UNITED NATIONS
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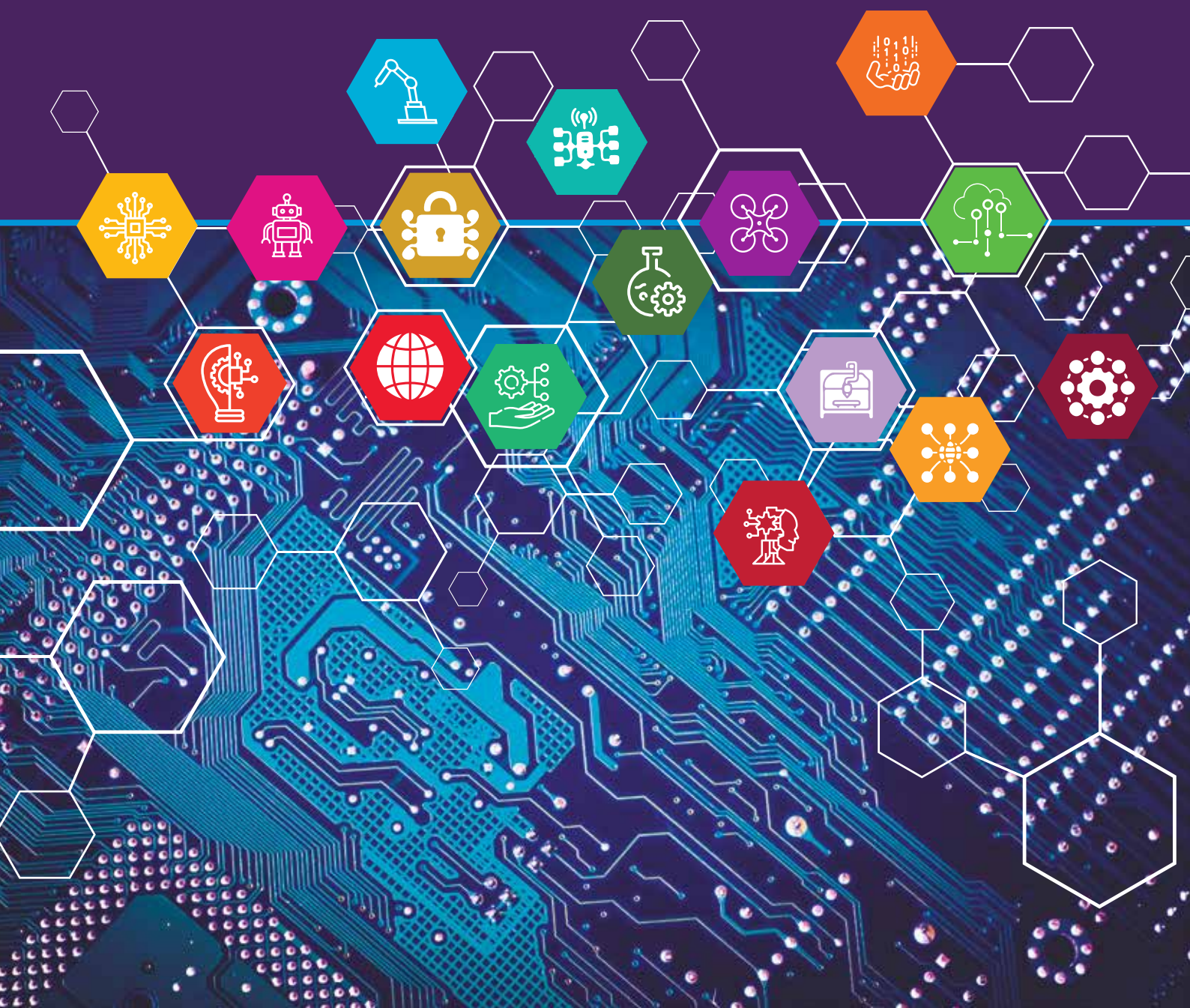
# A NEW GENERATION OF SCIENCE AND TECHNOLOGY PARKS

UNIDO's strategic approach to fostering innovation and technology for Inclusive and Sustainable Industrial Development



# A NEW GENERATION OF SCIENCE AND TECHNOLOGY PARKS

## UNIDO's strategic approach to fostering innovation and technology for Inclusive and Sustainable Industrial Development

### A technical cooperation tool for innovation-driven economic development

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# Executive Summary

This publication aims at introducing the new **technical cooperation module** of the United Nations Industrial Development Organization's Department of Digitalization, Technology and Innovation (DTI) on **Science and Technology Parks** (STPs) in the context of the **Fourth Industrial Revolution** (4IR).

STPs can contribute significantly to achieving Inclusive and Sustainable Industrial Development (ISID) and other industrial-related targets of the 2030 Agenda by promoting innovation-driven economic development. The Module highlights their role in strengthening regional and sectoral innovation ecosystems and promoting closer linkages between two distinct and usually separated economies: science and research institutions and industry. By leveraging the synergies of several actors and the potential of the 4IR, STPs facilitate the **commercialization of technologies and innovations** locally developed, including "green" solutions, which contribute to accelerating the transition from a linear economy towards a circular economy.

By establishing STPs, UNIDO aims to **advance economic competitiveness** in developing countries and countries with economies in transition by fostering knowledge sharing, facilitating technology adoption, empowering MSMEs – especially through their digitalization and internationalization –, promoting investment, boosting entrepreneurship, inclusivity and job creation.

To attain such an ambitious goal, the UNIDO Department of Digitalization, Technology and Innovation (DTI) designed a **comprehensive strategic framework** based on five areas of intervention: Improving Innovation Ecosystems; Strengthening Institutional Capacity; Upscaling Technology; Empowering Start-ups and MSMEs; and Promoting Investment & Infrastructure. UNIDO Member States will benefit from this innovative approach and the ample experience UNIDO has in this field.

Thus, this publication aims to orient representatives of governments at several levels, institutions, and other interested actors on UNIDO's approach, methodology, and tools in this field and show which results and impact might be expected. All activities shall be tailored based on specific needs, circumstances, and goals to effectively address national and regional challenges. This publication also includes a non-exhaustive **portfolio of services and a compilation of cases** to exemplify some successful interventions.

# Acknowledgements

This publication was prepared by the Department of Digitalization, Technology and Innovation (DTI) of the UNIDO Directorate of Digitalization, Technology, and Agri-Business (DTA), under the overall guidance of Alejandro Rivera Rojas. Substantive contributions for the Module were provided by the team of international experts Sibilla Sartori, Alberto Medina, Rebeca Gallardo, Dudzai Marufu, and Denisse Navarro.

The publication benefitted from the valuable inputs, and constructive comments received from Marco Kamiya, Farrukh Alimdjanov, Stephan Kratzsch, Fernando Santiago Rodriguez, and Global Policy Incubator GmbH, as well as from the extensive editorial review carried out by Darren Gleeson.

A special thanks to the Managing Director of the DTA, Bernardo Calzadilla Sarmiento, for his guidance and support provided to this publication.

# Contents

# List of Acronyms

| | |
|---|---|
| **4IR** | Fourth Industrial Revolution |
| **AI** | Artificial Intelligence |
| **CITE** | Innovation and Technology Centres |
| **COMFAR** | Computer Model for Feasibility Analysis and Reporting |
| **CONCYTEC** | Peruvian National Council of Science and Technology |
| **CP** | Country Programme |
| **DTA** | Directorate of Digitalization, Technology and Agri-Business (UNIDO) |
| **DTI** | Department of Digitalization, Technology and Innovation (UNIDO) |
| **EAEU** | Eurasian Economic Union |
| **EC** | European Commission |
| **EIB** | European Investment Bank |
| **ESCAP** | United Nations Economic and Social Commission for Asia and the Pacific |
| **ESCWA** | United Nations Economic and Social Commission for Western Asia |
| **EU** | European Union |
| **FAST** | Foundation for Armenian Science and Technology |
| **FDI** | Foreign Direct Investment |
| **FI** | Financial Institution |
| **FTZ** | Free Trade Zone |
| **GIZ** | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| **GVC** | Global Value Chain |
| **HTDZ** | High-Tech Development Zone |
| **IASP** | International Association of Science Parks and Areas of Innovation |
| **ICGEB** | International Centre for Genetic Engineering and Biotechnology |
| **ICS** | Centre for Science and High Technology in Trieste (Italy) |
| **IoT** | Internet of Things |
| **IP** | Industrial Park |



LIST OF ACRONYMS

| | |
|---|---|
| **IPR** | Intellectual Property Rights |
| **IRPF** | Integrated Results and Performance Framework (UNIDO) |
| **ISID** | Inclusive and Sustainable Industrial Development |
| **ISO** | International Organization for Standardization |
| **IT** | Information Technology |
| **KPI** | Key Performance Indicator |
| **LDC** | Least Developed Country |
| **MNC** | Multinational Company |
| **MSME** | Micro, Small & Medium Enterprise |
| **PCP** | Programme for Country Partnership |
| **PPD** | Public-Private Dialogue |
| **PPP** | Public-Private Partnership |
| **RBM** | Results-based Management |
| **R&D** | Research and Development |
| **SDG** | Sustainable Development Goal |
| **SEZ** | Special Economic Zone |
| **SME** | Small and Medium Enterprise |
| **SMIC** | Smart Manufacturing Innovation Centre |
| **STI** | Science, Technology, and Innovation |
| **STP** | Science and Technology Park |
| **TC** | Technical Cooperation |
| **TDZ** | Technology Development Zone |
| **UNCTAD** | United Nations Conference on Trade and Development |
| **UNIDO** | United Nations Industrial Development Organization |
| **UNIDO ITPO** | UNIDO Investment and Technology Promotion Office |
| **WB** | World Bank |

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# A. Background

# A.1 SCIENCE AND TECHNOLOGY PARKS

## A.1.1 Introduction

Science and Technology Parks (STPs) have no standard definition. Worldwide, an STP might also be referred to as an innovation hub, innovation and technology centre, research park, business innovation centre, innovation park, techno-city, technopole, or technopolis.

The International Association of Science Parks and Areas of Innovation (IASP) defines an STP as "an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions".[1] On the contrary, for the United Nations Educational, Scientific and Cultural Organization (UNESCO) the term "encompasses any kind of high-tech cluster".[2] UNIDO, together with the United Nations Conference on Trade and Development (UNCTAD), the World Bank (WB) and other entities, define an STP as "facility areas that support and promote technological development, including through research and attracting technology-based companies, with the purpose to facilitate innovation and knowledge-based economies, providing an environment and ecosystem conducive to innovation, knowledge-based work and R&D activities".[3]

STPs create an environment that facilitates knowledge sharing, technology transfer, entrepreneurship development, market-driven innovation and investment promotion by fostering linkages between academic institutions, industrial companies and funding partners. As a result, STPs can play a fundamental role in advancing industrial competitiveness, job creation, and promoting innovation-based economic development, thus contributing significantly to the achievement of the 2030 Agenda for Sustainable Development.

STPs are frequently considered to be the evolution of industrial parks (IPs). However, the several types of economic zone models (Figure 1) – besides being characterized by a similar structure – have differing natures and functions: while the initial model of industrial parks focused mainly on productivity, over time, more innovation-centred models have emerged, making a higher contribution to knowledge-driven economic development.

The early industrial parks (IPs) were often centred on trade and investment facilitation to encourage industrialization and expand the economy (with only secondary effects of technology transfer, knowledge flow, and collaboration). IPs were typically more manufacturing-oriented and had a limited association with innovation or research and development (R&D); they mainly focused on creating an environment for industrial tenants by providing land to operate, basic facilities and dedicated infrastructure. From this experience, more specialized industrial areas – such as Export Processing Zones (EPZs) and Free Trade Zones (FTZs) – arose to provide tailored local customs regulations (e.g. tax incentives and tariff exceptions) and specialized business services.

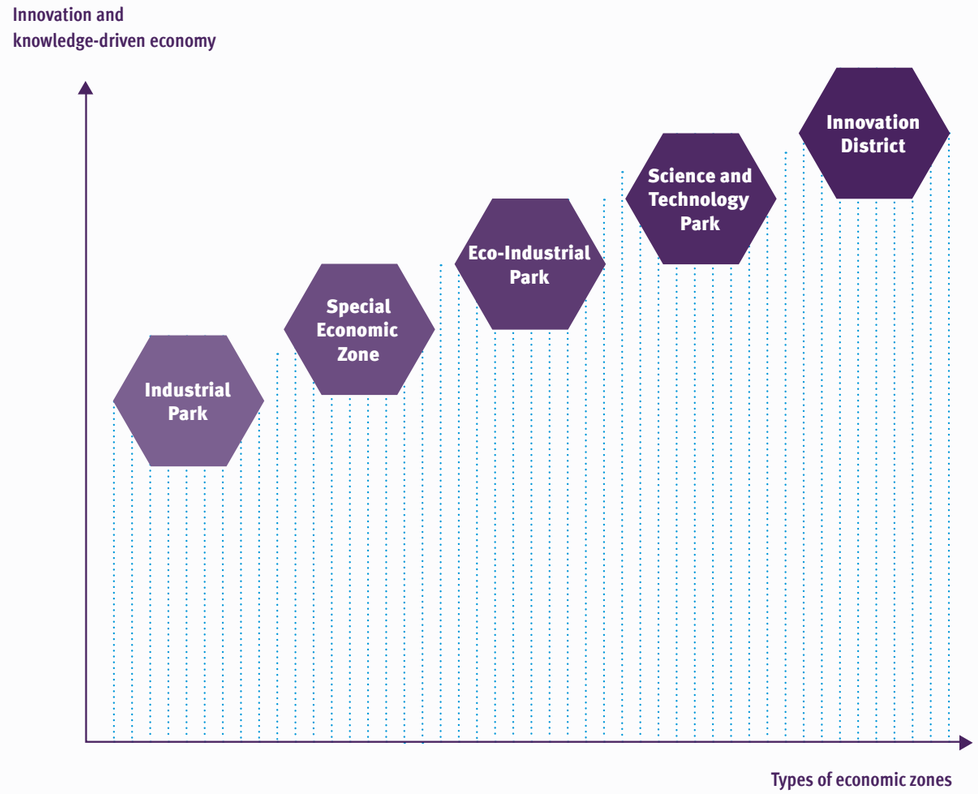
On the contrary, the new generation of parks is more oriented towards innovation, technological development and commercialization of new knowledge and have targeted management strategies for promoting knowledge exchanges and technology diffusion, plans for building relationships with public research organizations, science industry professionals and the investment community.

[1] IASP, *Definitions: How IASP defines our key terms*, www.iasp.ws/our-industry/definitions (2018)
[2] UNESCO, *Science Parks around the World* (2018)
[3] UNCTAD, *World Investment Report 2018: Investment and New Industrial Policies* (2018)





Figure 1: Types of parks categorized on the basis of their innovation degree




Source: Author's own compilation based on UNIDO, *Economic zones in the ASEAN: Industrial Parks, Special Economic Zones, Eco Industrial Parks, Innovation Districts as Strategies for Industrial Competitiveness* (2015)

In 2015, it was estimated the existence of over 400 science parks worldwide[4], while a European Union (EU) report in 2013 estimated that in the EU Member States there were 366 STPs[5]. However, estimates on the number of STPs worldwide vary considerably depending on how such institutions are defined. Some estimates might also mention hybrid institutions, including SEZs addressing the high-tech field, which follows SEZs' general principles and uses them to host firms in science-based areas. In China, for instance, by the end of 2017, 156 high-tech development zones (HTDZs) had been established, while Turkey is estimated to have 83 technology development zones (TDZs) – both already operative and under construction – designed to support R&D activities and attract investments in high-tech fields. Similarly, between 2005 and 2015, the Russian Federation established six techno-innovative SEZs. Thus, due to the multitude of economic zones – some of them hybrids – focused on science and technology and innovation-related areas, the number of actual STPs is not easy to define.

