towards the elaboration of an individual model of park management, and the collected resources predispose the park to extend operations towards the economic and technological development of the region.

The measures characteristic of the particular phases of a park's life cycle include the actions described in Table 2.

On the basis of evaluation (on a scale from 1 to 4) of the level of realisation of the 20 actions in the development of a park, it was possible to determine the current level of the park's development. The following formula[9] was used to calculate the level of development of particular science and technology parks within one of the three phases of their life cycles:

$$dev_{ip} = \sum x_{ij} / \left(k * n_p\right) \tag{2}$$

where:

i	a particular science and technology park,
j	actions undertaken by and technology parks within one of the three phases of life cycle (p),
k	maximum level of realisation of these actions in the park (on the scale from 0 to 4),
n	number of possible actions as part of the p-phase of the park's life cycle.

This approach reduced the value of the calculated indicators to the common band [0;1]. Next, as an average of the obtained levels for each phase of the life cycle (dev_1, dev_2, dev_3), the average level of realisation of actions for each STP was determined.

To group the parks by the level of realisation of actions within each phase of the life cycle and the internationalisation, the authors used the agglomeration method of Ward (1963) with the measure of dissimilarity that equals the square Euclidian distance. This method allocates objects to new clusters in a way that minimises the sum of squared deviations of the variables, which describe particular elements in a given cluster. This allows the identification of the possibly homogenous clusters. As a criterion for

[9] The applied formula corresponds to the solution proposed by Jaworek *et al.* (2023, p. 389).

identifying the number of groups, the Duda-Hart (Duda *et al*., 2020) Je(2)/Je(1) index-stopping rule was used.

Based on literature studies, the questionnaire identified the thirteen most important obstacles to the internationalisation process. In order to examine the internal consistency of variables describing the internationalisation of parks, Cronbach's Alpha reliability index was calculated. The value of this indicator for the identified variables assessed is $\alpha = 0.829$. This confirmed that the factors adopted for assessment are consistent. Thanks to the obtained results of the Cronbach alpha test, the reliability of the research tool was confirmed.

In order to determine the strength and direction of the existing relationship between obstacles and the internationalisation index of the studied parks, Kendall's τ test was used. Kendall's coefficients indicate not only the strength but also the direction of the relationship, where $\tau>0$ means the occurrence of a positive correlation, and $\tau<0$ means the occurrence of a negative correlation between the examined features. The closer the Tau value is to 0, the weaker the monotonic relationship between the examined features. The significance level of $\alpha=0.050$ was adopted in the analysis.

The study was carried out between June and September of 2022, covering all of the STPs in Poland. Seventeen questionnaires were completed and returned, which is 54.5% of the total number of parks in Poland. In one case, the request to participate in the study was declined due to the park's organisational matters. As answers regarding the internationalisation were not provided by park number 13, the park was not accounted for in the final analysis.

Results

Activities of the parks result not only from the strategy elaborated and adopted at the level of their management but also from the number and character of their resident companies. As follows from the aggregated data, the science and technology parks in Poland differ largely in terms of the age and size of resident enterprises. Most parks have a large share of companies operating in the parks for longer than three years. In the parks' tenant structure, none of the company sizes under analysis had a share over 75% (Table 3).

The duration for which businesses operate in a park has an impact on both the actions undertaken by the park itself and the level of the development of the resident businesses. As the aggregated data suggest, the companies residing in the STPs are at various stages of development. Most often, the share of companies in phase 1 or 2 of development does not exceed 25%. The share of companies in phases 3 and 4 is more diverse, but in most parks, it does not exceed 25% (Table 4).

As it is evident from the study, the parks were at different stages of internationalisation. On the basis of the number and type of the actions the parks engaged in, it was concluded that only three parks realised objectives at all phases of internationalisation; none of the parks, however, attained the most advanced phase, i.e. establishing an agency abroad (Fig.1).

Taking into account the realisation of the actions characteristic for the particular phases of internationalisation, three groups of parks were identified (Fig. 2). The most numerous cluster (10 parks) was composed of STPs for which the values of the synthetic indicator of realisation of actions in every phase of internationalisation were low. Another cluster (4 parks) was characterised by a very low value of the indicator for the first phase of internationalisation but the highest values for phases 2 and 3. The last cluster of two parks had relatively high values for the realisation of actions in the first and third phases of internationalisation.

On the basis of the presented data, it was concluded that the studied parks are going through the process of internationalisation at various rates. They are also at different phases of this process. It should be noted that some parks take intensive measures in the second phase and enter the third phase of internationalisation with confidence (Group 1). In another group, two parks are in the process of implementing intensive measures in phase 2 but relatively seldom engage in phase 1 actions (Table 5). This may result from the adopted strategy as well as from the different ages of these parks. However, the largest group is represented by parks, which do not take active measures for the sake of internationalisation.

