

Innovative Start-ups & Technology Transfer challenges in the context of Business Internationalization

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Abstract

The paper work emphasizes the real contribution of innovative start-ups and technology transfer at the business/economy level and the importance of this process for the internationalization phenomenon. Also it is very important here the creation of a link between educational systems (universities spin-off) and economy as a beneficiary of innovation (new products and services) in all the sectors and especially in the technological one.

The main point of this paper work consists in the study of the entrepreneurial process multiple dimensions, with accent on challenges that have to face the new technology- driven enterprises in the new knowledge economy international context.

Keywords: Start-up, Spin-off, Technology transfer, Business, Internationalization

1. Introduction

This paper work presents and describes the born of global business phenomenon and defines global/international starters. Then it will be emphasized the literature findings related to knowledge-intensive companies. As university spin-offs are knowledge-intensive or high-tech firms, looking at the specific needs of technology starters will provide us with first valuable insights. In a next step, it is presented the literature review dealing specifically with international innovative start-ups and the typology of this kind of businesses, technology transfer, functional areas in which the innovative international businesses acts, entrepreneurship, dimensions of entrepreneurial process and strategies for technology driven enterprises.

The latest developments of these concepts show that the business internationalization and technological transfer are the way for progress of our present society. The educational system thorough universities and research institutions have to bring their contribution to the technologic progress.

Following this, below are the few concepts which appear along the paper.

Innovative Start-ups are considered as new enterprises engaged in existing local markets but

introducing new perspectives and having the potential to compete in international markets.

Highly Innovative Start-ups are new enterprises engaged in new markets, new technologies, novel products or services and in knowledge based industries that demonstrate a potential for job creation and growth.

A spin-off is a new organization or entity formed by a split from a larger one, based on a pre-existing one, or a new company formed from a university research group or business incubator.

International start-ups, i.e. university spin-offs which are global from inception, require particular capabilities to address the specific problems related to early internationalisation. Referring at international start-ups, in the ideal case, the spin-off has all the required capabilities in house from the start.

In reality however, new companies often start with limited resources: founders have strong technical skills but lack of international business experience; financial resources of the company are restricted; an industrial application is still in development phase or the company has not yet identified his first customer and needs to build up track record and reputation.

Technology transfer is the process of converting scientific and technological advances into marketable goods or services.

Business Internationalization is the process of planning and implementing products and services so that they can easily be adapted to specific local languages and cultures, a process called localization.

The internationalization process is sometimes called translation or localization enablement. Using an information technology related example enablement can include: allowing space in user interfaces (for example, hardware labels, help pages, and online menus) for translation into languages that require more characters; developing with products (such as Web editors or authoring tools) that can support international character sets; creating print or Web site graphic images so that their text labels can be translated inexpensively; using written examples that have global meaning; for software, ensuring data space so that messages can be translated from languages with single-byte character codes (such as

English) into languages requiring multiple-byte character codes (such as Japanese Kanji);

The international plans for innovative start-up support aims at giving an overview of all the capabilities needed to support global start-ups in their internationalisation process. By identifying and developing capabilities oriented towards global start-up support does not limit itself to the university, research centre or any other type of innovative organization. Partners in, or outside the region can and should be involved within such an effort.

An analyse however, define a plan for innovative start-up support, it is not sufficient to look at the support structures available within the transfer offices of research units; one also has to identify the needs of global start-ups and the capabilities needed to become successful global firms.

Support can be organised or mobilized on 3 levels: the university/research unit and its TTO, regional or national partners, and international partners. The mobilization plan consists of organizing required or needed resources on these levels.

2. Typology of international innovative start-ups

Special attention was paid to the problems related to internationalisation of the new venture in the following functional domains: research and development, production and operations, sales / market development, and finally, organisation and governance.