[4] El-Haggar S., *Sustainability and innovation: The next global industrial revolution,* Oxford University Press (2015)
[5] UNCTAD, *World Investment Report 2019: Investment and New Industrial Policies* (2019)

## A.1.2 Essential elements

While there is no precise list of essential elements constituting an STP, these are characterized by some common critical components: (1) a plot of land and related infrastructure, (2) a management team (governance), (3) multiple firms as tenants, (4) a key objective focused on promoting technology, R&D and innovation, (5) financing sources. However, they may differ in size, functions, ownership and location, depending on additional elements. An STP initiated by a Government, for example, might be more R&D-focused.

**Table 1: Essential components of an STP**

| Essential components | Explanation |
|---|---|
| **Site and Infrastructure** | An STP should occupy a plot of the appropriate size, whose ownership can be purely private, joint or state-owned. The selection of the land should take into account possible future expansion and consider the potential environmental and social impact the STP might have. STPs often offer their tenants common infrastructure (including digital infrastructure), benefiting from economies of scale. These shared services might include co-working and training spaces, fabrication laboratories, business incubation and acceleration programmes, among others. |
| **Governance** | The management team's functions may vary but need to cover property management as the landlord. For example, the team often needs to select the firms (tenants). Likewise, it stimulates and manages the flow of knowledge and technology between the actors, facilitating communication and cooperation. |
| **Tenants** | Multiple firms are the tenants of the STP. The key activities of the firms need to cover R&D and innovation. Firms in STPs work cooperatively and competitively to support new products or satisfy industry or individual customer needs. Often, it is helpful to include some research institutes in an STP, but this does not necessarily have to be the case. STPs usually facilitate the creation of new businesses through incubation and spinoff mechanisms. Moreover, they nurture and foster the growth of tenant firms (including start-ups and MSMEs), particularly by advancing research outcomes to create viable commercial products. |
| **Technology and innovation promotion mission** | An STP should target management strategies for promoting knowledge exchange, technology diffusion and innovation. To this end, an STP may encourage and facilitate R&D collaboration and an efficient synergy among the actors. An STP may also encourage and support start-ups and incubation. |
| **Financing resources** | Most STPs functions are based on at least two differentiated revenue streams: their operational budget and revenue linked to externally funded projects or services provided. |

Source: Author's own compilation based on ESCAP, *Establishing Science and Technology Parks: A Reference Guidebook for Policymakers in Asia and the Pacific* (2019)





## A.1.3 Theories on the origin of STPs

The development of STPs is commonly associated with theories aiming to explain the dynamics and interactions between the different actors within the innovation system (Table 2). Three theories are commonly mentioned in the literature: (1) cluster theory, (2) 'triple helix' model, and (3) growth pole theory. However, in practice, the establishment and development of some STPs might also follow a hybrid scheme, combining elements from different theories, partially reflecting the relative stage of development of a given country or region.[6]

**Table 2: Different theories of origin of an STP**

| | |
|---|---|
| **Clusters Theory** | Under the Cluster Theory, an STP results from an agglomeration of companies of the same sector. Therefore it is placed in the broader context of clusters, defined as spatial agglomerations of firms and related institutions or organizations.<br><br>The geographical collocation of firms, referred to as agglomeration economies, is determined by the need of individual firms to innovate. Indeed, they are often unable to innovate independently and need to be part of a functioning innovation system or ecosystem and network of firms.<br><br>Besides bringing companies together, a distinctive characteristic of an STP (according to cluster theory) is that they can actively enhance existing commonalities and complementarities between firms inside the park. In this regard, anchor tenants, such as national research institutes, can play a crucial role in attracting other firms with similar interests.<br><br>The above explains why SMEs need to form clusters to improve their ability to compete and survive. Indeed, clusters may benefit from knowledge spillovers, resulting from informal knowledge transfers and exchanging ideas among firms located in the same STP. |
| **'Triple Helix' Model** | An STP may originate from the collaboration among three entities: government, private firms and universities. Every actor contributes to the STP through its potential:<br><br>• **Universities:** offer R&D experience, research methodologies, and access to expensive testing and research equipment.<br><br>• **Private firms and entrepreneurs:** offer business experience, regional knowledge about gaps in the market, and an opportunity to commercialize the research being cultivated within the universities.<br><br>• **Governments:** incentivize R&D and knowledge-intensive environments by channelling specific domestic innovation strategies into their STPs. |
| **Growth Pole Theory** | STPs are often rationalized as a critical physical setting for promoting local R&D capabilities and spearheading urban and regional economic growth. This perspective examines the role and contribution of science parks in the context of regional development. Growth poles can contribute to regional economic growth in two ways:<br><br>**Internally (within an STP):** as a place for start-ups and an incubation programme.<br><br>**Externally (beyond the STP):** accelerating the information economy plays a self-reinforcing role in developing regions. STPs would promote a technology-driven view of urban and regional development. |

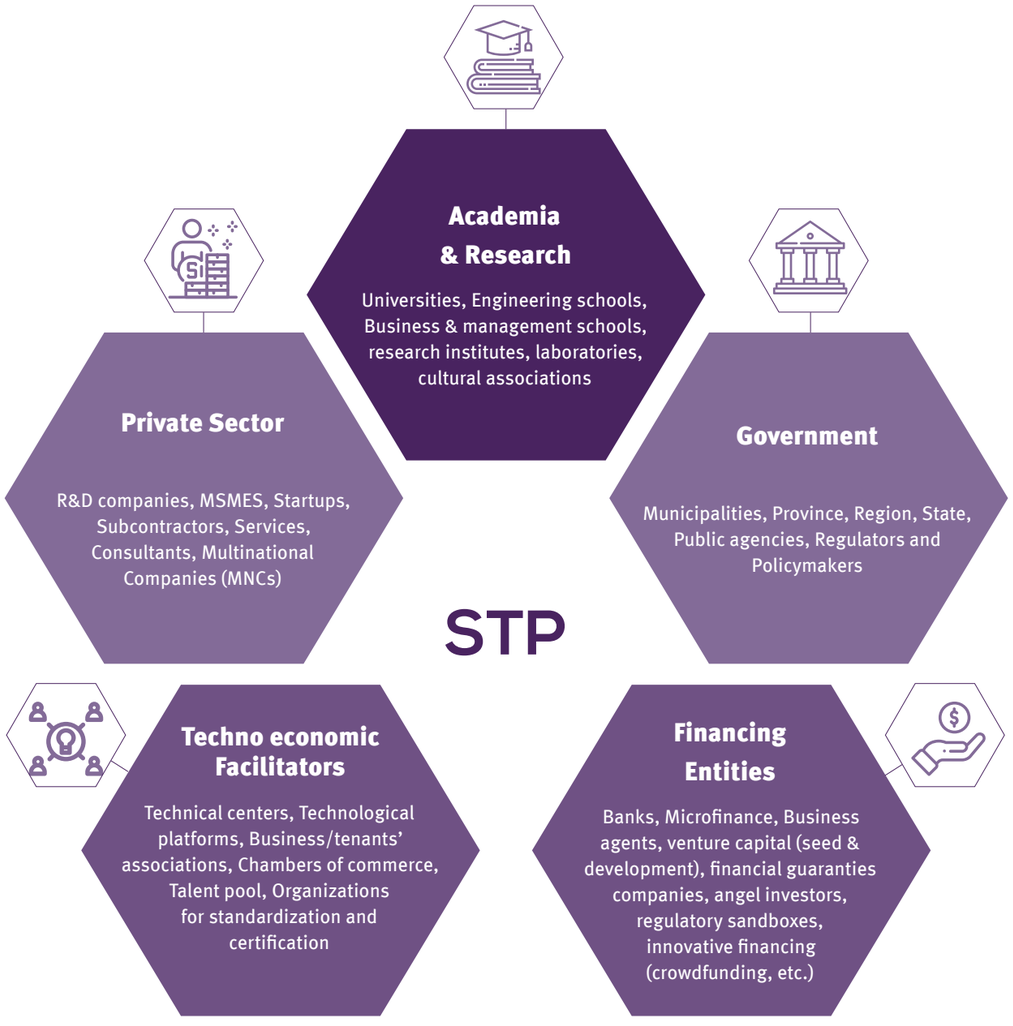
Source: Author's own compilation based on ESCAP, *Establishing Science and Technology Parks: A Reference Guidebook for Policymakers in Asia and the Pacific* (2019)

[6] For more information: *ESCAP, Establishing Science and Technology Parks: A Reference Guidebook for Policymakers in Asia and the Pacific* (2019)

## A.1.4 Relevant actors

As mentioned above, an STP originates primarily from a collaboration between three principal entities: the government at different levels, academia, and the private sector. In addition, however, several other essential actors are involved in an STP, including those providing financial sources, as well as techno-economic facilitators in various forms (Figure 2).

**Figure 2: Principal actors involved in an STP**




Source: Author's own compilation





**Table 3: Role and driving-interest of actors involved in an STP**

| | Role within an STP | Interest in getting involved |
|---|---|---|
| **Government** | Creates the policy and regulatory framework with favourable conditions for the establishment of STPs; and often provides the main initial investment. | Positive social and economic impacts that STPs have at a local and regional level. |
| **Academia & Research** | Provides R&D experience, research methodologies, skilled workers, as well as access to expensive testing and research equipment. | Results of research activities, provision of services to industry, curricula development. |
| **Private Sector** | Represents the link to the market and allows the development and commercialization of innovative and technology-enabled solutions, products, and business models. | Competitiveness, financial return generated by the development and commercialization of products. |
| **Financing Entities** | Invest in projects developed within an STP, including through impact investment which, alongside a financial return, generate positive, measurable social and environmental impact. | Financial return generated by the investment, social and environmental impact. |
| **Techno-economic facilitators** | Provide several services, among others, to facilitate market-reach. | Financial return generated by the services provided. |

Source: Author's own compilation

## A.1.5 Design and Implementation

Concerning the design and implementation of industrial parks and zones, UNIDO International Guidelines for Industrial Parks[7] identifies five general core principles, which contribute to building a successful STP:

**Table 4: Five core principles to design and implement a successful STP**

| | UNIDO's five principles: |
|---|---|
| 1 | Transparency of parks and zones to provide clarity to investors, reduce unpredictability and risk and instil confidence. |
| 2 | Their design, development and implementation should engage all stakeholders and particularly local communities, small-scale producers, and such disadvantaged groups as youth and women. |
| 3 | Parks and zones should be carefully planned, designed and integrated into national and regional development strategies. |
| 4 | They should be based on robust legal and policy frameworks developed within the broader framework of the country's legal system. |
| 5 | They should contribute to growth that is socially, economically and environmentally sustainable. |

Source: Author's own compilation based on UNIDO, *International Guidelines for Industrial Parks* (2019)

[7] UNIDO, *International Guidelines for Industrial Parks* (2019)





## A.1.6 Specificities

STPs are an integral part of the local innovation ecosystem in designing systems that maximize the potential for driving innovation, research and development for sustainable economic growth. In addition, STPs furnish a platform for collaboration engagements for private enterprises, public corporations, MSMEs and start-ups, increasing their visibility to attract Foreign Direct Investment (FDI) for funding innovations and local talent, thus improving economic competitiveness and the social development of the various economies. The successful establishment of STPs in developed countries had been attributed to the strength and diversity of their economies. However, for developing countries and countries with economies in transition, some factors must be considered for successful implementation and maximization of the functionality and operational capabilities of STPs (Figure 3).

One central element that characterizes successful STPs is mobilising resources, including through public-private partnerships (PPP). This capability enables innovation ecosystem actors to exchange ideas, best practices and share resources.[8]

Promoting the development of STPs compels local authorities to upgrade infrastructure initiatives, due to the availability of technical assistance to transform the economy and for middle income and developing countries. This, in turn, generates innumerable employment opportunities enriching the development of the society at large.

One central element for STPs is the creation of networks between companies, customers, suppliers, universities and other actors. These interactions facilitate, foster and underpin innovation processes. Moreover, these innovation processes build upon the creation, transfer and use of knowledge. The more interdependencies between actors and knowledge flows are created, the more STPs can advance towards superior technological trajectories.[9] This emphasis on the nature and intensity of knowledge flows within the networks is key to SPTs.

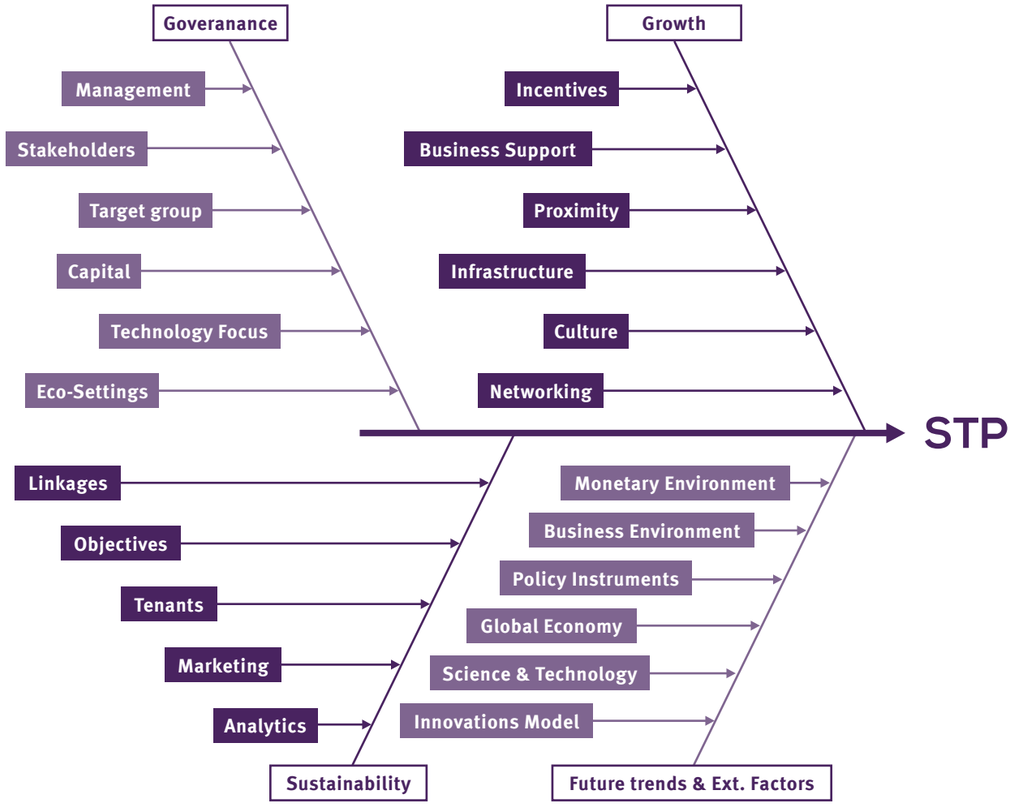
On the other hand, the paradigm shift in the use and application of 4IR digital technologies in the 21st century has changed the competitive landscape of economic development globally. As a result, STPs in this era have shifted focus from more science and invention to technology and innovation thematic areas. In this regard, technology transfer has gained momentum due to the exponential growth, economic and social development impact exhibited by the capacity in emerging technologies.