If the actions defined for each phase are taken into consideration, it becomes evident that no clear boundary between these phases can be set in practice. All of the parks, albeit at different rates, realise the actions characteristic of each of the three phases of the cycle. The intensity of the measures undertaken, however, can corroborate the claim that the development of parks happens in a certain sequence of phases. The first stage of park development (which includes creating the park's operational concept,

developing the park's plan, and coordinating agreements with stakeholders) is the most advanced in the parks studied. None of the parks surveyed showed low levels of completion in phase 1 measures (as shown in Fig. 3).

Among the parks that participated in the study, four were most advanced in the realisation of phase 1 of their life cycle.

The measures taken warrant the claim that all parks go through the second phase of the life cycle. However, these actions are realised on a modest level. Of thirteen actions associated with this life cycle phase, only two (creating the park's promotion policy and generating income from rent) did not indicate a low intensity of implementation. Among the remaining eleven measures, the ones most often indicated as being at a low level of implementation were developing a specialist laboratory offer for external entities, developing acceleration programs for young entrepreneurs (with solutions from Industry 4.0), and improving the infrastructure in the laboratory and R&D facilities.

The examination of the level of realisation of actions characteristic for phase 2 of the life cycle demonstrated a wide disparity between particular parks in this respect. For nine parks, this parameter was scored higher than the average for all STPs (2.80). The lowest degree of realisation is indicated for life cycle phase 3 (average of 2.5). Similarly to phase 2, the third life cycle phase demonstrated more diversified realisation levels than phase 1. Among measures of the lowest level of realisation was the process of obtaining accreditation from the Polish Business and Innovation Centers Association (nine parks). The collected data suggest that only three parks realise actions at an advanced or very advanced level, typical for phase 3 of the life cycle.

According to the level of realisation of actions towards the development of parks, three clusters of parks can be distinguished (Fig. 4). In the case of two clusters (1 and 3) and on average for the whole group, the values of the indicators related to the realised actions corroborate the finding that the phases of the parks' life cycles are of sequential nature. The most intensive measures were implemented in the first phase of the life cycle, the less intensive ones in the second phase, and the least intensive ones occurred in the third phase (Table 6).

Using the degree of implementation of actions in the distinguished phases of the life cycles of the parks, undertaken during particular internationalisation stages, three clusters were identified (Fig. 5). The most numerous was the cluster characterised by the sequential order of the life

cycle phases, but it was also the cluster where actions towards internationalisation were the least intensive (Table 7).

Diagram 6 presents the means and confidence intervals for the level of realisation of actions in particular stages of a park's life cycles and the phases of internationalisation. The geometrical figures mark the average levels of realisation of actions, while the whiskers show the minimum and maximum values (at 95% probability). Their analysis leads to the conclusion that the highest level of realisation can be found for actions in the first life cycle phase of the parks. The second phase has a slightly lower level of realisation, falling even lower in the third phase, which is in line with the adopted hypothesis of the sequential development of the parks. On the other hand, the average levels of realisation of actions with regard to internationalisation are non-linear, with the highest mean found in the second phase and the lowest in the first phase of internationalisation.

The analysis of interdependence between the status (phase) of a park's internationalisation and its life cycle phase indicates a low level of adjustment of the two indicators, *dev_mean* and *int_mean*. Together with the increase in the average level of realisation of actions in the parks, there is a growth in the realisation of internationalisation actions (and *vice versa*). However, the adjustment of the curves (linear and square) to the data is small, 4.0-3.5% (Fig.7).

Regarding the correlation between the assessment of obstacles to the implementation of internationalisation and the internationalism index, it should be stated that there is a statistically significant monotonic relationship between the assessment of three obstacles and the level of the internationalisation index (Table 8). The above finding prompted the authors to adopt the hypothesis that there is a monotonic relationship between the assessment of obstacles and the level of the internationalisation index in the case of obstacles: O1 — lack of external financing to undertake and develop activities in this area; O2 — lack of own financial resources to undertake/develop activities in this area and O11 — ignorance of the regulations governing business activity abroad. In these three cases, since the value of Kendall's τ coefficient was above zero, it can be assumed that there is a positive correlation between the individual factors used for assessment. In other cases, since the value of Kendall's τ coefficient was also above zero, it can be assumed that there is a positive correlation between the individual factors used for assessment, but it is insignificant.

