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Overview of international academic literature on Science and Technology Parks, focusing on sustainable management opportunities. The internal aspect of sustainability.

BREAKOUT SESSION 1 – ROLE OF INNOVATION SPACES IN THE DEVELOPMENT OF TECHNOLOGY, INDUSTRY, AND FINANCE

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EXECUTIVE SUMMARY

This study explores the key factors influencing the successful management of Science and Technology parks (STPs) through a systematic review of international literature. By synthesising academic research, it examines how STPs ensure sustainable operations and identifies internal and external factors shaping their planning and management. The analysis is based on scientific publications indexed in Scopus from 1994 to 2024. The twenty most cited and relevant studies were examined to assess STPs' perceived impact, key stakeholder groups, applied management models, and revenue sources. Findings indicate that STPs' impact on industrial actors is the most frequently studied aspect, followed by their interaction with higher education institutions. STPs have evolved from being mere real estate investments into key physical components of regional innovation clusters. They serve as intermediaries that support innovation, foster economic recovery, and contribute to achieving the economic and social sustainability goals of both the region and the nation.

THE OVERALL PURPOSE OF THE PAPER

Hungary has started a nation-wide Science and Innovation Park (SIP) development program in which the Government support Obuda University to build up three STPs. From that purpose, we extensively study the key success factors of existing SIPs especially from sustainability point of view to learn what are the key components of success.

This study seeks to provide a research-based perspective on how Hungarian STPs can be structured for long-term success. When considering sustainability in management decisions, this research aims to contribute both to Hungarian innovation policy and to international discussions on STP development. By examining management strategies that support long-term viability, the study provides insights that may inform policy decisions and practical approaches to STP planning. Additionally, it serves as a resource for those involved in the establishment and management of new STPs, offering perspectives on how these parks can be structured to operate efficiently and remain relevant over time.

THE METHODOLOGY USED

We explored the key factors influencing the successful management of Science and Technology parks through a systematic review of international literature. By synthesising academic research, we examined how STPs ensure sustainable operations and identified internal and external factors shaping their planning and management.

The analysis is based on scientific publications indexed in Scopus from 1994 to 2024, identifying the most active researchers, journals, research topics, methodologies, and institutional contributions. The twenty most cited and relevant studies were further examined to assess STPs' perceived impact, key stakeholder groups, applied management models, and revenue sources.

To ensure the selection of relevant literature, a structured search strategy was implemented using the following CCL search expression: *(TITLE-ABS-KEY ("science park") AND TITLE-ABS-KEY (innovat) AND TITLE-ABS-KEY ("success factor") OR TITLE-ABS-KEY (entrepreneur*) OR TITLE-ABS-KEY (success AND criteria) OR TITLE-ABS-KEY (technology AND transfer)) AND PUBYEAR > 1993 AND PUBYEAR < 2025 AND (LIMIT-TO (DOCTYPE, "ch") OR LIMIT-TO (DOCTYPE, "ar"))**

This methodological approach was designed to capture a broad range of studies that discuss innovation, success factors, entrepreneurship, success criteria, and technology transfer within the context of Science and Technology Parks. The inclusion criteria focused on journal articles and book chapters to ensure a strong academic foundation for the review.

173 publications were identified via database search from which 143 records were excluded after quick check due to lack of relevance. 30 records – full text papers - have been assessed out of which 10 papers were excluded due to lack of focus on the keywords searched. Finally, we deeply investigated 20 papers.

THE MAJOR FINDINGS OF TRENDS FOUND AS A RESULT OF OUR ANALYSIS

Findings indicate that STPs' impact on industrial actors is the most frequently studied aspect, followed by their interaction with higher education institutions. The international academic literature over the past three decades confirms that the topic of Science and Technology Parks (STPs) and the factors contributing to their successful management is well-established. STPs have evolved from being mere real estate investments into key physical components of regional innovation clusters. They serve as intermediaries that support innovation, foster economic recovery, and contribute to achieving the economic and social sustainability goals of both the region and the nation.

Technovation has been one of the leading journals on this topic, offering geographically diverse case studies, most of which employ empirical methodologies. These publications, often authored by multinational researchers from the United States, the United Kingdom, and China, bring a multidisciplinary approach to the subject. The impact of STPs, as highlighted in the research, is debated; it can be either neutral or positively significant, depending on factors such as the specific context of the country or region, as well as the level of stakeholder participation.

The objectives, original mission, and environmental conditions of a science park play a crucial role in shaping its structure and operations. Based on these factors, Lobejko and Sosnowska identified four distinct management models. The first is the university science park, which operates as an integral part of the university, leveraging its academic resources and infrastructure. The second is the independent organization, structured as a Limited Liability Company, providing greater autonomy in decision-making and management. The third model is the corporate park, established as a stock company, often with a focus on profitability and investment returns. Finally, the network park operates through a collaborative network structure, emphasizing partnerships and resource sharing among various stakeholders. These models differ significantly in their organization and governance.