The trends in technological development determine the need to keep abreast of new innovations and updates constantly. However, trends and sparks are not limited to technological changes only, but they connect with the business environment, policy instruments, global economy and innovation management standards, and innovation, evolving to achieve greater social impact. A maximized operation capacity for STPs consists of an entirely digitalized business environment, thus enhancing the interconnectedness of processes or demonstration centres for knowledge-based and hands-on learning experiences for the emerging generations.

[8] For more information, see Section A.1.11

[9] UNCTAD, *Curso de formación en políticas de Ciencia, Tecnología e Innovación, Módulo 5: Fomento de los vínculos para la innovación* (2017)

Figure 3: Factors for Science Park Planning




Source: Wasim M. U., *Factors for Science Park Planning*, World Technopolis Review (2014)





## A.1.7 Services

STPs offer a wide range of services, which are usually grouped into the following categories:

| | |
|---|---|
| **Shared services** | Encompass spaces and services such as meeting and conference rooms, reception, telephony, internet access, among others. The shared services can also comprise technology and digital-related services and infrastructure, such as cloud and platform services and shared networks. The occupiers of STPs value these services since they help reduce costs for users, helping the competitiveness of client business. |
| **Signposting and networking** | Mechanisms by which an STP is helping companies to find the sources of advice, finance and other resources they need from within the existing infrastructure (signposting) or by bringing knowledge-based businesses together from across the region for programmes of workshops and seminars (networking). The value-added that comes with this service is that STP attracts large regular attendances and becomes a feature of the regional technology landscape. |
| **Professional business support and innovation services** | Services are targeted mainly to start-up and growing SMEs, including mentoring and business advice, start-up programmes (often linked to an incubator), access to finance, marketing, project-based student and recent graduate placement programmes and open innovation. |
| **Property services** | Services are oriented towards ensuring that start-up businesses and SMEs have access to affordable specialist premises that might improve operational efficiency or reduce barriers to growth. These premises can include collaborative working spaces such as fab labs, open innovation centres, living labs and cross-sector incubators. |
| **Market orientation of innovation** | Services aim to support the conversion of scientific breakthroughs and technological achievements into industrial and commercial success through promotion and collaboration activities, from strengthening networks with academia, research and industry to incubation of spinoffs and start-ups. |

## A.1.8 Performance measurement and impact

STPs contribute significantly to an ecosystem's elements needed to nurture innovation, local businesses, technology transfer, and industry collaboration and to positively impact the development of a knowledge economy. In terms of performance, STPs can be assessed both at the macroeconomic level (i.e., employment creation, the attraction of research activity, attraction of venture capital and regional development), as well as at microeconomic level (i.e., patent generation, interaction with research centres, and creation of qualified employment).

The performance measurement of STPs has been a challenge considering that STPs might have different objectives. Hence, it is essential to examine the interaction between objectives and the nature of performance. In general terms, STPs are expected to promote upskilling of the labour force, provide employment opportunities, strengthen interdisciplinary research and development, attract investment, enable regional integration, and facilitate the transition towards an innovation-driven economy.

The ability of STP's tenants to generate patents has been identified as a key indicator of success since it demonstrates STP's capability to promote talents and accelerate creativity. It is well documented that the application of patents, trademarks and designs allows MSMEs, start-ups and other innovators to protect their creative initiatives and ensure maximum gain and sustainability of operations. But although patents play an essential role in securing commercial benefits arising from creative efforts, they have substantial limitations to assess the overall performance of an STP. Within the context of countries transitioning towards establishing a knowledge-based economy, STPs can also play a crucial role in advancing patent fillings also through other forms of intellectual property rights (IPRs) such as trademarks, copyrights, and industrial designs. The number of patents fillings are, in fact, not a good reference for assessing the success of research and development even when they are compared with companies from the same industry.[10] For determining an STP performance, it is usually needed to establish a set of indicators. Although the latter may vary according to the specific objectives of the STP, some of the most common indicators are as follows:

[10] Reeb D., Zhao W., *Patents Do Not Measure Innovation Success,* Critical Finance Review 9 (2020)





**Table 5: Non-exhaustive list of selected STP-related indicators**

| STP implementation indicators | STP outcome indicators | STP impact indicators |
|---|---|---|
| • Area of land developed and building pace constructed.<br>• Number of companies located at the park.<br>• Number of companies "graduated" from the STP.<br>• Rental and services income (Monthly and yearly earnings).<br>• Type and range of typical services provided by the park. | • Amount of capital raised (i.e., public and private investors).<br>• Total amount of investment in R&D.<br>• Number of local suppliers and workforce.<br>• Number of high-quality workforce available.<br>• Number of products/services developed by tenants.<br>• Number of technology transfer agreements.<br>• Cooperation agreements established. | • STP contribution to high-technology production.<br>• Number and type of employment generated (i.e., number of qualified scientists and engineers employed).<br>• Exports share related to the operation of the park.<br>• Intra-industry structural change rate (share of high-tech activities within MVA).<br>• Wage increases of STP workforce compared to national wages. |

Source: Author´s own compilation based on EC, Directorate-General for Regional and Urban Policy, *Setting Up, Managing and Evaluating EU Science and Technology Parks: An advice and guidance report on good practice* (2014); Chan K. F., Lau T., *Assessing technology incubator programs in the science park: the good, the bad and the ugly*, Technovation, Elsevier, 2004

Performance measures or indicators are essentially an internal management instrument line with the objectives of the STP. Regular monitoring provides evidence on progress and achievements against the goals established. In contrast, evaluations require the intervention of external parties for assessing the impact of the park. For example, evaluating a park might require conducting interviews and collecting on-site information to accurately determine the positive spillovers attributed directly to the park operation. In practice, conducting an objective evaluation is a complex process since it requires identifying positive changes that would not have been possible without the conditions brought by the park. For example, the jobs transferred to the park as a direct result of the re-location of a company should not be considered additional jobs automatically; only those jobs generated by relocated companies due to the new conditions provided by the park are to be counted.[11] In sum, while monitoring offers decision-makers valuable information to modify and fine-tune the park's strategies, evaluation is instrumental in assessing the extent to which an STP has to fulfil its original purpose and attain its outcomes.

In general terms, some common factors characterize well-performing STPs. Among others, successful STPs are usually well-connected with networks at all levels and have a good strategy and proactive approach to guarantee visibility at a national and international level; have accurate designs of buildings and infrastructure, including incubators and innovation spaces; have a well-functioning ownership and governance architecture, where all the right actors are on board with a clear division of responsibilities and competencies; have a strong portfolio of value-added services, and perform such services in partnership including with academic research centres, and other relevant actors.

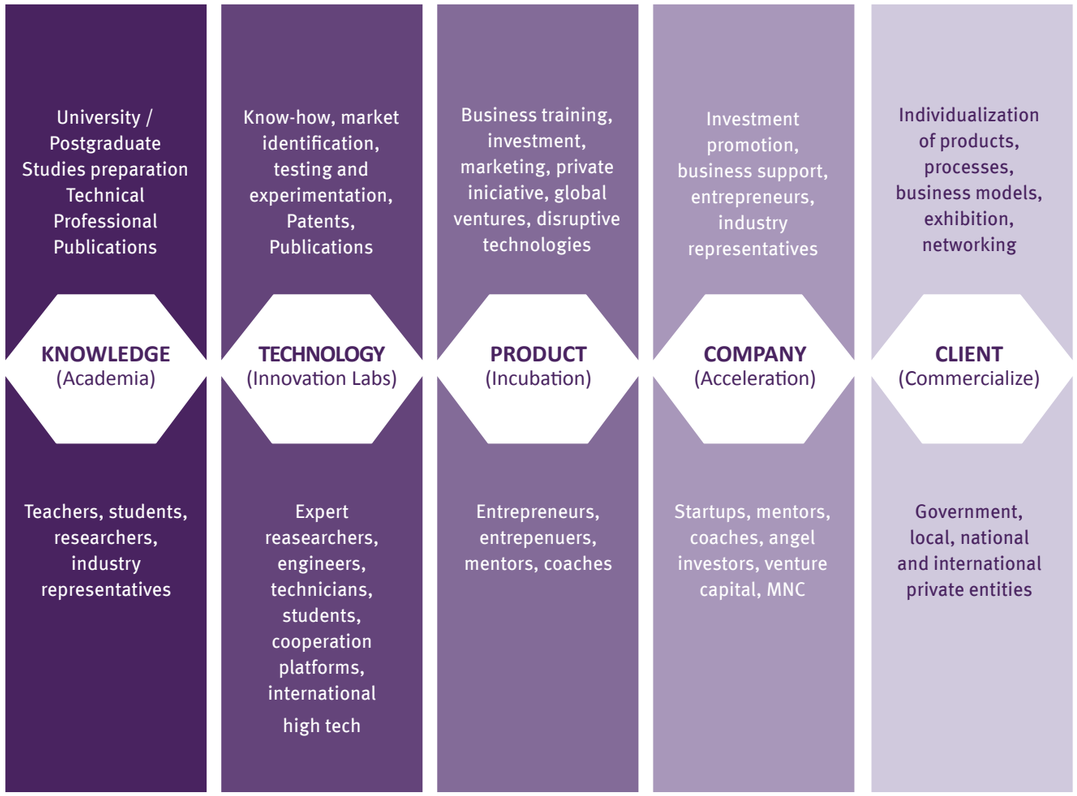
[11] EC, Directorate-General for Regional and Urban Policy, *Setting Up, Managing and Evaluating EU Science and Technology Parks: An advice and guidance report on good practice* (2014)

## A.1.9 Empowering MSMEs and start-ups

The global start-up economy is estimated at $3 trillion US dollars in value of the GDP of any of the most advanced economies.[12] Start-ups contribute to creating an average of 3 million new jobs every year. However, about 90 per cent of new start-ups fail, and one of every four start-ups within the first year. Likewise, around 50 per cent of start-ups fail before reaching their fifth year of operations, while 60 per cent do not become a profitable business.

Enabling a high innovative capacity of start-ups can increase their likelihood of survival, if this capacity is oriented to improve its efficiency, adaptability and strengthen its market power.[13] However, turning innovations into marketable products, and improving upon a competitive business advantage, is complex and usually costly. Figure 4 lists interactions, processes and actors typically involved to highlight and exemplify the above.

**Figure 4: From the ideation towards the commercialization of innovative solutions**




Source: Author's own compilation based on FAST, *Innovation District Concept* (2019)

[12] Start-up Genome, *The Global Startup Ecosystem Report 2020: The New Normal for the Global Startup Economy and the Impact of COVID-19* (2020)

[13] Hyytinen A., Pajarinen M., Rouvinen P., *Does innovativeness reduce startup survival rates?*, Journal of business venturing, 30(4) (2020)





STPs play a central role in supporting start-ups in converting their ideas into commercially viable products (through incubation mechanisms) and then helping them scale up and develop sound business plans and models (through acceleration), thus playing a key role in accelerating growth and increasing start-the productivity of start-ups.

Based on their contribution to employment and economic development, SMEs also constitute the backbone of the global economy. In this regard, STPs can play a fundamental role in actively promoting SMEs' growth and productivity. Through a dynamic and innovative mix of rules, programmes, infrastructure and services, STPs can facilitate communication between the companies, researchers and entrepreneurs and provide environments that enhance a culture of innovation, creativity and quality.

STPs can also be instrumental in counteracting the current gender imbalance in entrepreneurship. Despite improvements in recent years, the proportion of women entrepreneurs continue to be comparatively lower and more likely to operate in non-capital-intensive sectors. Moreover, in many countries, the number of women graduating from STEM fields is even higher than men. Yet, they are widely underrepresented in the industry, showcasing their struggle to access the STEM workforce. In this sense, STP can promote women entrepreneurial innovations by easing their engagement with stakeholders and potential investors, facilitating their access to finance, and offering an environment conducive to innovation.

An STP should concentrate on the needs of enterprises and academic organizations and developers, and workers to have the necessary balance of infrastructure. Companies, start-ups and entrepreneurs should be able to regard the facilities of a park as an office space, labs, networks and centres where people can connect and work together. As it turns out, physical facilities and support services are essential to a park's viability. They are a primary determinant of its survival, reputation, and the level of public confidence it enjoys.

Developing the required infrastructure for enabling the right conditions for SMEs and start-ups can require significant investments. However, it is essential to highlight that investments can also be sequential and progressive and not necessarily occur within a few years. The STP of Adlershof in Berlin, for example, was planned in concentric rings with the central research institutions and businesses and the outer ring development areas. As the SMEs located in the park increased, the park continued to invest in facilities and resources to match companies' evolving needs. The case of Adlershof also highlights that at every stage of the development, SMEs remained the park's primary focus.

# A.1.10 Risks and challenges

| | |
|---|---|
| **Initial assessment and strategy** | Among the main challenges while considering investing resources in an STP are the identification of the outcomes for the STP and assessing the several instruments available to check whether an STP would be the best option in a specific context. Indeed, the notable government's investment must be justified by the social or economic impact the STP should have. Therefore, an initial assessment might reveal that other policy instruments might reach the same goals with a lower commitment of resources. |
| **Human resources** | Another important aspect of a successful STP is the human capital managing the park. Given that the management team is responsible for multiple cross-cutting tasks, including coordination and communication among various stakeholders, R&D, capital management, infrastructure and other activities and construction works, experts with complementary knowledge and backgrounds (such as in business, marketing, negotiation, and communication) might bring a positive plus to the park. Moreover, for the STP to succeed, the management team must adjust its strategy in an ever-changing environment. |
| **Capacities and technology transfer** | Another challenge highlighted[14] is promoting a successful collaboration among different players in STPs. Collaboration and coordination due to geographic proximity should not be taken for granted: indeed, it doesn't translate automatically into technology transfer or synergies. Technology transfer might be facilitated through the common infrastructure the park might offer. However, a well-established plan to promote such interaction (both among park's actors and with external actors) needs to be designed, including to exchange good practices. |

[14] ESCAP, *Establishing Science and Technology Parks: A Reference Guidebook for Policymakers in Asia and the Pacific* (2019)





| | |
|---|---|
| **Planning and developing** | Some risks might also be related to planning and developing an STP. Therefore, some success factors have been identified to achieve the parks' most common expected goals and objectives:[15]<br><br>**Size of the STP**<br>When an STP is too small, there can be risks of failure. For example, according to some authors[16], 40 per cent of STPs are investing less than a million euro over a ten-year period, which is not enough to get leverage effects.<br><br>**Objectives and goals**<br>When too many goals and activities are linked to creating an STP, the park risks failing. Moreover, the long-term socio-economic benefits of a less developed region cannot be accomplished only through STPs. Therefore, it is important to consider that other elements in the business environment need to be considered. |
| **Monitoring and measuring** | Performance management and monitoring system are necessary for tracking progress and measuring performance.[17] A detailed target system for the STPs can serve as an early-warning system for low-performing parks. These mechanisms should be established at the beginning of the park's lifetime and built upon as additional functions are added. |
| **Fund mobilization** | As described in the following section, public funds are often essential to build an STP. Indeed, parks require a considerable initial investment which is usually not followed by a short-term earning. An STP is a long-term project that requires much time and effort. Common risks are related to financial management. Therefore, it is essential to design a plan to attract alternative financial sources to guarantee the park's sustainability. |