Discussion

Park activity, as highlighted by researchers (İmer *et al*., 2021; Ruiz *et al*., 2017), is determined by the strategy and characteristics of the tenant firms. The varying level of development of companies as park tenants is a rather natural phenomenon, ranging from start-ups, including new technology-based firms (NTBFs) to multinationals (Albahari *et al*., 2019; Franco *et al*., 2020; Ng *et al*., 2021). However, it raises some implications for park policy. Park activities will also then be differentiated according to the needs of the tenants. This may limit the possibility of implementing more advanced strategies, such as the internationalisation of parks. This is because such strategies should, on the one hand, stimulate the development of their tenants, but at the same time, should be consistent with the capabilities and needs of tenants.

The importance of actions on the part of managers aimed at the internationalisation of company-locators was noted by Anton-Tejon *et al*. (2024), among others. Collaboration, with universities and other organisations is also an important element in the development of parks (Löfsten & Klofsten, 2024; Ullah *et al*., 2023). The authors emphasise that the establishment of communication channels between parks and universities fosters an open exchange of ideas, joint discussions and problem-solving. The congruence between the goals and objectives of SPs and universities, especially in areas such as research topics, industry partnerships, technology transfer and talent development, further reinforces the mutually beneficial nature of this relationship. However, as Clemente-Císcar *et al.* (2024) point out, park tenants are not always able to take advantage of the development opportunities provided by park activities. Those where the park's impact on development was most evident were mainly newly established companies with export potential. At the same time, Lecluyse *et al.* (2022), based on the results of their study, also highlighted the need to improve knowledge regarding park tenants and their propensity to use park services.

The varying degree and process of internationalisation was pointed out by Guadix *et al.* (2016). However, parks participating in the study have established cooperation with their foreign counterparts located in countries of the Baltic Sea region and other Central European countries (Croatia, Malta, Germany). This confirms the staged course of the internationalisation process of Polish science and technology parks. In the sequential model of internationalisation, the differences between the home market and the

expansion market (e.g. language, education, business practices) condition the order of entering foreign markets, i.e. first closer then further away in terms of mental distance. However, at the same time, the existence of a so-called paradox is pointed out, which refers to inconclusive findings on whether mental distance facilitates cross-border activities (Chen *et al*., 2020; Liu *et al*., 2023). For this reason, in-depth research on this issue is recommended, i.e. identifying the impact that mental distance has on internationalisation decisions or the effectiveness of ways to mitigate the challenges of mental distance by strategic decision-makers (Egwuonwu *et al*., 2020; Liu *et al*., 2023; Safari & Chetty, 2019; Yan *et al*., 2020).

Significant obstacles to the internationalisation process identified in the studies, relating to, among other things, the lack of external funding, may be due to the need to support the internationalisation process. Indeed, as other researchers have pointed out (Glittová & Šipikal, 2022; Yang & Lee, 2021), the success of a park largely depends on its supportive environment. Instead, the lack of financial resources at the level of the organisation itself as a significant obstacle to the aforementioned process may allude to the resource approach of internationalisation, in which the possession of unique resource packages determines a greater propensity to expand abroad (Li, 2018). Tomelin *et al.* (2018), on the other hand, note that a way to reduce obstacles and stimulate the internationalisation process, not only for the parks themselves but also for their tenants, is the creation of coherent internal and external networks and the specialisation of parks.

Importantly, the identification by managers of the above-mentioned obstacles was positively correlated with the level of internationalisation of the parks. This situation may be due to the fact that — as park managers emphasised in face-to-face interviews — the internationalisation process is often not preceded by a detailed analysis of the foreign market. Unfortunately, managers often become aware of the obstacles that actually exist, including those related to unfamiliarity with the legal regulations associated with internationalisation, only at the point of undertaking activities abroad.

The results of the study, therefore, provide a basis for indicating the type of action that should be taken to activate parks internationally. Such activities should be undertaken at a higher level than the parks themselves, as studies have shown that they do not have sufficient financial resources. At the same time, park managers emphasised that due to many ongoing tasks, there are not enough resources of various kinds to undertake more

organised activities aimed at increasing internationalisation. Unfortunately, the lack of adequate preparation for such activities can result in various types of problems, including financial or legal. For this reason, in the context of the ways of stimulating the internationalisation of parks identified in the literature, one of the desired courses of action may be the creation of cooperation networks at various territorial and entity levels. Involving all stakeholders in the above-mentioned process in the networks created may not only intensify the internationalisation process but also reduce the problems associated with it. Supporting the international activities of the parks is important because of the role these organisations play in the triple helix system. Given the importance of this activity, this support should be implemented not only at the regional level but also through integrated activities at the national level.

Conclusions

Given the importance of the activities of science and technology parks in stimulating innovation-driven growth, especially in countries seeking effective development forces today, as well as the research results obtained confirming the importance of activities carried out with varying intensity for internationalisation, it is necessary to look for the reasons for most of the relatively low level of internationalisation.