Table 1. Functional areas for international start-ups

Research & Development
Finding scientific partners
Finding technical partners
Access to specialised R&D equipment and facilities
Production / operations
Setting up production facilities abroad
Finding partners for production
Access to industrial networks
Sales / market development
Market research and competitor analysis
Identification of lead customers
Export
Setting up sales/distribution networks
Setting up after-sales service
Organisation & governance
Human Resources Management
Legal / tax consulting
Advice in the field of IPR
Acquiring (international) financing
Access to entrepreneurial networks

Source: Hordes MW., Clancy J.A. & Baddaley J. (1995). *A primer for global start-ups*, Free Press

London

3. Globalization – the base for international innovative start-ups and technologic transfer

Since the late 1980's, an increasing number of new ventures, global from inception, have emerged in countries all around the world (Aspelund & Moen 2001; [2] Oviatt & Mc Dougall 1997[9]). The advances in communication and information technologies have reduced the transaction costs of international business and allow small companies to manage their international operations more efficiently. Transportation of goods has become cheaper, more frequent and more reliable. In addition, international trade agreements and the development of free trade areas have facilitated trade between countries. Human capital has become more mobile and gained more elaborate capabilities resulting in entrepreneurs more often acquiring international experience.

In addition to above factors, new market conditions such as the increasing importance of niche markets and the emergence of global networks and alliances have also played a role in the current internationalization phenomenon. Advances in production and process technologies, allow the small ventures to manufacture sophisticated and specialised product on a small scale and at competitive costs. This enables SMEs to compete with larger firms on cost and quality, often with more flexibility.

If we want to define innovative international start-ups we can use the following definition: "Global innovative Start-up firms are those that from inception seek to recognise and exploit opportunities by combining resources from and selling outputs in multiple regions around the world". In line with this definition, and given the current concern with spin-offs from universities, the literature review will focus on international/global oriented knowledge-intensive companies. A significant portion of the born global literature deals with high-tech businesses (Rialp-Rialp 2001) [11] as international start-ups are mostly found in the high-tech industries.

4. Dimensions of the entrepreneurial process

In this section, we concentrate on needs and challenges of techno starters in order to identify possible areas for providing and developing an adequate support infrastructure. While this section addresses overall needs and issues on the level of techno starters, we will focus more specifically on the international or global needs of these companies within a next section.

Entrepreneurship can be seen as the process in which actors interact in such a way that opportunities are recognized, preparatory steps are taken in order to exploit the recognized opportunity, which subsequently lead to the creation of value.

Recognizing that the entrepreneurial process includes multiple-actors and multiple levels of aggregation, where actors interact and construct new technologies into new business, one can use a multidimensional framework inspired by the work of Parsons on social systems theory (e.g. Parsons, 1951, 1977; Groen, 1994; Groen et al., 2002). A basic axiom is that entrepreneurs act purposeful in interaction with other actors. Originally, a social system was defined by Parsons as follows:

“...a social system consists in a plurality of individual actors interacting with each other in a situation which has at least a physical or environmental aspect, actors who are motivated in terms of a tendency to the “optimization of gratification” and whose relation to their situations, including each other, is defined and mediated in terms of culturally structured and shared symbols” (Parsons 1964, pp. 5-6).

Four mechanisms are embedded in this definition: (1) interaction between actors; (2) striving for goal attainment; (3) optimisation of processes; and (4) maintaining patterns of culturally structured and shared symbols. Each of these mechanisms produces its own type of processes, with its own specific type of capital needed.

Each mechanism can be related to a specific dimension.

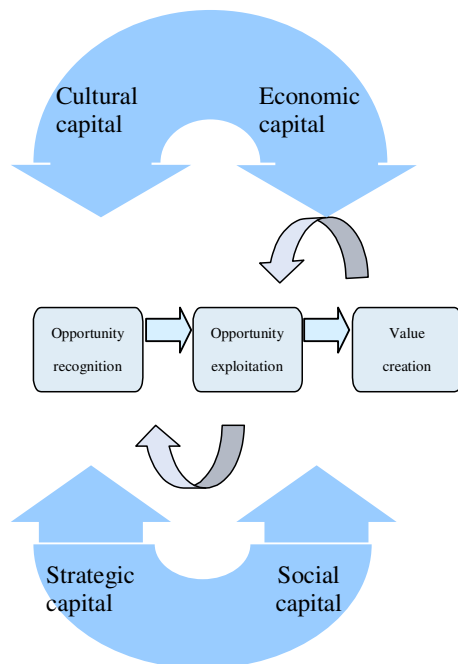


Figure 1: Four dimensions in the entrepreneurial process (adapted from Van der Veen and Wakkee, 2004)