[15] EC, Directorate-General for Regional and Urban Policy, *Setting Up, Managing And Evaluating EU Science And Technology Parks: An advice and guidance report on good practice* (2014); ESCWA, *Science and Technology Parks: Global Outlook with a Focus on the Arab Region* (2018)

[16] EC, Directorate-General for Regional and Urban Policy, Przeor M., *Role of Science and Technology Parks (STP) in regional innovation strategies – EU experience* (2015)

[17] EC, Directorate-General for Regional and Urban Policy, *Setting Up, Managing And Evaluating EU Science And Technology Parks: An advice and guidance report on good practice* (2014)

## A.1.11 Sustainability

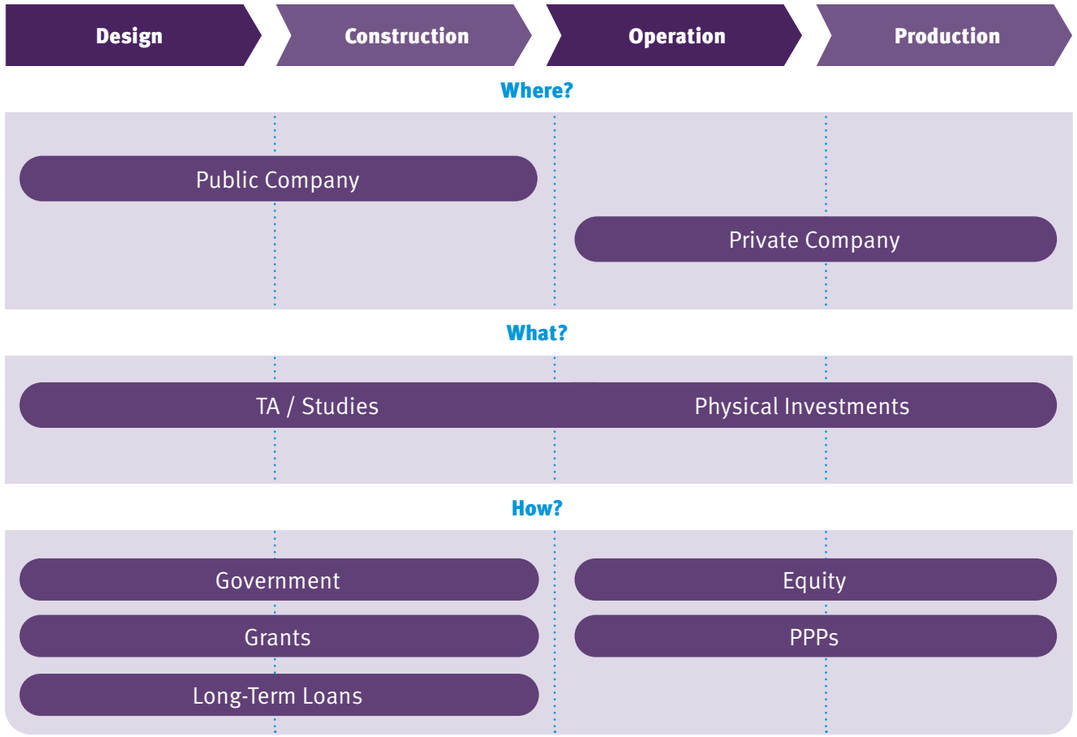
Park management must take a long-term view of planning, focusing on ensuring the sustainability of the park's activities. This result might be achieved through several integrated strategies, including a well-functioning, integrated and flexible **financing system, a marketing strategy, and a partnership-building strategy.**

The financing plan is particularly relevant since STPs are dynamic environments with a flexible organizational structure, and such flexibility is also reflected in the funding revenues, which are often integrated to adapt to different kinds of projects or interventions.

Indeed, most STPs function based on at least two differentiated revenue streams: their operational budget and revenues linked to external funding.

Figure 5 shows that funding sources might vary according to the stage of an STP. While STPs' design and construction phases are generally addressed by public funding (through grants and long-term loans), the STP also needs a financial sustainability plan to guarantee its growth once the initial public intervention is concluded. Indeed, being STPs long-term projects and requiring significant investments, the initial input usually comes from a public entity. However, the initial State's effort is generally meant to be a 'seed investment'. Therefore, it is expected that the STPs would reach the goal of a self-sustaining park by attracting alternative funds.

**Figure 5: Investment stages for public governing body and private operations**




Source: EIB, *Guidebook for decision-makers: Plan and manage a Science and Technology, Park in the Mediterranean* (2010)

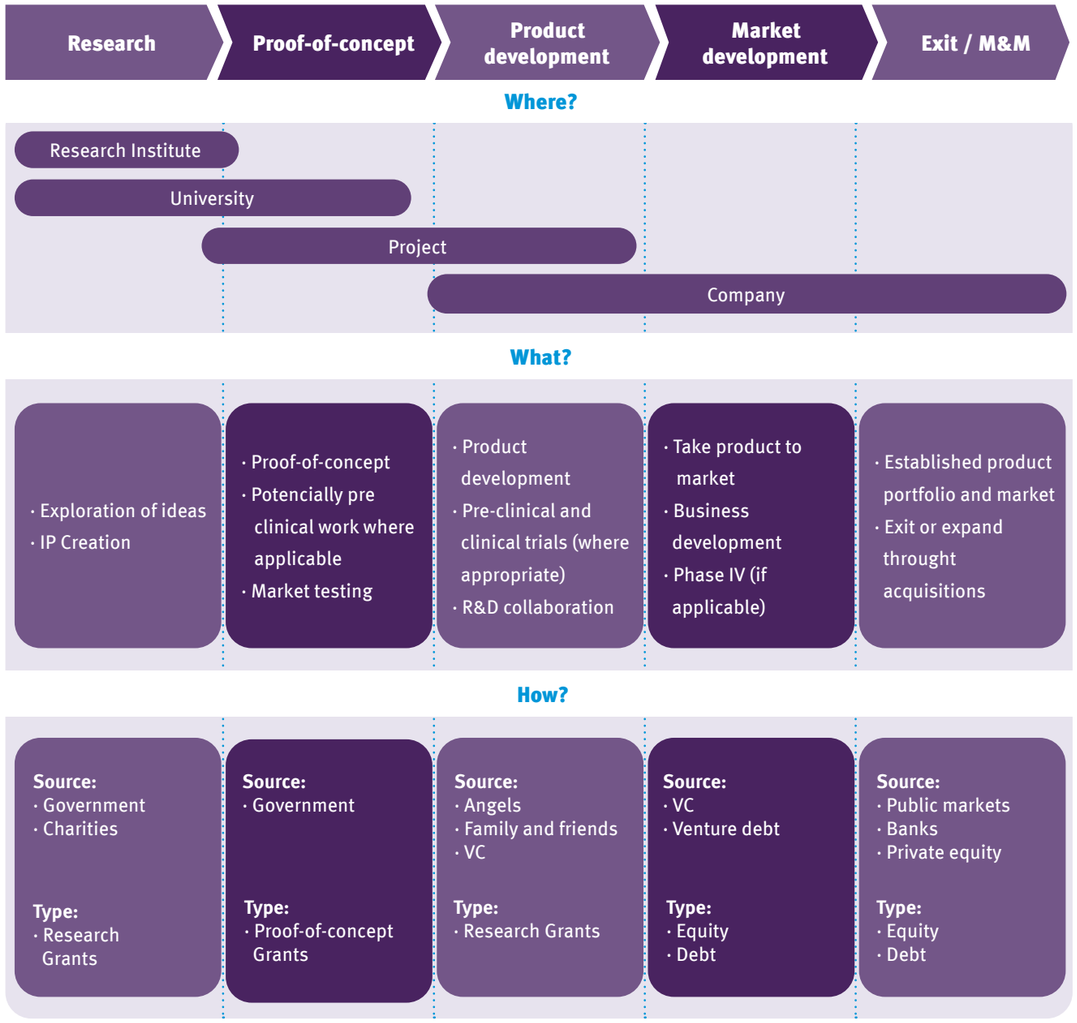




It has been demonstrated that continuous public initiatives are unnecessary or might be limited in favour of private-sector funds or hybrid sustainability mechanisms. In this respect, Technopolis, in Finland, was established initially as a result of a public effort (promoted by the Finnish city of Oulu), subsequently evolved until becoming a sizeable privately-owned company, currently quoted on the Helsinki stock market. This demonstrates that during the 'start-up phase', the public sector is usually mainly involved by ensuring basic infrastructure funding. Contrarily, the private sector focuses more on infrastructure and tangible assets for companies.

An STP should have a robust financial plan that considers all the alternative funding sources applicable to achieving sustainability. Such sources might come from various revenue streams according to the object and stage of the investment (Figure 6). Such revenue streams might come from both public and private, including, but not limited to, competitive funds, revolving funds, foreign investments, angel investors, and government programmes.

**Figure 6: Technology product life-cycle and funding requirements**




Source: EIB, *Guidebook for decision-makers: Plan and manage a Science and Technology, Park in the Mediterranean* (2010)

**Angel investors** are considered an important resource for parks' viability since they tend to intervene by offering dual support during the initial stage of creation and development of MSMEs: providing financial inputs, as well as the technical assistance to scale up knowledge. Many business angels are alumni of the sectors in which they invest. Therefore, they can bring their expertise to MSMEs, thus raising their competitivity. By supporting start-ups to overcome the "valley of death", angel investors' intervention promotes the creation of new businesses, thus contributing to STPs' growth and sustainability. Therefore, the STP management team should design an effective strategy to attract such investors, whose intervention is usually profit-oriented.

Similarly, **FDI** is often considered among the most relevant funding resources. Thus, adopting a strong strategy to attract this stream of revenue should be of primary interest. It has been recognized that foreign investments might be stimulated, among others, through bilateral agreements with other parks operating in the same sectoral focus. Such agreement concretely builds by participating in collaborative research projects or multilateral industrial development initiatives. This approach has been widely adopted worldwide, including between Chinese and Korean Technopolis (e.g. Beijing-Hanggju City and Gyeongsan City), as well as between the Tunisian El Ghazala Technopole – the second-largest in Africa – and several European technopoles (including, Technopole of Bari, Italy; Technopole of Nice Sofia-Antipolis, France; Marseille Innovation Technopole, France). Science park networking is often seen as an essential tool to promote massive investment programs, materialized in ad-hoc initiatives, such as Malaysia's National Incubator Network.[18]

A particularly relevant element for an STP's financial sustainability is the capacity to attract **impact investment** (Figure 7). Impact investment is an alternative, innovative and sustainable financial mechanism that generates positive, measurable social and environmental impact alongside a financial return.

**Figure 7: Types of investment having a different degree of social and environmental impact**

| | Responsible Investing | | Impact Investing | | |
|---|---|---|---|---|---|
| **Tradicional Investing** | **Ethical Investing** | **Sustainable Investing** | **Thematic Impact Investing** | **Impact Firs Investing** | **Venture Philanthropy** |
| Seeking competitive returns | | | | | |
| | Mitigating Environmental, Social, and Governance (ESG) risks | | | | |
| | | Pursuing Environmental, Social, and Governance opportunities | | | |
| | | | Focusing on measurable high-impact solutions | | |
| Financial returns with limited consideration of ESG factors or ethical constraints | Investments are screened out based on ESG risk or ethical constraints | Sustainability factors and financial returns drive investment selectrion and shareholder advocacy | Focus on issue areas where social or environmental need creates a commercial opportunity for market-rate returns | Focus on issue areas where social and environmental need requires some financial trade-off | Addresses societal challenges that cannot generated a financial return for investors |

Source: Rally Assets, *The Impact Investing Guidebook for Foundations* (2019)

[18] For more information: E IB, *Guidebook for decision-makers: Plan and manage a Science and Technology, Park in the Mediterranean* (2010)





## A.1.12 From an Existing Park towards a successful STP

Successful STPs might also result from a modernization process implemented in already existing parks that, for several reasons, do not reach the expected performance or no longer meet the market needs. In this sense, an STP can also rise from existing infrastructure, duly re-organized from several points of view, including – but not limited to – through the re-orientation of its activities and operation towards innovation. The design of an action plan needs to be strictly tailored to the identified park since the interventions strongly depend on its status, focus areas, and weaknesses. In general terms, the process begins with an in-depth impact assessment of the park and a mapping exercise of other existing parks and zones of the country and region, to identify the current performance limitations and gaps in the intervention design and point towards the potential for transformation into STPs.

For instance, the **Daedeok Innopolis** (Republic of Korea)[19] results from a modernization process focused primarily on connecting R&D with private firms and production facilities to commercialize research results. The shift from a predominately research-focused entity towards a collaborative organization focused on commercializing research projects allowed the park to be competitive and integrated into the regional and national innovation ecosystem.

It is worth mentioning that the modernization or re-purposing of one STP can become the first step towards a more comprehensive revision of the national regime of science and technology parks, industrial parks or special economic zones (SEZS). In other words, besides upgrades in the infrastructure of an individual park, UNIDO can provide assistance to conduct further regulatory changes to related policies and programmes to enhance the impact and contributions of STPs to the country.

[19] Korea Innovation Foundation, www.innopolis.or.kr/eng

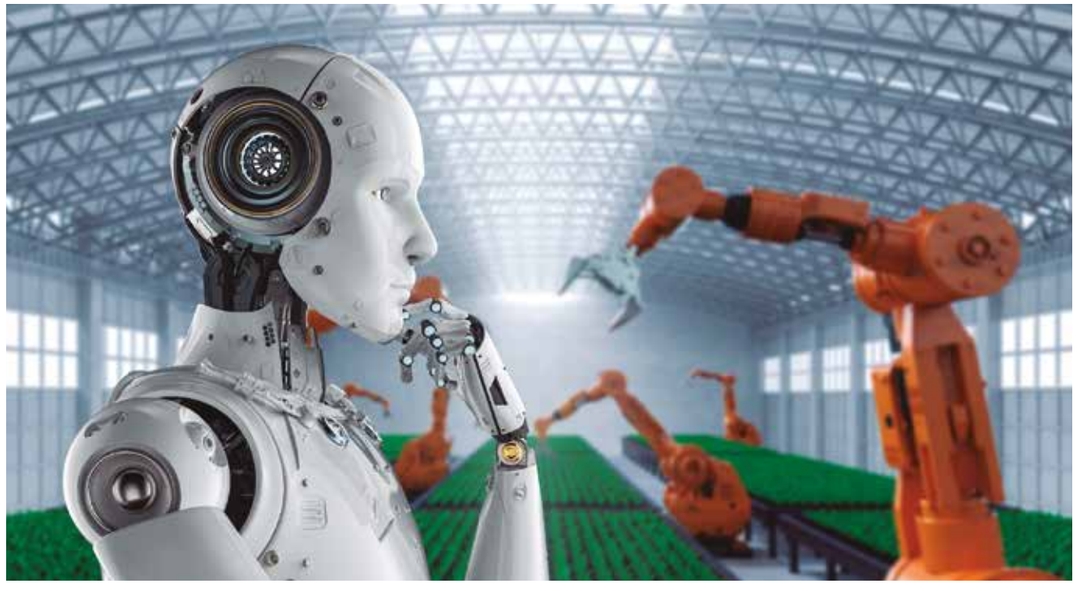
# A.2 THE POTENTIAL OF THE FOURTH INDUSTRIAL REVOLUTION

## A.2.1 4IR expected benefits and most common risks

The convergence of the digital and manufacturing sectors has been disrupting established production patterns for some time now. The term “Industry 4.0” was coined by the German government and presented at Hannover Messe in 2011, while the “Fourth Industrial Revolution” entered our vocabulary in 2015 courtesy of the World Economic Forum. The concept of 4IR defines the fusion of leading-edge production techniques and smart systems that integrate with organizations and people, including artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, nanotechnologies, biotechnologies, autonomous vehicles, genetic engineering, quantum computing, and other technologies. Exponential technological change affects all scientific disciplines and economic sectors and blurs differences between them. It also affects all countries, though not in the same way and at the same time.