The results of the study also failed to confirm the hypothesis that the internationalisation process of parks follows the traditional sequential model of internationalisation. The average levels of implementation of internationalisation activities showed a non-linear distribution. The highest average value was recorded for the second phase of internationalisation and the lowest for the first phase. However, it was confirmed that the development of the parks themselves, as described in the three phases of the life cycle, occurs sequentially; the highest level of implementation of activities was found for the first phase, a lower level in the second phase, and the lowest level occurred in the third and final phase of the life cycle.

The sequential development of parks at the national level may, therefore, in principle, indicate the possibility of creating and achieving individual stages in an undisturbed manner, in line with the assumptions indicated in the literature. The problem, however, is the internationalisation of parks. Not only is it characterised by a low level, but its course also does

not indicate that it is the result of the successive implementation of previously established activities.

Although the study confirmed that the processes of development and internationalisation are interrelated, i.e. an increase in the implementation of activities by parks leads to an increase in the level of internationalisation and vice versa, the current study indicates that there is little correlation between the phase (status) of a park's internationalisation and the phase in its life cycle.

This problem is also indicated by the results of studies relating to obstacles to the internationalisation process. This is because the most significant ones are diagnosed only at an advanced level of internationalisation. Thus, such an important activity of parks is undertaken without a prior in-depth diagnosis of the international situation. Such a case may result in limited effectiveness of the activities undertaken in the direction of internationalisation and generate problems during international activity. The low effectiveness of the internationalisation initiator's activities may also become a de-stimulant factor in the cooperation of foreign partners.

Despite the relatively large group of parks that participated in the study and were included in the analysis (17 of 33), some limitations of the study may be related to the small number of observations or some factors that were not included in the analysis. These may have affected both the development of the parks and their internationalisation. However, those diagnosed in the current literature were included. A more detailed analysis is therefore needed, not only of the available data but also of additional information about the parks' activities. Relating the above analysis to one of the four dimensions (institutional) in the diagnosis of the internationalisation of a science and technology park, it is worth expanding future research to include the other dimensions: behavioural, microeconomic and systemic.

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Annex

Table 1. Activities undertaken by parks and the phase of internationalization

The phase of internationalization	Activities
I phase	analysis of target markets
	analysis of technological and market trends
II phase	cooperation of the park with dedicated entities in the field of internationalization, e.g. PAIIZ, COIE
	training, consulting and brokerage services
	participation in international events, e.g. seminars, conferences
	international joint projects
	promotion of tenant-enterprises at fairs and exhibitions
	exchange of staff and park management (internships, study visits)
III phase	animating meetings between companies from various parks outside the country
	introducing internationalization issues into the program of pre-incubation courses
	international patent protection
	participation in international organizations associating parks, e.g. IASP
	modification of the Park's offer in the field of supporting the internationalization of tenant companies
	cooperation with foreign scientific or research centres
	establishing a representative office of the park abroad

Source: own study based on: Guadix *et al.* (2016, p. 5), Zacharewicz *et al.* (2017, pp. 24–28).

Table 2. Activities undertaken by parks and the phase of the STP's life cycle

The phase of the STP's life cycle	Activities
I phase	creating the concept of the park's operation
	creating the park development concept
	implementation of agreements concluded between the park's shareholders
II phase	creating the concept of promoting the park
	business space development
	equipment level of the laboratory or R&D zone
	development of consulting services in the area of incubation for start-ups
	development of acceleration programs for young enterprises (with industry 4.0 solutions)
	development of a personalized offer of consulting services for tenant companies after the incubation period
	development of the offer of specialized consulting services for external entities
	development of the offer of specialist laboratory services for external entities
	creating coworking spaces
	creating a networking space

Table 2. Continued

The phase of the STP's life cycle	Activities
II phase	rental income making profit/overall financial result (if applicable) creating new jobs
III phase	designing a business model or management model of the park cooperation with national scientific centers development of the Park's innovation (e.g. cluster seeds) obtaining the accreditation of the Polish Center for Accreditation

Source: own study based on Allen (2007, pp. 4–5, 15).