Applying the multidimensional framework of entrepreneurial processes on starting entrepreneurs, these entrepreneurs face the following challenges:

- I. The *strategic dimension*: the entrepreneur has to set a goal for the enterprise. This concerns the business idea, the product and/or service, and the positioning of the enterprise in the market.
- II. The *economic (or financial) dimension*: the enterprise probably will not be profitable from the start. Some ‘bridging’ money might be necessary. Starting enterprises often lack sufficient capital and/or a track record to attract investments.
- III. The *skills and values dimension* (also called *organizational dimension*): the entrepreneur has to develop patterns of organizational behaviour and structures in order to create value in an efficient and effective way.
- IV. The *network dimension*: starting entrepreneurs need to develop a network of suppliers, clients, knowledge providers (like universities), governmental bodies, the Chamber of Commerce, trade organizations, support agencies, etc.

5. Technology-driven entrepreneurship

Schumpeter’s definition of entrepreneurship (1934) is one of the most well-known and most often used definitions within entrepreneurship research. His “Theory on Economic Development” (1961) [12] is regarded as the classic statement on entrepreneurship, not only by economists but also by other social scientists. As mentioned earlier, in Schumpeter’s view entrepreneurship is about new combinations of products, processes, organisations and markets. These new combinations imply innovations, which may be incremental or radical. Creating a new combination of existing products, processes, organisations or markets is called an incremental innovation: no major changes or adaptations are necessary to use the new combination in existing contexts. Radical innovations, on the other hand, will lead to, structural re-adjustments: existing socio-economic structures dissolve and are replaced by new actors with new technologies which create significantly more value than the replaced technologies.

Two ideal types of technology-driven enterprises can be distinguished based on this degree of technology-intensity: (1) front end technology based firms (or new technology based firms); and (2) application oriented technology based firms. The difference in technology-intensity has several implications for the needs starting entrepreneurs have to fulfill. The next

table enumerates these differences grouped in our four dimensions.

Organisation	Shared facilities. Lab scale. Patents versus confidentiality.	Own facilities or network organisations for large scale production and/or marketing. Patent owners.
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Table 2 Comparing two types of technology-driven start-ups on four dimensions

	<i>Front end technology based firms (or: New technology based firms)</i>	<i>Application oriented technology based firms</i>
Strategy	Inherently uncertain because of the technology dynamics.	Relatively certain on basis of thorough market analysis. Uncertainty with regard to market dynamics (e.g. competitors).
Financing	Considerable need for financial capital, often for longer periods of time. Risks are high, return may be high.	Considerable need for financing, but often more easily obtained because of shorter time to market and/or less uncertainty.
Networks	In first instance, emphasis on academic/technological networks. Later on, more focus on business and industry.	Emphasis on production and market networks (lead users).

As said, they are grouped around the four dimensions of entrepreneurial networking. We will first describe the needs and challenges techno starters face when they develop their idea into a business strategy.

6. Strategies for innovative international Start-ups and technology driven enterprises

Strategy formation, the process of deciding which value for whom will be created in which way, is a difficult but important part in the entrepreneurial process. As we described earlier in this paper, the entrepreneurial process can be divided into three major stages: (1) opportunity recognition; (2) preparation for opportunity exploitation; and (3) value creation. In each of these stages entrepreneurs (to-be) may experience serious difficulties.