Unlike previous revolutions, 4IR radically transforms products, processes and business models and increasingly blurs the boundaries between the physical and the digital realms. The 4IR is bringing forward new business models driven by customer needs, assuring a ready market for the product being produced. It provides enhanced organizational agility (innovation and response to customer demands), manufacturing innovation, improved product safety and quality, focus on people as much as in technology, ensures a layer of protection (industrial safety), environmental and social benefits,-building towards a hybrid workforce interacting with cyber systems for increased efficiency.

4IR can bring significant benefits from several perspectives, through technological solutions able to have a great impact both on developed and developing countries and contribute to achieving the Sustainable Development Goals (SDGs).







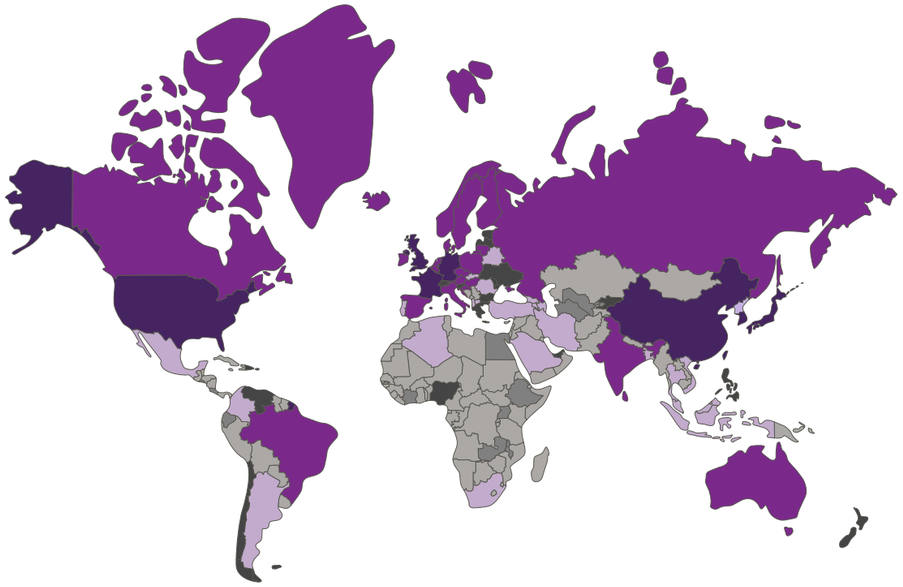
| | |
|---|---|
| **ECONOMIC** | From an **economic** point of view, 4IR technologies can accelerate growth by lowering transaction costs, guaranteeing greater control over production processes, increasing productivity, competitiveness, product quality, and customer-oriented product, as well as assuring higher industrial safety. For instance, smart, digital networking and cyber-physical systems can advance global value chains (GVCs) by allowing horizontal and vertical networking within the value chain and the management of these processes in real-time across great distances, leading to the creation of intelligent production systems. Similarly, big data analytics might provide real-time insights to improve production efficiency. Moreover, blockchain can guarantee a higher safety and security of data collection, ownership and transfer, which lead to higher efficiency and productivity. Additionally, data analytics allow collecting and analysing real-time customer data, enabling the direct involvement of customer demands and facilitating cost-effective mass customization of products, thus enhancing product–service characteristics and functionalities. |
| **ENVIRONMENTAL** | From an **environmental** perspective, 4IR solutions might contribute to achieving higher resource efficiency and effectiveness; have easier access to electricity and water; guarantee a reduction of greenhouse gas emissions; and help improve waste management, supporting effective circular economy business models that consume renewable material resources. |
| **SOCIAL** | 4IR technologies can also bring several benefits at a **social** level. Indeed, they have the potential to improve human cognition, health and physical capabilities; enhance creativity and innovation; advance education-sector and training systems; enhance creativity and innovation; improve workers’ safety; provide better access to food, sustainable energy and universal healthcare; and create more opportunities for vulnerable groups.[20] |


[20] UNIDO, *Bracing for the New Industrial Revolution - Elements of a Strategic Response* (2019)

Despite the positive impact 4IR technologies can have, especially on economic growth, the application of 4IR technologies might also bring some significant risks. Thus, it is essential to identify potential threats to mitigate their negative effects. UNIDO's publication "Bracing for the New Industrial Revolution" provides an overview of the challenges faced while dealing with 4IR technologies.

Advances in automation might negatively affect employment in the manufacturing sector, with a potentially more significant impact on labour-intensive economies, notably on least developed countries (LDC). Another particularly relevant threat is the widening of the technological gap between developed and developing countries. UNIDO's Industrial Development Report 2020 found out that around 90 per cent of all global patents related to advanced digital production technologies, as well as around 70 per cent of the exports of capital goods associated with these technologies, are accounted for by just ten economies, "the frontrunners"[21] (Figure 8). Therefore, low-income countries, which usually have lower capabilities in science, technology and innovation (STI), risk lagging further behind and failing to achieve the SDGs.

**Figure 8: Different engagement of countries in the production and use of advanced technologies**




Source: UNIDO, *Industrializing in the digital age, Industrial Development Report* (2020)

[21] UNIDO, *Industrializing in the digital age, Industrial Development Report* (2020)





In general terms, the major scientific and technological breakthroughs have an impact globally, and countries alone cannot fully unlock the potential of emerging technologies and mitigate the associated risks. Therefore, to meet the challenges and reap the benefits of 4IR technologies, actions should be taken at the national and international level to ensure a smooth transition towards 4IR, and the realization of SDGs, especially SDG 9. In this respect, the services UNIDO offers in the framework of this Module are tailored actions designed and combined to respond to specific national needs.

Acknowledging the importance of 4IR technologies, UNIDO among several initiatives, has created a **UNIDO Knowledge Hub** to deliver high-quality and transformative online training regarding 4IR, targeted towards stakeholders in developing countries. Similarly, the **UNIDO Learning Development and Knowledge Facility (LKDF)** performs a similar function for enhancing upskilling and learning initiatives for the future of manufacturing. The Organization has also launched a webinar series titled "Inclusive and Sustainable Industrial Development (ISID) In the Age of the 4IR", aimed at mainstreaming the 4IR in UNIDO's technical cooperation, strategic, normative activities.

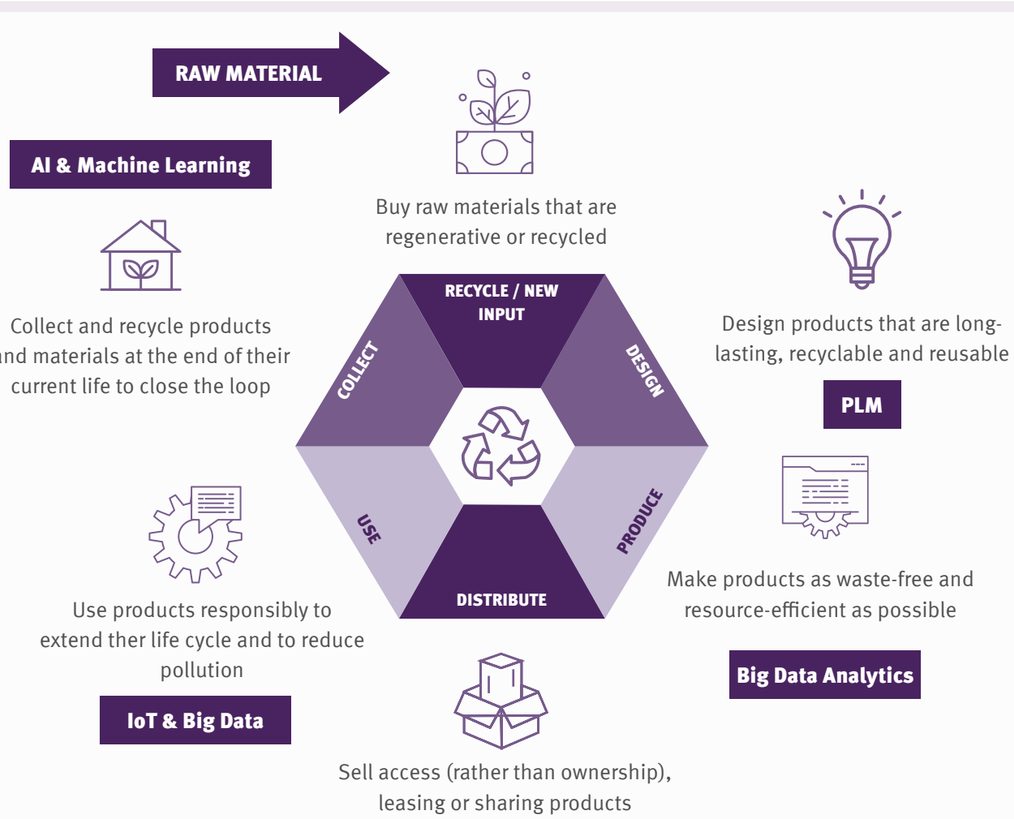
Additionally, DTA has convened numerous forums and initiatives relating to advanced innovation, all of which have a strong MSME component (e.g. the **Global Manufacturing and Industrialization Summit**; the **Global Call for Innovative Ideas versus Covid-19 and beyond;** the **Women in Industry and Innovation conference**). These forums represent an opportunity to promote and exchange innovative ideas and solutions and facilitate MSMEs' exposure. UNIDO also engages extensively with several UN systemic forums and publications on technology issues, such as the Technology Facilitation Mechanism, STI Forum, UN Innovation Network, AI for Global Good Summit inter alia.

## A.2.2 STPs as a tool to promote a green economy through 4IR technologies

STPs have great potential to promote the circular economy by supporting entrepreneurship towards products and services with a circular impact. The application of 4IR technologies might develop solutions able to have a strong influence on several phases of the industrial production cycle: among others, IoT and Data Analytics might improve waste management and promote circular business models; Robotics can contribute to reducing waste and human errors, thus increasing performance; 3D Printing can reduce the demand for spare parts, allowing the development of more sustainable prototypes, and improving maintainability and prolonging the life cycle of products (Figure 9).

STPs unlock 4IR technologies' potential to accelerate the transition **from a linear to a circular economy,** both by creating a fertile environment for the development of new and more environmentally-friendly products and processes, as well as by improving production efficiency.

**Figure 9: 4IR technologies involved in different phases of a circular-economy production cycle**



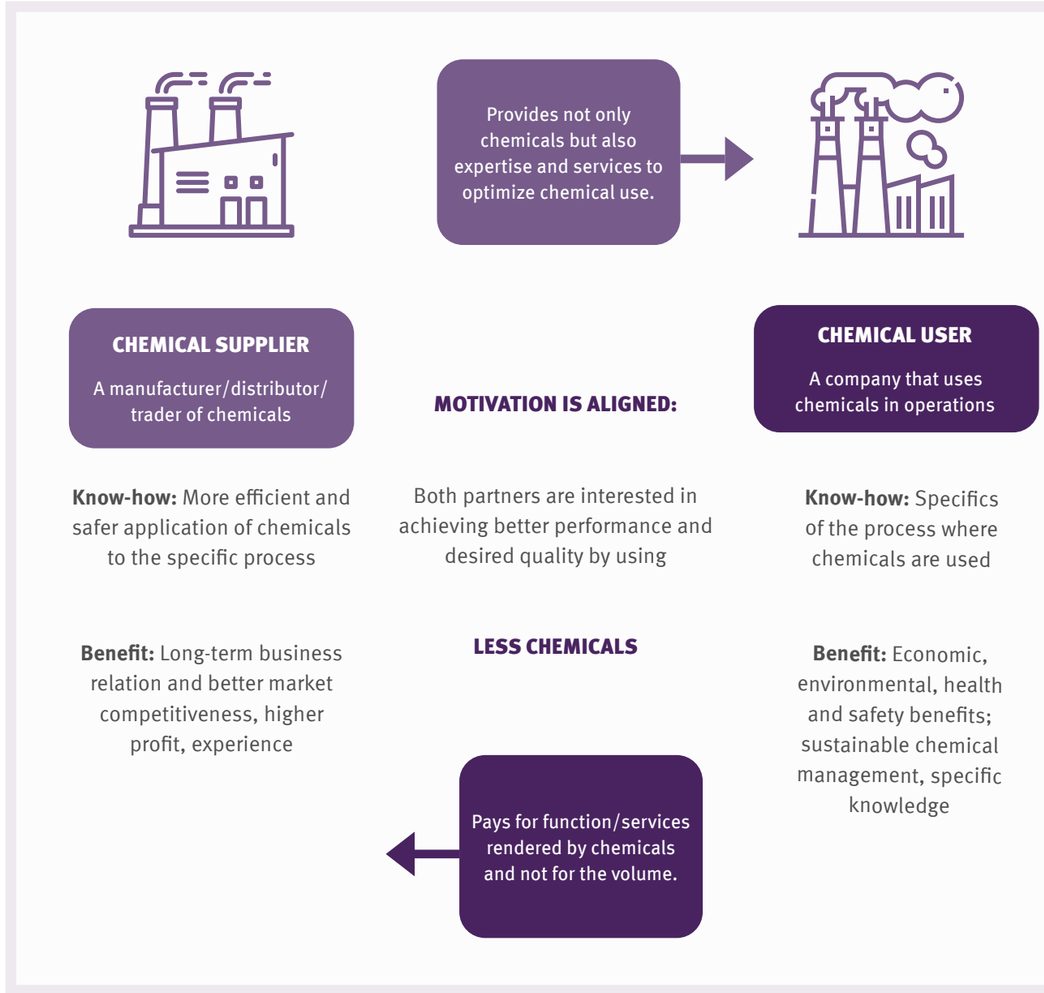

Source: Hanf M., Taival, *What is circular economy and why is it relevant to you?* (2019)





New business models generated in the framework of STPs might reduce the linear inefficiencies, thus having several advantages, including for the environment, inter alia, in terms of energy efficiency and reduction of $CO_2$ emissions. An example in this respect is **UNIDO's Chemical leasing**[22] (Figure 10). This service-oriented business model shifts the focus from increasing the sales volume of chemicals towards a value-added approach: the producer mainly sells the functions performed by the chemical, with functional units being the main basis for payment. Such an approach contributes to reducing unnecessary hazardous chemicals consumption and protects human health and the environment.