Regarding the governance of STPs, all triple helix stakeholders – government/city, academia, and private investors/partners – participate in decision-making or supervisory bodies. Although public partners were less interested in daily management, they were more focused on maintaining control through a supervisory panel. Thus, the risk was transferred to the private sector, while the management had to remain dynamic, as the set-up is new and could entail unforeseeable challenges for all parties, occasionally requiring another private investor to step in. The public body aims to prevent the private partner from focusing solely on the monetization of real estate, striving instead for full occupancy without selecting the profile of companies entering the park. The pre-selection of tenants, along with adequate investments in laboratories and amenities, significantly impacts the delivery of high-quality research. Structured stakeholder management is vital from the very early stages, as innovation ecosystems have complex value chains, and both supply and demand should be considered.

Some studies highlighted that the success of places like Silicon Valley cannot be easily replicated due to the unique entrepreneurial culture in the United States. Moreover, while state intervention is often necessary for the functioning and success of STPs, the absence of such intervention does not necessarily doom a park to failure.

Despite the emphasis on sustainable operation, some studies found no significant difference in the performance of companies within the park compared to those outside it, or in the development of regions with and without a park. This led some researchers to classify the impact of STPs as neutral, while others argued that the parks have a clear positive influence.

An interesting finding of the research is that building an informal network of relationships within STPs is just as important as leveraging formal relationships. This indicates that successful management not only depends on strategic business connections but also on fostering a collaborative community within the park. In terms of management models, the reviewed studies present a varied picture, with the composition of leadership often depending on the level of involvement of local stakeholders. In many cases, an independent company has been established to manage the park.

Regarding revenue sources, three key categories emerge: direct or indirect government support, the infrastructure within the park, and the services offered by the park for a fee. STPs typically engage in activities that ensure their sustainable operation. These include selecting appropriate partners, providing project-based technology and office infrastructure, and offering professional and convenience services. Several internal factors are crucial to determining a park's sustainability. These include the growth potential of industrial partners, the university's ability to create value through

scientific research, and the strength of the network of relationships between companies within the park. The more robust and intensive formal and informal networks are, the greater the innovation potential within the park. External factors also play a significant role in park-sustainability, particularly the social, political, and economic conditions of the region, including the activity of local government.

A BRIEF SUMMARY OF OUR INTERPRETATIONS AND DISCUSSION OF THE RESULTS

All in all, the evaluation of STPs remains complex, with reported impacts ranging from neutral to strongly positive, depending on context. Management models vary, with state ownership being the most common, often through dedicated entities. Revenue sources include state subsidies alongside income from infrastructure and service provision. This study contributes to a deeper understanding of STP management and highlights key considerations for future research and policy development.

The impact of STPs is debated, with some studies reporting neutral effects on firm performance, while others highlight positive contributions to regional development and innovation. The study underscores the importance of structured management, stakeholder collaboration, and sustainable funding models in ensuring long-term success. These insights contribute to the broader discussion on STP management and provide policy recommendations for future research and development.

Future research could further explore the activities that Science and Technology Parks (STPs) engage in to support long-term operations, with a particular focus on their interactions within the park and with external stakeholders. This exploration would involve analyzing the economic, social, and environmental aspects of sustainability in the context of park management. Researchers could expand the study by identifying the specific activities and initiatives that STPs adopt to integrate sustainability principles into their operations. These activities may include implementing green technologies, promoting sustainable business practices among tenants, fostering eco-friendly infrastructure, or supporting regional economic development through responsible innovation. Recent studies highlight climate risk as a driver of green innovation, motivating companies to pursue digital transformation and green technologies. By reviewing additional databases and case studies, research can delve deeper into how these activities are structured, how they align with broader sustainability goals, and affect the long-term viability of STPs.

Investigating how the pursuit of sustainability affects the day-to-day operations and strategic direction of parks could reveal both challenges and opportunities for park management. It is crucial to assess whether sustainability efforts lead to measurable benefits in terms of innovation, tenant satisfaction, regional development, or financial sustainability. If researchers identify both the successes and shortcomings of sustainability efforts, they can provide actionable recommendations for park management. These recommendations could focus on improving the integration of sustainability into park operations, enhancing collaboration with external stakeholders, and ensuring that sustainability initiatives align with the park's long-term strategic goals.

Furthermore, future studies could offer specific guidance for stakeholders involved in STP development and management. When examining best practices and lessons learned from successful parks, researchers could recommend strategies to help parks balance innovation with environmental, social, and economic responsibility. The knowledge gained from such research could inform decision-makers about the most effective ways to support the ongoing sustainability of STPs, ensuring that these parks remain resilient and contribute positively to both regional and national economic and social sustainability.