Opportunity recognition

The business idea for a new technology-driven enterprise is often based on the assumed value of technological know-how and expertise of the entrepreneur. However, assessing the value of new technologies (involving radical innovations) appears to be extremely difficult. The process of converting global possibilities of new technologies (like nano technology or biomedical technology) into an enterprise with very specific and limited goals, is a very risky and highly uncertain one. Therefore, one of the most important problems techno starters encounter is that they are not able to estimate the commercial opportunities of technology .

This problem is also partially caused by an asymmetry of the information – most techno starters are not willing (and often not able) to share information with others (like investors), especially when the latter is better equipped to develop the business opportunity. Techno starters are believed to be not very capable of dealing with these kinds of strategic sensitivities.

Preparation for exploitation

Having isolated a business idea, this idea has to be developed into a full-fledged business opportunity. Characteristics of a good business opportunity:

- The opportunity is able to meet a demand.
- Customers can be reached within a reasonable period of time.
- The opportunity generates relatively much added value.

- Competition is small or manageable.
- The business opportunity is difficult to copy.
- Intellectual property can be safe guarded.
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In general, it appears to be difficult to assess these characteristics for technological innovations. Moreover, relatively un-experienced techno starters lack the knowledge and experience to assess the potential value of their business idea. More generally, the strategic orientation and marketing skills of techno starters are mediocre.

Exploitation and value creation

In most instances, a solid business plan forms the basis for exploiting the business opportunity. Necessary resources need to be combined to enable exchange with the market. Exploitation is necessary to generate cash flow. The techno starter, often exclusively oriented towards technological potential of his idea, has limited marketing skills and financial capacities. Technological knowledge is not necessarily needed on the market. The lack of marketing and financial skills also becomes evident in the business plan. This plan is often used to convince providers of capital and not seen as an instrument for reflection and purposive action.

7. Challenges for Start-ups and technology driven enterprises

Financial Dimension

Securing financial capital to start and develop an enterprise appears to be one of the major challenges techno starters encounter. Many studies focus on this issue. As is often the case with ‘regular’ start-ups, also techno starters face financial difficulties in setting up their enterprise. Laboratory and production facilities are expensive, time to market is long, and it is difficult to assess the future return on investment (ROI). Use of regular investment selection criteria (based on ROI and cost recovery) often leads to negative investment decisions of banks. Besides, a starting entrepreneur lacks a track record, necessary for banks to estimate financial risks.

Technology-driven enterprises are often faced with a (financial) gap between prototype development and full scale production and sales. The time needed to develop successful product-market combinations may take years. Cash-flow generated in this developmental period will generally not cover costs made. As a solution to this cash-flow

problem techno starters switch (partly) to consultancy instead of investing time and money in production.

As indicated, providing securities to financiers is often problematic. Technology-driven start-ups have little tangible assets. They represent a high intangible value, such as their knowledge (including patents), networks and market strategy. Assessing these intangible assets is extremely difficult.

Resuming many techno starters have difficulties in securing enough capital for their enterprise. A low return on investment, prolonged time periods to recover costs and investments, and difficulties in assessing intangible assets, are among the explanations provided. We identified the following five major financial needs of technology-driven start-ups.

1	As a consequence of the (financial) risks associated with technology-driven start-ups (due to lack of track record of entrepreneur, extended time-to-market, unclear ROI, intangible assets like knowledge and patents), these start-ups have great difficulties in securing financial seed and venture capital. For front-end technology based firms these problems are even more severe than for application oriented technology based firms.
2	Techno starters underestimate the time and energy necessary to secure venture capital and/or subsidies.
3	In general, commercial banks do not offer tailor-made products to technology-driven start-ups.
4	The provision of securities is difficult, since the major assets of technology-driven start-ups are tacit, intangible and embodied in knowledge and technology.
5	Informal investors are more likely to bridge the gap between proof of principle and prototype. However, there are relatively few informal investors or business angels in the Netherlands.