Table 3. The number of parks in terms of the structure of tenants by age and size of enterprise

Enterprise age	Number of parks by tenant structure			
	up to 25%	26-50%	51-75%	over 75%
up to 3 years	8	5		2
over 3 years		1	6	8
Enterprise size	up to 25%	26-50%	51-75%	over 75%
micro-enterprise	4	1	3	5
small enterprise	8	3	3	
medium enterprise	9	1	2	

Table 4. The number of parks in terms of the structure of tenants according to their development phase

Enterprise development phase	Number of parks by tenant structure			
	up to 25%	26-50%	51-75%	over 75%
phase 1: incubation (using the services and infrastructure of the Business Incubator under the agreement with the park)	10	1	1	2
phase 2: acceleration (using the services and infrastructure of the park on the basis of de minimis aid/scaling programs for start-ups)	10			1
phase 3: stabilization (strengthening the market position/cooperation network/customer portfolio)	6	4	3	
phase 4: maturity (ready to function outside the park)	8	3	1	3

Table 5. Classification of parks into clusters within the degree of implementation of activities for internationalization (int) in each of the three phases

Group	Parks	Int_1	Int_2	Int_3
1	1,2,16,15	0,25	1,88	1,29
2	10,14	1,50	1,83	0,36
3	11, 12, 17, 7, 6, 9, 4, 8, 5, 3	0,40	0,62	0,46
Total		0,50	1,08	0,65

Table 6. Classification of parks into clusters and average values of the degree of implementation of activities (dev) in each of the three phases of the parks' life cycle

Group	Parks	Dev_1	Dev_2	Dev_3
1	4, 11, 5, 17, 9, 6, 7, 3, 8, 12	0,73	0,69	0,58
2	16,2,15,1	0,75	0,63	0,70
3	10,14	0,71	0,63	0,53
Total		0,73	0,67	0,61

Table 7. Classification of parks into clusters and average values of the degree of implementation of activities (dev_i) and activities for internationalization (int_i) in each of the three phases of park development

Group	Parks	Dev_1	Dev_2	Dev_3	Int_1	Int_2	Int_3
1	1,2,16,15	0,75	0,63	0,70	0,25	1,88	1,29
2	10,14	0,71	0,63	0,53	1,50	1,83	0,36
3	11, 12, 17, 7, 6, 9, 4, 8, 5, 3	0,73	0,69	0,58	0,40	0,62	0,46
Total		0,73	0,67	0,61	0,50	1,08	0,65

Table 8. Analysis of the relationship between obstacles and the internationalization index of the studied Parks (Kendall's Tau correlation)

Obstacles	Kendall's Tau correlation coefficient
O1 - lack of external financing to undertake and develop activities in this area	0,590*
O2 - shortage of own financial resources to undertake/develop activities in this area	0,614*
O3 - the need to redesign the current business model	0,169
O4 - no activities carried out in the area of international marketing	0,342

Table 8. Continued

Obstacles	Kendall's Tau correlation coefficient
O5 - reluctance to establish cooperation on the part of foreign entities	0,190
O6 - lack of employees with the necessary competencies. lack of employees with the necessary competencies	0,341
O7 - lack of knowledge of foreign languages	0,232
O8 - lack of professional experience in international organizations/enterprises	0,329
O9 - lack of ability to establish and maintain foreign business relationships	0,086
O10 - ignorance of the specifics of foreign business culture	0,170
O11- ignorance of the regulations governing business activity abroad	0,380*
O12 - reluctance to undertake foreign business trips	0,080
O13 - reluctance to introduce changes	0,166