**Figure 10: UNIDO's Chemical Leasing**




Source: UNIDO, *Chemical Leasing*, www.chemicalleasing.org

[22] UNIDO, *Chemical Leasing*, www.chemicalleasing.org

# A.3 ON THE ROAD TO INNOVATION

UNIDO identified the need to create environments conducive to innovation and digital transformation of industry. Indeed, inadequate strategies, policies and regulatory frameworks can be detrimental to innovation, impeding the achievements of industrial development targets. It has also been observed that often determining their soundness, appropriateness, and validity might be difficult since such assessment requires significant time and resources. Nevertheless, this effort is vital to accumulate sufficient evidence and identify the need to change or reorient them.

Innovative firms, both start-ups and incumbents, often face some limiting obstacles, such as disproportionate, inconsistent or over-cautious application of regulatory requirements. Start-ups might suffer limitations from the small dimension of their teams, which may lack the experience to deal with regulatory compliance. At the same time, established firms' current structures may not efficiently respond to new developments emerging from their innovation teams.

Furthermore, start-ups and MSMEs often lack the organizational capacity to transform innovative solutions into marketable products. This is compounded by the existing gaps between demand and supply of funding available for them, largely due to risk perception and lack of interaction between MSMEs and potential investors (inter alia, venture capitalists and angel investors). Guided by the awareness of the importance of innovation for sustainable socio-economic development, this Module has been designed to answer the needs mentioned above by accelerating the materialization of STP development, fostering technology transfer, innovation commercialization and investment promotion.

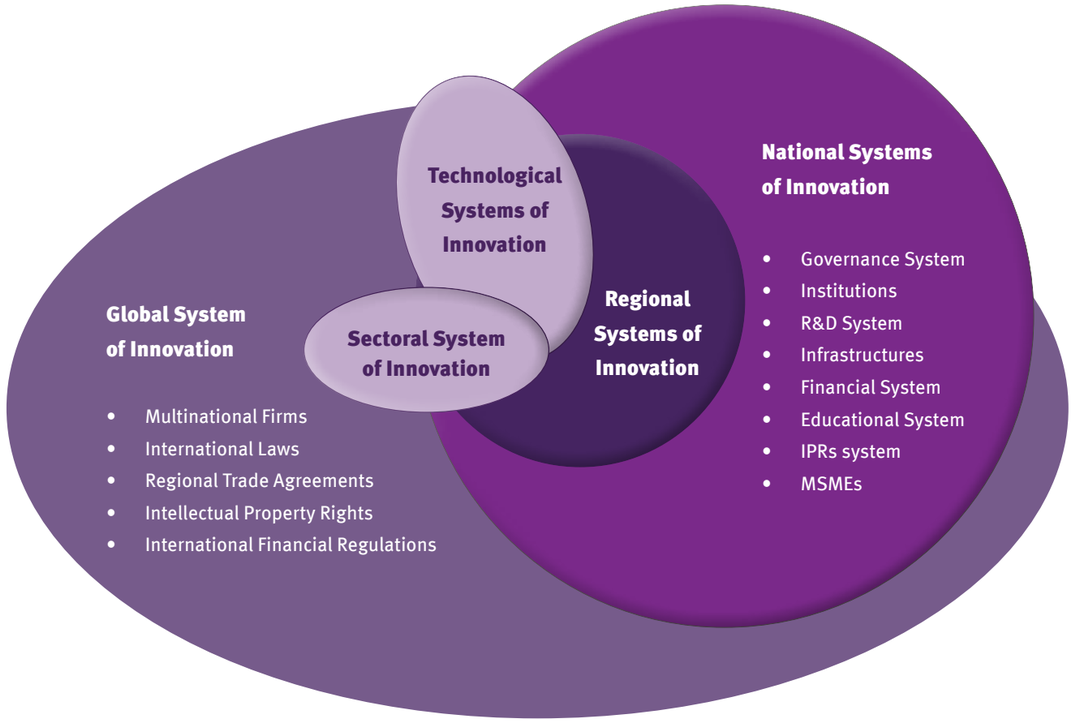




Figure 11 illustrates the relationships between the different innovation systems (global, regional, national, technological and sectoral). At the global level, trade and multinational enterprises generate and disperse innovation across countries. On the international level, commercial agreements, international law, including intellectual property rights, and financial laws govern innovation practices across countries. While the interlinkages between institutions, rules and regulations, educational and financial system, rules and regulations, and existing infrastructure constitute the national system.

Within the boundaries of national innovation ecosystems, regional innovation ecosystems co-exist. Regional innovation ecosystems are characterized by government structures, workers, organizations, clusters, facilities, workers, training mechanisms and organizations. Although local and regional structures can provide external markets, openness to national and global systems is also significant. Sectoral networks are constrained by industry specificities but may range through regions and nations. Technological systems are based on standardized or platform technology and can be used in several markets, regions, and countries.[23]

**Figure 11: Relationship between global, national, regional, sectoral innovation systems**




Source: Author's own compilation based on Asheim B. T., Lawton Smith H., Oughton C., *Regional Innovation Systems: Theory, Empirics and Policy, Regional Studies* (2005)

[23] Frenz M., Oughton C., *Innovation in the UK regions and devolved administrations: A review of the literature for the Department of Trade and Industry and the Office of the Deputy Prime Minister* (2005)

# A.4 STPS' CONTRIBUTION TOWARDS AN INNOVATION-DRIVEN ECONOMY

4IR technologies bring opportunities to capitalize on technological transformation, and STPs have the potential to realize such capitalization. Indeed, STPs promote new technological developments and business models driving the 4IR, facilitating innovation and knowledge-based economies.

In this respect, STPs will leverage the synergy of two different and usually separated economies: on one side, the research economy, which is driven by the creation of new knowledge. On the other side, the commercial economy, which is driven by the marketplace.

The task of forging closer ties of collaboration between both actors has proven to be a complex and intricate process. Indeed, frequently, their activities and methods seem entirely incompatible, and their goals diverging. However, their combined action can have a significant positive impact on the economy, society and environment.[24] In general terms, the new generation of STPs could leverage the accelerated 4IR digital transformation to impact five major areas known as the '5Cs': Capacity, Collaboration, Content, Capital and Communication (Figure 12).

**Figure 12: The 5 major areas on which STPs through digital technologies have an impact**


Source: Author's own compilation based on ESCAP, *Establishing Science and Technology Parks: A Reference Guidebook for Policymakers in Asia and the Pacific* (2019)

[24] Oh D. S., Phillips F., Park S., Lee E., *Innovation ecosystems: A critical examination,* Technovation, Elsevier Volume 54 (2016)





By promoting new technological developments and business models, STPs facilitate innovation and knowledge-driven development and, economic diversification and will contribute to:

- Fostering innovation ecosystems that stimulate and managing the flow of knowledge and technology between universities, R&D institutions, companies and markets;
- Facilitating the creation and growth of innovation-based companies through clustering, incubation, acceleration and spinoff processes;
- Boosting the transformation of new knowledge and innovative ideas into commercially viable products and services that satisfy industry or individual customer needs;
- Providing high value-added services together with high-quality space and facilities for the acceleration of SME's growth;
- Enabling the internationalization of their resident companies to work in a global network of innovative companies and research institutions.

# B. The reason for UNIDO Assistance

# B.1 ISID MANDATE

The UNIDO mandate to promote inclusive and sustainable development is based on the recognition by its Member States that progress can only be achieved through strong, inclusive, sustainable and resilient economic and industrial growth and the effective integration of the economic, social and environmental dimensions of sustainable development.

UNIDO strongly believes that ISID will be a key driver for the successful integration of the economic, social and environmental dimensions required to fully realize sustainable development for the benefit of our future generations. UNIDO, therefore, advances ISID by building and improving the necessary industrial capacities in its Member States.

UNIDO delivers its ISID mandate in a holistic manner to achieve effective outcomes and impacts through four enabling functions: (i) technical cooperation; (ii) analytical and research functions and policy advisory services; (iii) normative functions and standards and quality-related activities; and (iv) convening and partnerships for knowledge transfer, networking, and industrial cooperation. The Organization serves as a global forum for industrial cooperation and standard-setting and provides policy advice and technical cooperation services.[25]

In its **global forum role**, UNIDO identifies state-of-the-art practices and encourages knowledge exchange in industrialization, related standards, and industrial policymaking while engaging key stakeholders that have the potential to enhance the ability of low-, middle-, and high-income countries to pursue inclusive and sustainable industrial development.

As a **provider of technical** cooperation and policy advisory services, UNIDO supports the creation of conducive policy environments for inclusive and sustainable industrial development and builds capacities in public and private institutions to support the growth of industry and related services, with a particular focus on SME and entrepreneurship development.

The substantial increase in voluntary financial contributions to the Organization over the past ten years, which allowed consequently an increase of technical cooperation activities carried out by UNIDO, bears witness to the recognition of UNIDO's important role and its successful approach in providing an effective response to industrial development needs.

By applying this dual approach, UNIDO can count on extensive expertise in working with governments, industry and other major stakeholders to advance the establishment of innovation ecosystems through capacity building, policy advice, advocacy and the facilitation of partnerships.

[25] UNIDO, *Inclusive and Sustainable Industrial Development. Creating shared prosperity, Safeguarding the environment* (2014)





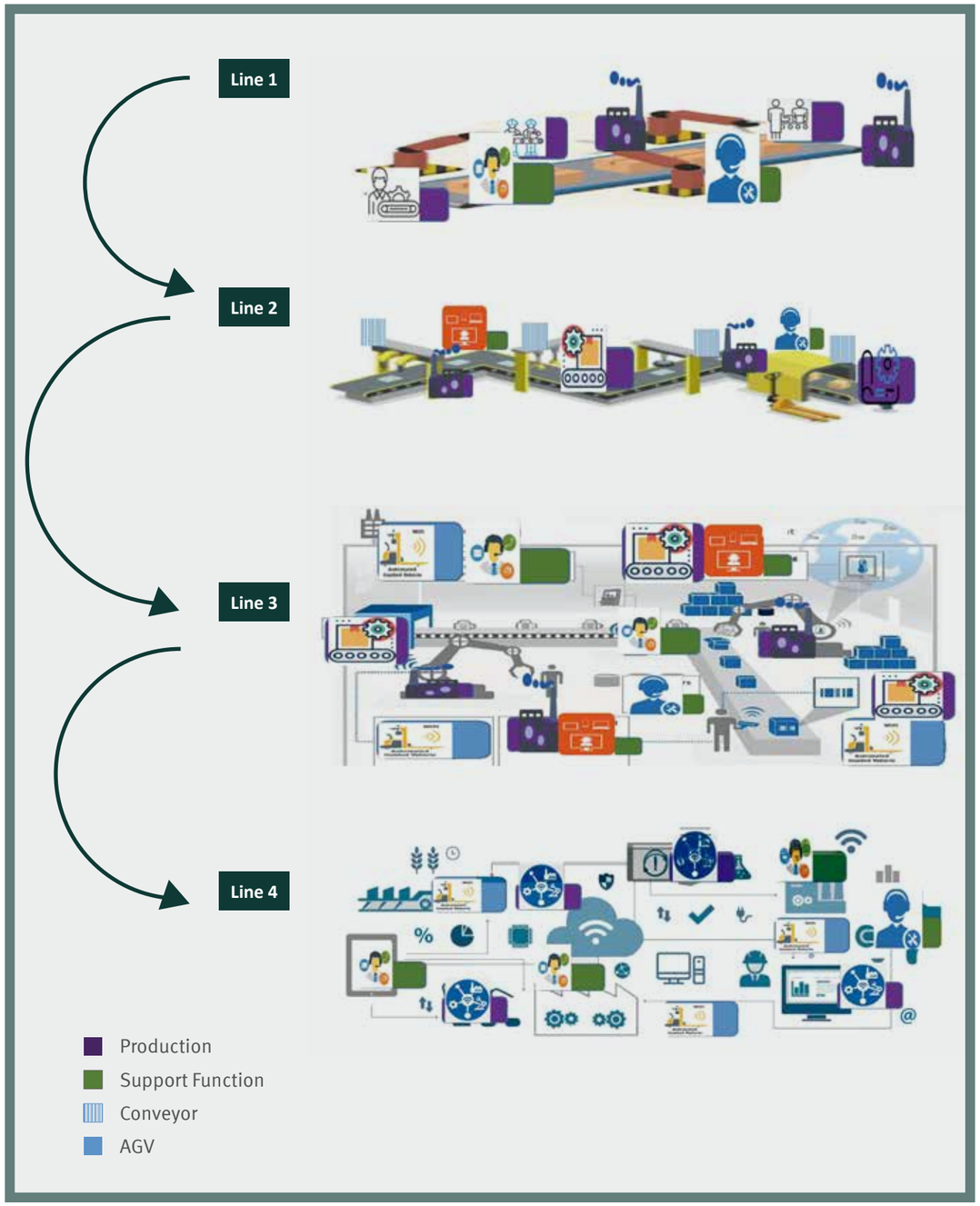
# B.2 PROMOTING ECOSYSTEMS OF INNOVATION: A UNIDO'S PRIORITY

Promoting environments conducive to innovation is among UNIDO's key priorities. The new generation of STPs is characterized by the constant evolutions in emerging technologies upheld through the utilization of AI, Big Data analytics, IoT and other 4IR technologies, contributing to fully automated intelligent systems and connected cyber-physical programs. UNIDO provides enterprise capacity development expertise for upgrading employees with the critical skills required for the digital transformation of businesses and accelerating the adoption and adaptation to emerging technologies. The UNIDO's Medium-Term Program Framework (MTPF) 2019-2021 entails a strong emphasis on smart manufacturing development and training, which is vital for UNIDO in the era of exponential digital transformation of the various industrial sectors, and is one of the main factors promoted is the generation of new STPs. This framework embraces different scenarios of automation stages for initiatives to realize a standard level of successful performance measurement of STPs.

In other words, STPs are a form of laboratory for experiments which are anticipated to add value and stretch development standards of the economy and surrounding environment. Similarly, arrangements can be made to observe the behaviour of objects in different patterns, permitting the flexibility of gradual intensity increments, for instance, in translating from manual to digital operational environments. Usually, many infrastructure set-ups lack standardized levels of development, so there is a need for a steady flow in alterations to give room for evaluating capacity utilization and exploring other relevant possibilities for furthering infrastructure development. In this context, STPs are useful for examining adoption and adaptation to technologies according to the different levels at which firms operate, analysing the growth potential and probing full automation options for businesses.

An example of digital level systems tests is shown in Figure 13, which exemplify the structured transpose from manual to smart factory systems. It simplifies – through four levels – the gradual conversion from a manual system of programs to automation driven by emerging technologies, with line 1 representing a more manual work, and line 4 depicting a smart, intelligent factory. The digital intensity grows with levels, thus, the workforce's training requirements simultaneously increase. A highly automated scenario can be piloted to foster the adoption of new technologies and widen the participation of all critical stakeholders of innovation clusters in the various Member States, where UNIDO provides technical assistance in establishing STPs.