Organisational and managerial dimensions

Obviously, the entrepreneur plays a vital role in the entrepreneurial process. The fundamental characteristics of an entrepreneur are the following:

Characteristics of entrepreneurs

Entrepreneur characteristics
Risk-bearing
Source of formal authority
Innovation; initiative

Need for Achievement Drive Communication ability; technical knowledge Networking with resource providers Recognizing and seizing opportunities
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Some characteristics of entrepreneurs have negative connotations like a tendency for solo-performance, difficulties in delegating tasks, and avoidance of insecurity .

Successful high tech companies are more often founded by teams than by individual entrepreneurs. Each team member brings his or her expertise, knowledge and working experience into the enterprise. But often, the founder(s) and employees primarily reflect the technical skills necessary and not the necessary entrepreneurial skills with regard to marketing, business administration and organization, financial management, human resource management.

Entrepreneurial knowledge and skills are essential for the successful development of an enterprise. A right balance of entrepreneurial characteristics is necessary, since a lack and an excess of specific characteristics hinder enterprise development. Summarising, we postulate the following two major needs related to the organisational need of a starting technology-driven enterprise.

1	Techno starters are too much focused on the technological side of their enterprise.
2	Techno starters have limited knowledge and skills related to business administration and management.

Network dimension

In the previous sections we identified various needs related to the strategy, financial and organizational dimension. Given these needs, the support network of the entrepreneur is an important supplement to his/her own resources. One of the most important steps in the enterprise development process is the selection of network actors. The networks of techno starters are mainly technologically oriented. The entrepreneurs have few social (and network) skills and do not see the value of maintaining their network. The attention has to be paid to all stakeholders within the entrepreneur’s network. Often, network contacts are restricted to the largest customer, the venture capitalist and shareholders, while suppliers and smaller customers are neglected.

Techno starters are primarily interested in the potential of the technology or application they are working with. This technological orientation has several consequences, for their strategic orientation for example (they underestimate the business side

of their enterprise, they have difficulties in focusing their business plan), but also for the network contacts they establish and use. In so far as they have networks, these networks appear to be primarily technologically oriented as follows:

1	The techno starter’s focus on technology is also evident in his/her network. These networks are often limited in size and mainly technology oriented.
2	Time spent on and priority attached to network building and maintenance is insufficient.
3	Techno starters have limited networking and social skills.

8. Innovative start-ups and technology transfer in international context

The identified characteristics of innovative start-ups and the capabilities they need to acquire in terms of organisational resources and entrepreneur’s profile, in order to build up a sustainable global venture. These characteristics are organized in the following table per functional area. This categorization approach has been adopted based on the case studies/interviews: entrepreneurs and managers of entrepreneurial firms could relate more easily to such distinction than to the more ‘academic’ distinction between cultural, strategic, social and economical capital. At the same time, both types of categories can be linked in an exhaustive manner as the following table makes clear. As such, this table already summarizes the different needed capabilities identified as relevant for providing global start up support.

Table 3: Types of capital - Needed capabilities Global-Start-ups

	Type of capital	Dimension
Research & development		
Performing a ‘technological due diligence’ (assessing how unique the company’s technology is in the world/on the market)	Cultural	Skills & value
Creating an appropriate IP strategic (global)	Strategic	Scope
Developing a balanced innovation strategic (including R&D roadmap, balanced portfolio of short, medium and long term R&D objectives)	Strategic	Scope
Identifying and providing access to specialised R&D equipment and facilities	Cultural	Skills & value