Note: Correlation significant at the 0.05 level

Figure 1. Activities undertaken by parks and the internationalization phase

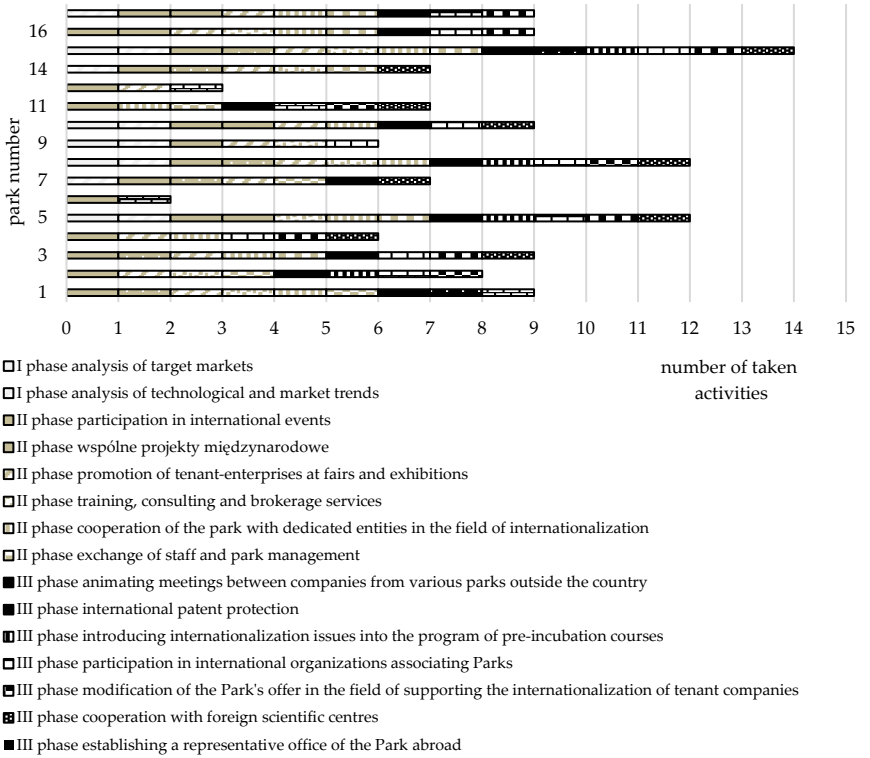
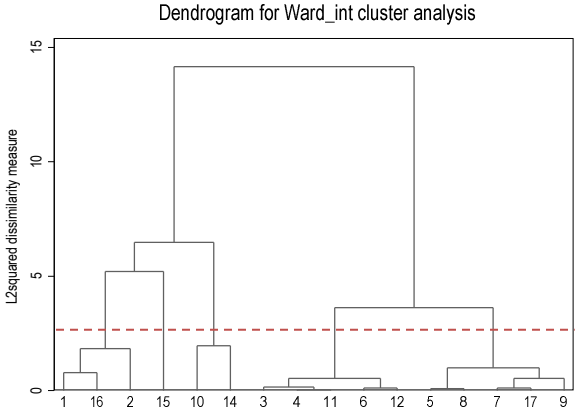
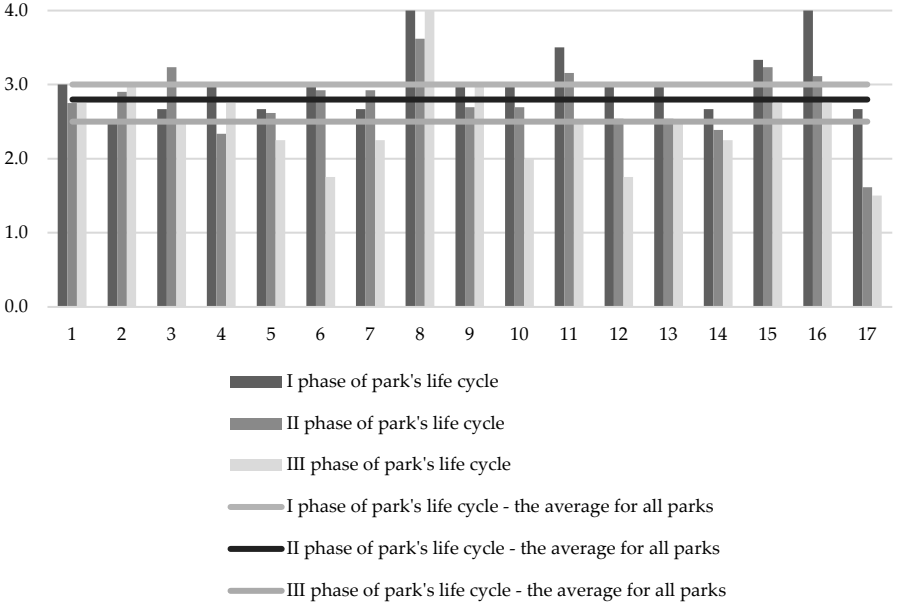


Figure 2. Dendrogram for the degree of parks' internationalization



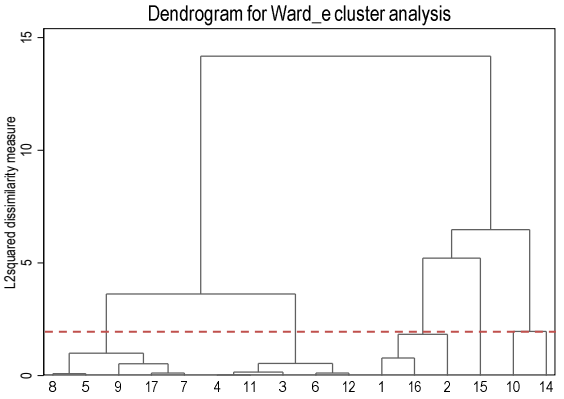
Note: The proposed three-element solution is marked with a dashed curve.