Figure 13: Exemplification of a structured transpose from manual to smart factory systems




Source: Author's own compilation based on Fraunhofer Institute for Production Systems and Design Technology, *Learning Factory for Industry* 4.0., Lecture presentation in Industrial Transformation Mexico - Hannover Messe edition (2019)





# B.3 UNIDO'S TECHNICAL EXPERTISE

Acknowledging science and technology's key role in promoting innovation, the DTI Department proposes a technical service module specifically meant to facilitate the establishment of STPs and maximize their added value and sustainability. The DTI Module "A new generation of Science and Technology Parks" benefits from UNIDO's extensive expertise and experience in the area, as well as from its existing network and growing partnership with the private sector, including foundations/associations and companies. Thanks to the expertise and resources of donors, Financial Institutions (FI), and the private sector, UNIDO supports the development of successful STPs, to promote innovation-driven economic growth. Jointly with its partners, UNIDO will guide governments and the private sector to **establish new STPs or revitalize the existing STP's ecosystem**, fostering knowledge sharing, technology transfer, entrepreneurship development and investment promotion.

In general terms, UNIDO was one of the first development agencies to define guidelines for establishing industrial parks in the 1990s. In the 2000s, several UNIDO publications and forum events addressed the issue of industrial parks, including the UNIDO Industrial Development Report "Competing through Innovation and Learning" (2002/2003); the Industrial Development Report "Breaking in and Moving Up: New Industrial Challenges for the Bottom Billion and the Middle Income Countries (2009); and a series of Conferences on Industrial Parks (and related publications) held from 2010 to 2015 in several countries across Europe and Asia, including in Azerbaijan, Slovenia and Belarus.

In 2017, UNIDO partnered with GIZ and the World Bank to guide a broad definition of eco-industrial parks. As a result, the three organizations jointly published the "International Framework for Eco-Industrial Parks (EIPs)" and the "Practitioner's Handbook for Eco-Industrial Parks: Implementing the EIP Framework", a practical, step-by-step guide that takes stakeholders through the entire process of operationalizing the International EIP Framework.

In 2019, UNIDO hosted the International Conference in Peru on "Industrial Parks for Inclusive and Sustainable Industrial Development" and participated to the International Symposium on "Science Technology Parks as an Instrument for Innovation and Regional Competitiveness". These forums facilitated networking, knowledge and experience-sharing among policymakers, practitioners and academics and contributed to better understanding the role of a new generation of IPs and STPs and to build the capacity of public and private stakeholders to design, establish and manage parks. As a result, in 2019, **UNIDO published the UNIDO International Guidelines for Industrial Parks**, based on more than 40 years of UNIDO's experience in establishing IPs, which provides a reference for promoting STPs. It is worth highlighting that despite that STPs and IPs tend to have a different focus (see also section A.1), they hold important structural similarities. In this sense, UNIDO's international guidelines for industrial parks can orient decision-makers across all the implementation processes of an STP, from conducting pre-feasibility studies to its final commissioning and performance evaluation.

Additionally, UNIDO's hands-on experience with the various facets of investment promotion, application of new technologies and technology transfer has led to the development of methodological instruments and tools, such as the Computer Model for Feasibility Analysis and Reporting (**COMFAR**)[26] , a software that permits the user to simulate the short- and long-term financial and economic situation of investment projects. The software is being used as a branded FinTech Tool for conducting feasibility appraisals of major industrial and non-industrial projects to advise the Government's Investment Policy decisions.

[26] UNIDO, *COMFAR Software*, www.unido.org/resources-publications-publications-type/comfar-software

Moreover, **reverse pitching** (Figure 14) is a tool employed by UNIDO that requires a thorough understanding of the country's needs to provide tailor-made technical cooperation assistance to warrant the successful commercialization and sustainability of the concept developed. Ideally, products and services aim at satisfying experience and needs and are both generated by specific processes. Innovation is a process. Diversity is the key to developing, selecting, and combining concepts, even from interdisciplinary research fields to proof of concept in the field.

In business terms, for operational firms, this process ensures a firm knowledge base on the specific customer journey details for a successful introduction of the product before it reaches the market since it seeks to provide a solution to an identified problem in the market arena. Reverse pitching has another side that capitalizes on tackling business challenges converting them into conceivable ideas which are readily acceptable and transform into a great impact on economic and social development.

**Figure 14: UNIDO's Innovation Cluster Approach**


Source: Author's own compilation.

The reverse pitching sequential stages of development begin from the conception of a business idea, the identified needs. The innovation hub is where the needs are listed. A quantitative market search provides a benchmark to understand how well the competitors are satisfying customer needs. This is a laboratory for brainstorming, which brings about the idea's conception through a visual understanding of the competitive gaps with existing and future competitors. The ideation stage is intended to assign performance measurement parameters, check competitor levels, and ensure consistency between customer evaluations and product performance variables.

Concept development or proof of concept can only begin when the specifications are clear, and concepts are organized and selected using the ideal arithmetic matrixes and prototypes are developed and tested through test markets for customer validation. This phase aims to measure the degree to which the product under development is the acceptable solution to the challenge being addressed. The outcomes of the customer validation stage will determine the commercialization and upscaling of the idea into a product giving returns from the market. This ideal concept is even applicable for the institutionalization of STPs, bearing in mind that the underlying note driving this outcome is attaining sustainable industrial development and confirming positive social, economic, and environmental improvements. Hence there is a need to ensure proper governance structures and the sustainability of operations through the collaboration of innovation ecosystem actors.





## B.4 EXPERIENCES

Over the past several decades, UNIDO has been imparting its experiences and the best practices to developing countries and economies in transition in promoting industrial competitiveness and innovation, improving their socio-economic development through ad hoc initiatives. UNIDO recognizes the importance of 4IR technologies for achieving inclusive and sustainable industrial development. Therefore, it is engaged in technical assistance projects to maximize 4IR potential by strengthening linkages between science and research institutions and the industrial sector.

# BELARUS

B. THE REASON FOR UNIDO ASSISTANCE

## OVERVIEW

UNIDO supports the establishment of a pilot 4IR Demonstration and Innovation Center in the Brest region of Belarus. The center supports 4IR technological learning, smart manufacturing and innovation, and provides 4IR capacity-building services for beneficiaries from the Brest, Vitebsk and Mogilev regions. It also serves as a demonstration and 4IR technological learning centre for Belarus and other countries of the Eurasian Economic Union (EAEU).

The pilot centre exemplifies the production approach that can become the engine of economic growth in the region and the country: it demonstrates how forward-thinking engagement of technology can create smarter and cleaner manufacturing and how 4IR technologies at scale can transform the nature of work itself by engaging and improving human skills with minimal job displacement.

## MAIN OBJECTIVES AND IMPACT

The project seeks to contribute towards ensuring smooth transformation of the Republic of Belarus to 4IR, by addressing challenges such as lack of information on state-of-the-art technological solutions, imperfection of the industrial processes applied by the enterprises, shortage of skilled personnel, the inadequacy of innovation ecosystems at the level of SMEs, and underdevelopment of infrastructural base for 4IR. With this purpose, UNIDO supports the Ministry of Economy in implementing a project aiming at enhancing industrial competitiveness in the Republic of Belarus through leveraging the potential of 4IR technologies for smart manufacturing.

## UNIDO'S STRATEGY

The project's purposes are achieved through the implementation of tailored activities aiming at:

- Supporting the implementation phases for establishing a regional pilot 4IR Demonstration and Innovation Center in the Brest region.
- Formulating the EAEU Action Plan for cooperation on 4IR issues.

# CHINA


## OVERVIEW

UNIDO supported the establishment and operationalization of the Shanghai Global Science and Technology Center, which promotes innovative technologies in the manufacturing industry. This project is part of the strategy the Government of China designed to strengthen its global innovation network and, to support the implementation of ISID. Studies showed that the two major challenges MSMEs in the manufacturing sector have to face are: (i) low technological levels and weak access to modern technology, and (ii) a lack of skilled workforce. Therefore, the adoption of technology and its subsequent adaptation and application are of particular importance for sustained manufacturing growth. This allows manufacturers to stay competitive and increasingly challenging international markets. Additionally, investment in technology can facilitate innovation, essential for furthering technological progress.

## MAIN OBJECTIVES AND IMPACT

Through the establishment of an innovation and technology center – which promotes the introduction of advanced technologies in the manufacturing sector in China – UNIDO aimed at increasing industrial competitiveness, by upgrading technology, boosting innovation, generating decent jobs, and creating a sustainable environment. Additionally, the center supports the identification of the best technology-led solutions from China, and promotes their transfer to other developing or least developed countries, through the South-South Cooperation modalities, thus maximizing the impact of the intervention. The project allows many firms in the manufacturing sector in China – and other developing countries – to have access to new and better products, production processes, and management practices, thus, enhancing their productivity and export growth, through upgrading industrial technology-led solutions.

## UNIDO'S STRATEGY

The project's purposes are achieved through the implementation of tailored activities aiming at:

- Supporting the implementation process for establishing the Shanghai Global Science and Technology Center.
- Adopting a comprehensive multi-annual framework for the Center and a medium-term plan.
- Establishing a global partnership and networking platform with a growing portfolio of funded projects.

# PERU

## OVERVIEW

UNIDO designed a project to support the establishment of a pilot Science and Technology Park in Peru, in alignment with the national programme carried out by the Government of Peru to assist the digital transformation of the industrial sector. The programme is oriented towards strengthening innovation ecosystems and their market linkages in several regions of the country, according to their sectoral competitive advantages, and it is meant to be a solution to the lack of cooperation between government, industry and academia.

The UNIDO project is in line with the interventions carried out by the Peruvian National Council of Science and Technology (CONCYTEC), and particularly the viability assessment of 13 STPs initiatives distributed across the country (Figure 15) . More specifically, such interventions focused on analysing (i) the demand for innovative services in the respective CITE regions, (ii) the individual centres' capacity to respond to such demand, and (iii) the overall performance of the CITE network. Such analysis (and related recommendations) is meant to serve as inputs for developing an inclusive and sustainable CITE model.





**Figure 15: Map of STPs initiatives in Peru**


| 13 initiatives | |
|---|---|
| 10 | Universities |
| 1 | University and Regional Committee |
| 1 | Regional Committee |
| 1 | Chamber of Commerce |

Source: Author's own compilation based on CONCYTEC, *Guidelines for Science and Technology Parks in Peru* (2019)

## MAIN OBJECTIVES AND IMPACT

The overall objective of this project is to promote innovation-driven economic development in Peru by boosting regional and sectoral innovation ecosystems. More specifically the project seeks to create favorable conditions for the establishment of STPs, as well as to facilitate networking with other existing innovation tools and mechanisms in the Country, to realize the commercialization of "green" technological solutions. By strengthening the linkages between science and research institutions and industry, STPs facilitate knowledge sharing, technology transfer, entrepreneurship development, job creation, and investment promotion. Hence, STPs have the potential to significantly improve MSMEs' competitiveness – in particular their digitalization and internationalization –, and accelerate the transition from a linear economy towards a circular economy, by promoting the development of products and services with a circular impact.

## UNIDO'S STRATEGY

The project's purposes are expected to be achieved tailored activities aiming at:

- Improving the regulatory framework, policies and guidelines for accelerating the establishment of STPs.
- Promoting partnerships with high-tech institutions, MNC, and UNIDO ITPO networks, for encouraging technology transfer, new skills development, and investment.
- Supporting the design and implementation process for establishing a pilot STP in the Country.

# C. The Technical Module

# C.1 OVERALL OBJECTIVE

The overall objective of this Module is to leverage innovation-driven economic development to advance the attainment of the 2030 Agenda. More specifically, this Module aims at unlocking the potential of innovation and 4IR technologies by strengthening the innovation ecosystem and the linkages between science and research institutions and the industrial sector, fostering knowledge sharing, facilitating technology adoption, entrepreneurship development and investment promotion.

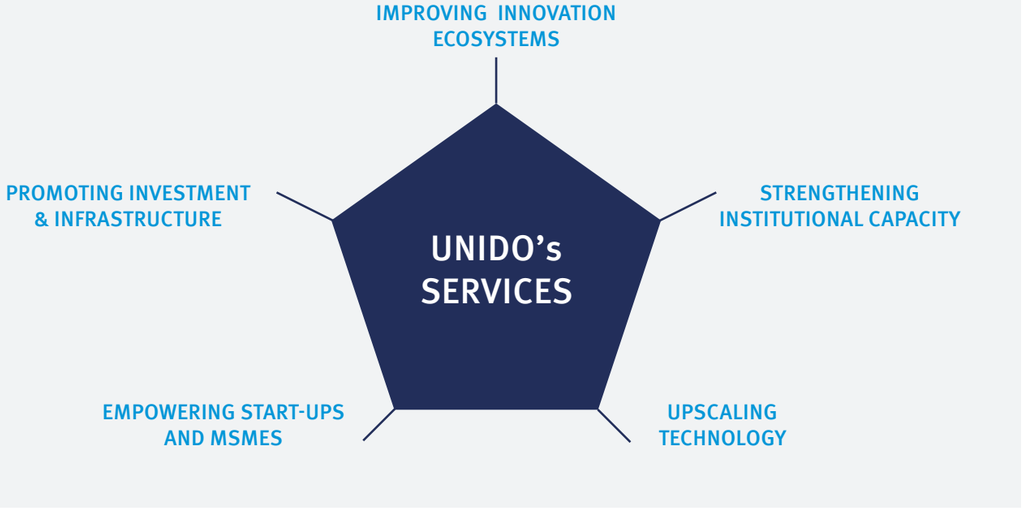
This Module has been designed to boost regional and sectoral innovation ecosystems by accelerating the development of STPs and facilitating networking with other existing innovation tools and mechanisms in a specific country, to realize the commercialization of innovative solutions locally developed, the transfer of new technologies and investment promotion; for improving SMEs' competitiveness, their digital transformation and internationalization.

# C.2 UNIDO'S SERVICES

UNIDO's **Department of Digitalization, Technology and Innovation (DTI)** offers specialized support to UNIDO's Member States, leading the way in addressing opportunities, challenges and risks stemming from the 4IR and its contribution to sustainable socio-economic progress.

UNIDO's DTI strategically combines its range of services to support developing countries and economies in transition to achieve enhanced industrial competitiveness and innovation. Special emphasis is placed on technologies associated with the Fourth Industrial Revolution (4IR) and ways to unlock their potential.

In this respect, UNIDO's DTI offers a package of services for sustainable advancement of industrialization through Science and Technology Parks, aiming at:








## IMPROVING INNOVATION ECOSYSTEMS

- Strengthening the **policy and regulatory frameworks** to facilitate the establishment and operation of STPs, in line with national and regional development strategies, by ensuring the complementarities between existing programmes, mechanisms, tools, incentives, and instruments supporting innovation (e.g. regulatory sandboxes).
- Developing a tailor-made **strategic plan** for the creation or reform of a national STP regime, outlining strategic objectives, intervention areas and concrete STP policy instruments.
- Advancing the adoption and implementation of **international best-practices, methodologies and tools** for the establishment and operation of parks.
- Identifying strategic priority sectors for attraction into STPs by conducting **a diagnostic study** on high-tech industry potential.
- Performing ex-ante **impact assessments** for STPs to inform evidence-based target setting, as well as the design of performance and risk-management systems.
- Supporting the design, development and implementation of pilot projects for the establishment of STPs, including through **(pre-)feasibility studies** (e.g. demand and economic impact projections, financial and policy analysis, socioeconomic and environmental impact analysis), and **feasibility studies** (e.g. business and master plans, financial modelling).
- Enhancing the **monitoring and evaluation frameworks** and systems for STPs, through the integration of 4IR technologies for data analysis and by supporting the establishment of STI Observatories.
- Conducting in-depth impact evaluations of existing industrial parks and zone programs to re-purpose and modernize underused or outdated industrial parks facilities for establishing an STP and strengthening related national strategies, policies, and regulations.