Figure 3. The degree of implementation of parks' activities in individual phases of the life cycle



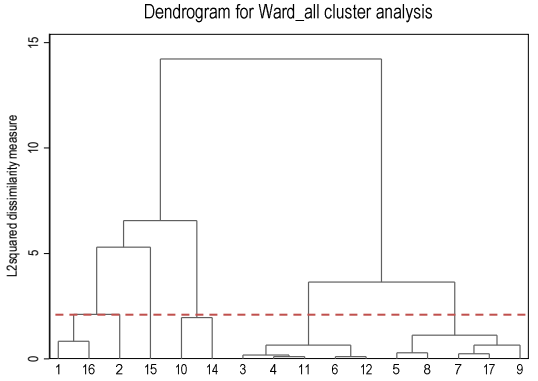
Note: Degree of implementation of activities: assessment on a scale of 0-4, where 0 - no activities, 4 - activities implemented to a very high degree

Figure 4. Dendrogram for the degree of implementation of activities in parks for their development



Notes: Longer curves indicate greater differentiation between parks in terms of the degree of implementation of measures. The proposed three-element solution is marked with a dashed curve.

Figure 5. Dendrogram for park development and internationalization activities



Note: The proposed three-element solution is marked with a dashed curve.

Figure 6. Means and confidence intervals for dev_i and int_i

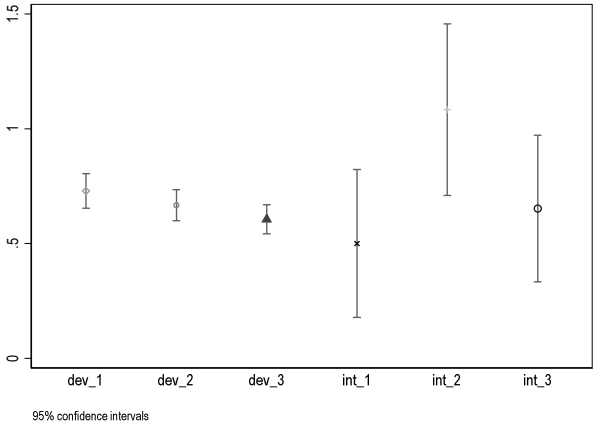
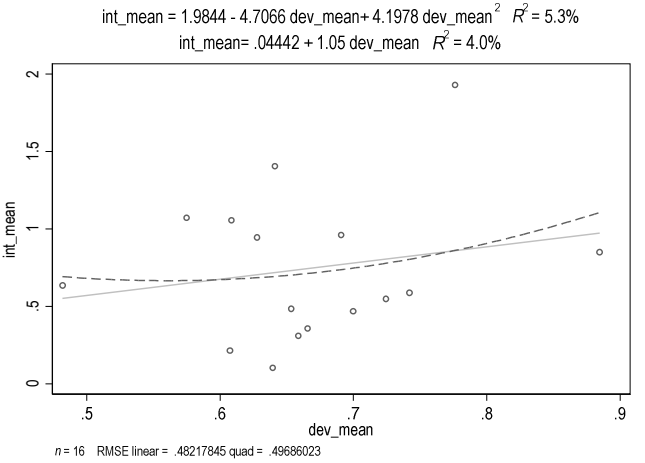


Figure 7. Scatter plot between the int_mean and dev_mean



Appendix

A survey questionnaire on the internationalisation of Science and Technology Parks in Poland addressed to Management Staff

Please put an "X" in the empty boxes next to your chosen answers or enter your answers in the appropriate places. It is possible to indicate more than one answer.

A. Characteristics of the Science and Technology Park

1. Please specify the share of enterprises according to their age in the total number of enterprises tenants of the Park:

Age of the enterprise	Structure			
	up to 25%	26-50%	51-75%	above 75%
up to 3 years				
above 3 years				

2. Please specify the share of enterprises according to their size in the total number of enterprises tenants of the Park:

Size of the enterprise	Structure			
	up to 25%	26-50%	51-75%	above 75%
micro-enterprise				
small enterprise				
medium enterprise				

3. Please specify the share of enterprises according to the criterion of their development stage in the total number of enterprises-tenants of the Park:

Development stage of the enterprise	Structure			
	up to 25%	26-50%	51-75%	above 75%
phase 1: incubation (using the services and infrastructure of the Business Incubator under the agreement with the Park)				
phase 2: acceleration (using the Park's services and infrastructure on the basis of de minimis aid/scaling programs for start-ups)				
phase 3: stabilization (strengthening market position/cooperation network/customer portfolio)				
phase 4: maturity (ready to function outside the Park)				

4. Please specify the share of enterprises according to the criterion of their **industry specialization** in the total number of enterprises tenants of the Park:

Industry specialization of the enterprise	Structure			
	up to 25%	**26-50%**	**51-75%**	**above 75%**
industry specialization (what?) ……..				
industry specialization (what?) ……..				
industry specialization (what?) ……..				