## STRENGHTENING INSTITUTIONAL CAPACITY

- Promoting **market- and technology-driven innovation strategies within the public sector**, by inter alia fostering PPPs, developing multi-stakeholder platforms, business incubators, and conducting, reverse pitching events, linked to the operation of STPs.
- Enhancing **governance models, sustainability strategies**, and **innovation management** at STP level, through the design and implementation of capacity building programmes, as well as by developing tailored-made guidelines and conducting studies at a country level.
- Addressing national and sectoral priorities and needs, through the development of institutional roadmaps **guidelines and manuals** related to the establishment and operation of STPs.
- Boosting firm-level innovation and technology adoption, by supporting the design of **institutional high value-added services**, inter alia, sprint programmes and business services.
- Enabling **knowledge sharing** among innovation stakeholders, including by establishing platforms and organizing ad-hoc events.
- Strengthening STP strategy and policy making capacities in the public sector through **hands-on training courses** on effective innovation policy through STPs.
- Facilitating **peer-to-peer learning** through international exchange programs among STP practitioners.
- Ensuring evidence-based decision making through **analytical capacity development** for STP analysts as well as monitoring and evaluation staff.





## UPSCALING TECHNOLOGY

- Facilitating **technology transfer**, foresight and adoption, particularly among startups and MSMEs, including by supporting the establishment of specialized centres and platforms to promote innovation, entrepreneurship and quality services.
- Building **digital skills**, by promoting updated academic curricula, organizing technical and vocational trainings (and other gender-sensitive capacity building activities), and by establishing (or scaling-up) new innovation and training centres.
- Advancing **smart manufacturing** and the adoption of 4IR digital technologies in manufacturing activities, including by supporting the establishment of pilot smart-manufacturing centre.
- Raising **awareness** on 4IR potential to ignite the development of technology-enabled products and business models, including by organizing global fora and other international events.
- Supporting the enforcement of **regulations** and the application of **standards, guidelines, principles**, among others, on inter alia privacy and data collection, interoperability, data management, industrial safety, cybersecurity, and IPR, related to the adoption of 4IR technologies, including through capacity building activities.

## EMPOWERING START-UPS AND MSMES

- Promoting youth and women's entrepreneurship, by facilitating access to and incentivizing their participation in incubation, acceleration and scale-up programmes.
- Facilitating **access to funding** among startups and MSMEs, inter alia by building capacities to develop sound business plans and strengthening linkages with international investors.
- Unlocking the potential of innovation and digital transformation, by supporting the adoption of **standards, guidelines and best-practices** at firm-level, including to identify and remove existing barriers.
- Advancing the **internationalization** of startups and MSMEs by enabling their participation in regional and global networks of innovative companies and research institutions and helping dress overcome barriers to international trade.
- Strengthening manufacturing associations, sectoral bodies, and chambers with respect to their innovation policy lobbying capacities through innovation road mapping.





## PROMOTING INVESTMENT & INFRASTRUCTURE

- Boosting **collaborative governance models** for the development and operation of STPs, particularly by fostering the consolidation of Public Private Partnerships (PPP).
- Facilitating investment and technology transfer, by building **strategic partnerships** with high-tech institutions and MNCs, and encouraging collaboration through UNIDO ITPO network, and UNIDO's Centre for South-South Industrial Cooperation.
- Promoting **innovative financing sources and models**, in particular by attracting investments having a social and environmental impact (e.g. impact investment), including through tailored studies on financial sustainability mechanisms.
- Promoting local and foreign investments by carrying out capacity building activities to facilitate the use of **financing tools** to conduct feasibility assessment (e.g. **COMFAR**).
- Advancing **gender-lens investing**, by building awareness and promoting investment strategies responding to the needs of women-led enterprises.
- Encouraging the use and development of **shared infrastructure**, including by raising awareness on the potential of shared digital infrastructure and infrastructure as a service (e.g. cloud computing).
- Attracting international investors, by carrying out **promotional and marketing activities** to disseminate the opportunities offered by STPs through UNIDO ITPOs and other global platforms.

# C.3 THEORY OF CHANGE

The graphic illustration of the Theory of Change shows how this Module seeks to make a substantial contribution towards the envisaged long-term impact of achieving SDG 9, focusing on promoting innovation-driven economic development through strongest linkages between science and research institutions and the industrial sector.

The main purpose of this Module is to facilitate the establishment or revitalization of STPs, including in terms of identifying and eliminating obstacles that might limit their development, their added value or sustainability, in order to make a substantial contribution towards the envisaged long-term goal of achieving SDG 9 and other industrial-related goals.

Activities are strategically designed to address specific national or regional challenges, and they lead to the five essential outputs the Module aims to reach. Activities, which result from multiple partners' efforts, might be implemented at various levels – macro, meso and micro –, thus, having an influence on several fronts. Section C.2 of this work provides a non-exhaustive list of UNIDO's services, which can be selected and combined to design a tailor-made intervention.

The change will be finally reflected in the long-term goal and will be tracked throughout the whole process by selected indicators. By adopting a results-based monitoring and evaluation approach, UNIDO objectively measure the performance generated by each level of intervention through selected **key performance indicators.**[27] For this purpose, UNIDO apply the integrated results and performance framework (IRPF), which represents a pillar of the United Nations Results-based management (RBM) approach.

[27] IRPF Indicators: (Annex I)





## SCIENCE AND TECHNOLOGY PARKS

**ECOSYSTEMS OF INNOVATION IMPROVED**

- Policy and regulatory frameworks for STPs assessed and strengthened.
- International best practices, methodologies, and tools adopted and implemented.
- STPs' establishment supported through activities. (e.g., pre-feasibility studies, M&E activities), as well as specific tools (COMFAR, etc.).
- Pilot projects on STPs developed and implemented.
- Existing parks upgraded.

**INSTITUTIONAL CAPACITY STRENGTHENED**

- Strategic partnerships among academia, R&D institutions, and industry promoted.
- Capacity building programs implemented.
- Knowledge sharing facilitated among the different groups of stakeholders.
- Programmes to foster innovation promoted.

**TECHNOLOGY SCALED-UP**

- Technology transfer facilitated.
- Technology adoption and adaptation supported, namely with respect to start-ups and MSMEs.
- Digital skills on advanced digital production technologies (ADP) developed or improved.
- Application of standards for digital technologies supported.

**START-UPS AND MSMES EMPOWERED**

- Programmes to build entrepreneurial skills designed and implemented.
- Entrepreneurs' participation in incubation, acceleration and scale up programmes promoted.
- Access to funding among start-ups and MSMEs facilitated.
- Adoption of standards, regulatory frameworks, guidelines and best- practices facilitated.
- Start-ups and MSMEs' internationalization advanced.

**INVESTMENT & INFRASTRUCTURE PROMOTED**

- Collaborative governance models for the development and operation of STPs boosted.
- Innovative financing models (including impact investment) fostered.
- Strategic partnerships promoted for investment attraction, including among high-tech institutions, MNCs and UNIDO ITPO global network.
- Gender-lens investing advanced.
- Shared infrastructure facilitated.

Improved regional and sectoral innovation ecosystems, by facilitating the establishment of Science and Technology Parks, which:

- empower start-ups and MSMEs through their internationalization and digital transformation
- promote job creation and entrepreneurship development
- foster circular economy

**ADVANCED INNOVATION-DRIVEN ECONOMIC DEVELOPMENT**

**IRPF Indicators (Annex I)**

**OUTPUT INDICATORS**
TCO.1
TCO.3
TCO.4
PAO.1
PAO.2
CPO.1

**OUTCOME INDICATORS**
POL.1
POL.3
INV.1
GOV.1
GOV.2
KASA.1
KASA.2

**IMPACT INDICATORS**
ECO.1
ECO.2
ECO.3
SOC.1
SOC.2

# C.4 FINAL CONSIDERATIONS

The overall objective of this Module will be achieved through a programme approach that fully aligns with UNIDO's ISID mandate, as well as the vision and principles of the 2030 Agenda for Sustainable Development and the SDGs. Developing projects in the framework of a more comprehensive and ambitious programme approach will maximize the effectiveness of UNIDO's intervention. However, the achievement of the overall objective and key results depends a lot on a successful rallying of other key partners behind the objectives and results of the programme. In this respect, UNIDO's proactive engagement as an impartial broker and match-maker will be crucial to serving as an effective catalyst for mobilizing partners and additional large-scale resources to extend the impact of UNIDO's TC and achieve the agreed transformative programme results. However, national governments will remain the primary counterparts of the programme, and therefore responsible for mobilizing substantial additional resources. UNIDO will play an advisory and supporting role to achieve the required large-scale "parallel" funding.

Seeking transformational change and large-scale development impact, the programme builds on the emerging evidence that 4IR technologies do have the potential to impact on various fronts positively. Indeed, 4IR technologies not only contribute to achieving SDG 9, but they also affect the social and environmental sphere by creating new job opportunities, supporting entrepreneurship, and providing green solutions. The programme promotes the overarching principle of the 2030 Agenda, namely, eradicating poverty and enhancing environmental and social sustainability.

# References


1. Asheim B. T., Lawton Smith H., Oughton C., *Regional Innovation Systems: Theory, Empirics and Policy, Regional Studies Regional Studies* (2011)
2. Chan K. F., Lau T., *Assessing technology incubator programs in the science park: the good, the bad and the ugly,* Technovation, Elsevier (2004)
3. CONCYTEC, *Guidelines for Science and Technology Parks in Peru* (2019)
4. El-Haggar S., *Sustainability and innovation: The next global industrial revolution,* Oxford University Press (2015)
5. ESCAP, *Establishing Science and Technology Parks: A Reference Guidebook for Policymakers in Asia and the Pacific* (2019)
6. ESCWA, *Science and Technology Parks: Global Outlook with a Focus on the Arab Region* (2018)
7. EC, Directorate-General for Regional and Urban Policy, Przeor M., *Role of Science and Technology Parks (STP) in regional innovation strategies – EU experience* (2015)
8. EC, Directorate-General for Regional and Urban Policy, *Setting Up, Managing and Evaluating EU Science and Technology Parks: An advice and guidance report on good practice* (2014)
9. EIB, *Plan And Manage A Science Park In The Mediterranean. Guidebook For Decision Makers* (2010)
10. FAST, *Innovation District Concept* (2019)
11. Fraunhofer Institute for Production Systems and Design Technology, *Learning Factory for Industry 4.0.*, Lecture presentation in Industrial Transformation Mexico - Hannover Messe edition (2019)
12. Frenz M., Oughton C., *Innovation in the UK regions and devolved administrations: A review of the literature for the Department of Trade and Industry and the Office of the Deputy Prime Minister* (2005)
13. Hanf M., Taival, *What is circular economy and why is it relevant to you?* (2019)
14. Hyytinen A., Pajarinen M., Rouvinen P., *Does innovativeness reduce startup survival rates?,* Journal of business venturing, 30(4) (2020)
15. IASP, *Definitions: How IASP defines our key terms,* www.iasp.ws/our-industry/definitions (2018)
16. Korea Innovation Foundation, www.innopolis.or.kr/eng
17. Oh D. S., Phillips F., Park S., Lee E., *Innovation ecosystems: A critical examination,* Technovation, Elsevier Volume 54 (2016)
18. Rally Assets, *The Impact Investing Guidebook for Foundations* (2019)
19. Reeb D., Zhao W., *Patents Do Not Measure Innovation Success,* Critical Finance Review 9 (2020)
20. Startup Genome, *The Global Startup Ecosystem Report 2020: The New Normal for the Global Startup Economy and the Impact of COVID-19* (2020)
21. UNCTAD, *World Investment Report 2019: Investment and New Industrial Policies* (2019)
22. UNCTAD, *World Investment Report 2018: Investment and New Industrial Policies* (2018)
23. UNCTAD, *Curso de formación en políticas de Ciencia, Tecnología e Innovación, Módulo 5: Fomento de los vínculos para la innovación* (2017)
24. UNIDO, *Bracing for the New Industrial Revolution - Elements of a Strategic Response* (2019)
25. UNIDO, *Chemical Leasing,* www.chemicalleasing.org
26. UNIDO, *COMFAR Software,* www.unido.org/resources-publications-publications-type/comfar-software
27. UNIDO, *Economic zones in the ASEAN: Industrial Parks, Special Economic Zones, Eco Industrial Parks, Innovation Districts as Strategies for Industrial Competitiveness* (2015)
28. UNIDO, *Inclusive and Sustainable Industrial Development. Creating shared prosperity, Safeguarding the environment* (2014)
29. UNIDO, *Industrializing in the digital age, Industrial Development Report* (2020)
30. UNIDO, *International Guidelines for Industrial Parks* (2019)
31. Wasim M. U., *Factors for Science Park Planning,* World Technopolis Review (2014)






# Annex I: UNIDO's selected Key Performance Indicators

Results-based management (RBM) is a strategy based on managing the achievement of intended results within a given context by integrating a results-oriented philosophy and principles into all aspects of management, as well as by integrating good practices and lessons learned from past performance into management decision-making. RBM is one of the five UN programming principles, along with a human rights-based approach, gender equality, environmental sustainability, and capacity development.

In line with these principles, in 2019, UNIDO adopted an Integrated Results and Performance Framework (IRPF), which allows for harmonising project-, programme-, country- and organizational results. In this respect, Annex I provides a list of selected KPIs used to monitor and evaluate UNIDO's initiatives developed in the framework of this Module:

## OUTPUT INDICATORS

### TECHNICAL COOPERATION

TCO.1: Number of capacity building activities provided

TCO.3: Number of toolkits and guidelines produced

TCO.4: Number of business plans developed

### POLICY ANALYSIS AND ADVICE

PAO.1: Number of industrial strategies and industrial policy documents drafted/prepared

PAO.2: Number of analytical and statistical publications produced

### CONVENING AND PARTNERSHIPS

CPO.1: Number of global fora, workshops/EGM/side events organized

## OUTCOME INDICATORS

### POLICIES AND STANDARDS

POL.1: Cumulative number of new or revised policies adopted by policymakers

POL.3: Number of guidelines adopted by relevant actors

### INVESTMENTS

INV.1: Number of investment-ready proposals elaborated

### GOVERNANCE

GOV.1: Number of institutions established or strengthened

GOV.2: Number of actors participating in enhanced collaboration settings (clusters, networks)

### AWARENESS, KNOWLEDGE, AND CAPACITY BUILDING

KASA.1: Number of actors gaining awareness/knowledge on UNIDO knowledge areas

KASA.2: Number of actors gaining skills in UNIDO knowledge areas

## ISID IMPACT INDICATORS

### STRATEGIC PRIORITY: ADVANCING ECONOMIC COMPETITIVENESS

ECO.1: Number of firms with economic gains (additional sales, savings)

ECO.2: Number of firms with improved labour productivity

ECO.3: Number of firms with an increase in exports

### STRATEGIC PRIORITY: CREATING SHARED PROSPERITY

SOC.1: Number of additional jobs created and jobs retained

SOC.2: Number of SMEs with increased inclusion in value chains

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Department of Digitalization, Technology
and Innovation (DTI)
Vienna International Centre,
P.O. Box 300, 1400 Vienna, Austria
Email: dti@unido.org
www.unido.org