5. Please specify the share of strategic enterprises (e.g. dynamically developing, with high development potential, operating in advanced technology industries, etc.) in the total number of enterprises tenants of the Park: ……. %
6. Please list the three key goals included in the Park's operating strategy for 2020-2030: ……
7. Please specify the degree of implementation of activities in the development of the Park:

No	Activities in the field of:	Assessment of the implementation of the action on a scale:			
		1 (very low)	**2 (medium)**	**3 (high)**	**4 (very high)**
1	creating a concept for the operation of the Park				
2	creating a concept for the development of the Park				
3	implementation of agreements concluded between the Park's shareholders				
4	designing your own business/management model of the Park				
5	cooperation with national research centers				
6	development of the Park's innovation (e.g. cluster seeds)				
7	creating a concept for promoting the Park				
8	**1.** development of business space				
9	level of equipment in the laboratory/R&D area				
10	obtaining accreditation from the Polish Business and Innovation Centers Association				

No	Activities in the field of:	Assessment of the implementation of the action on a scale:			
		1 (very low)	2 (medium)	3 (high)	4 (very high)
11	development of the offer of consulting services in the area of incubation for start-ups				
12	development of acceleration programs for young enterprises (with solutions in the area of Industry 4.0)				
13	development of a personalized offer of consulting services for tenant enterprises after the incubation period				
14	development of the offer of specialized consulting services for external entities				
15	development of the offer of specialized laboratory services for external entities				
16	creating a coworking space				
17	creating a space for network collaboration				
18	generating rental income				
19	achieving profit (if applicable)				
20	number of new jobs				

B. Internationalisation of the Science and Technology Park

1. Please indicate in what time frames the activities in the area of internationalisation were implemented:

No	Activities in the area of internationalisation:	in the past	now	in the future
1	establishing a representative office of the Park abroad			
2	participation in foreign events, e.g. seminars, conferences			
3	joint international projects			
4	animating meetings between companies from different Parks outside the country			
5	promotion of tenant enterprises at fairs and exhibitions			
6	introduction of courses on pre-incubation of internationalisation issues into the program			

No	Activities in the area of internationalisation:	in the past	now	in the future
7	training, consulting and brokerage services			
8	international patent protection			
9	analysis of target markets			
10	analysis of technological and market trends			
11	cooperation of the Park with dedicated entities in the field of internationalisation, e.g. PAIIZ			
12	participation in international organisations bringing together Parks, e.g. IASP, EBN			
13	modification of the Park's offer to support the internationalisation of tenant enterprises			
14	exchange of staff and management staff of the Park (internships, study visits)			
14	cooperation with foreign research centers			
16	other, what? ……..			

2. Please assess the expected benefits resulting from the internationalisation of the Park:

No	Benefits from the internationalisation of the Park:	Assessment of benefits on a scale:				
		1 (very low)	2 (low)	3 (medium)	4 (high)	5 (very high)
1	transfer of good practices to improve the Park's services					
2	creating partnerships to increase the Park's potential					
3	creating partnerships to increase the potential of tenant enterprises					
4	obtaining financial resources, e.g. through joint projects					
5	supporting tenant companies in acquiring new markets, customers, etc.					
6	encouraging enterprises with foreign capital to establish a branch or branch in the Park					
7	strengthening the Park's brand					

No	Benefits from the internationalisation of the Park:	Assessment of benefits on a scale:				
		1 (very low)	2 (low)	3 (medium)	4 (high)	5 (very high)
8	other, what? …….					

3. Please specify the intensity of obstacles related to the internationalisation of the Park:

No	Obstacles related to the internationalisation of the Park:	Assessment of the intensity of obstacles on a scale:				
		0 (don't occur)	1 (very low)	2 (medium)	3 (high)	4 (very high)
1	lack of external financing to undertake and develop activities in this area					
2	lack of own financial resources to undertake/develop activities in this area					
3	the need to redesign the current business model					
4	no activities carried out in the area of international marketing					
5	reluctance to establish cooperation on the part of foreign entities					
6	lack of employees with competences necessary in the process of internationalisation of the Park					
7	ignorance of foreign languages					
8	lack of professional experience in international organisations/enterprises					
9	inability to establish and maintain foreign business relationships					
10	ignorance of the specificity of foreign business culture					
11	ignorance of the regulations governing business activity abroad					
12	reluctance to undertake foreign business trips					
13	reluctance to make changes					
15	other, what? ……					

C. Metrics

1. The Respondent's age:
up to 24th
25-34
35-44
45-54
55 and above

2. The Respondent's work experience in a managerial position:

No	Specification	up to 1 year	from 1 to 5 years	above 5 years
1	in the current Science and Technology Park			
2	in another Science and Technology Park			
3	in a public organization (other than Science and Technology Park)			
4	in an international organisation in Poland			
5	in an international organisation abroad			
6	in a company with foreign capital in Poland			
7	in a company abroad			