Identifying and relating to (global) networks of “world-class” scientists, experts, technical and/or industrial partners	Social	Network
Production / operation		
Assisting / supporting the “make or buy” production decision	Strategic	Scope
Setting-up production facilities abroad	Cultural	Skills & value
Setting-up logistic infrastructure	Strategic	Scope
Selecting the appropriate location of facilities (taking into account local legislation related to industry, environment, etc and local support / incentive schemes)	Cultural	Skills & value
Identifying and selecting relevant partners for outsourcing	Social	Network
Developing adequate contractual arrangements related to IP/liabilities pertaining to production activities (including production partners)	Economic	Scale
Market development / sales		
Screening and selecting target markets / market segments (market intelligence)	Strategic	Scope
Identifying lead customers	Strategic	Scope
Defining and implementing the appropriate marketing mix for targeted market segments: products, price, distribution and promotion	Strategic	Scope
Developing an appropriate sales strategic and structure (including after sales and service)	Strategic	Scope
Developing adequate contractual arrangements related to IP / liabilities pertaining to sales activities (contracts with customers and/or distributors)	Economic	Scale
Organisation and governance		
Formation of a Board of Directors with international management experience	Cultural	Skills & value
Formation and development of a senior management team with international experience	Cultural	Skills & value
Recruiting and selecting “foreign” employees	Cultural	Skills & value
Developing adequate HR	Cultural	Skills & value

administrative procedures and arrangements (incl tax/legal aspects)		
Developing management capabilities	Cultural	Skills & value
Finance / administration		
Identifying, selecting and convincing investment / finance partners during the :pre-seed phase; seed phase;growth phase	Economic	Scale
	Economic	Scale
	Economic	Scale
Identifying and accessing grants/subsidies for export, R&D,	Economic	Scale
Identifying, developing and installing accounting /administrative /legal procedures pertaining to (global) activities (VAT, legal, import/export regulation, etc)	Economic	Scale

Based on global start-up case studies and a review of the literature on high-tech entrepreneurship and global start-ups, the needed capabilities to support global start-ups in their internationalization process have been already described. Above table summarizes the needed capabilities according to the 5 functional areas of internationalisation: Research and development, production and operations, market development and sales, organisation and governance, and finance and administration.

From other point of view the innovative start – ups needs support coming from universities which develops and helps spin-off companies to complete their capabilities and also from the regional/national and international partners.

As it was emphasized the universities are between the main actors of this process (see table 4).

9. Conclusions

Innovative start-ups are global organizations from inception that require particular capabilities to address the specific problems related to early internationalisation. These needed capabilities have been identified and delineated on the level of R&D, Market & Sales development, Production/Operations, Governance and Organization and Finance & Administration and resulted in a plan for global start-up support. Due to limitations in resources, global start-ups will more often than not benefit from external support in order to be successful and achieve global sales.

It is more an more important the approach of international business, this consists of transactions

that are devised and carried out across national borders in order to satisfy the objectives of individuals and organizations. That's why we have to build enterprises and to develop the international entrepreneurship culture taking into account this present approach over passing all the barriers of culture, society, economy and environment.

It is not enough all the time, for the ideas to be brilliant or for the organizations to be innovative, the needed capabilities possessed are the key for the entire process. The cooperation between business and education structures become more and more important today in our new knowledge society and economy. Also the practical vision of educational systems have to be developed but with the essential contribution and involvement of business/economic sector.

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Table 4: The international framework applied for the development of innovative start-ups and technology transfer

Increasing the number of Global Start-ups		Addressing the Needs of Global start Spin-Offs	
<u>Stimulating entrepreneurship among academics and research staff</u>	Creating awareness among university staff and students; stimulate entrepreneurial behaviour of university staff via incentive schemes; providing education and training with respect to entrepreneurship and business administration.	<u>Research and Development</u>	Performing a ‘technological due diligence’ (assessing how unique the company’s technology is in the world/on the market); Creating an appropriate IP strategic (global); Developing a balanced innovation strategic (including R&D roadmap, balanced portfolio of short, medium and long term R&D objectives); Identifying and providing access to specialised R&D equipment and facilities; Identifying and relating to (global) networks of “world-class” scientists, experts, technical and/or industrial partners
<u>Improving Technology Transfer Mechanisms and Specialised support structures/Infrastructure</u>	Professionalizing the support with respect to contract research, patenting/licensing and spin off activities, including specific services related to the specific needs of global starters; providing and developing adequate research and incubation facilities.	<u>Sales & Market Development</u>	Screening and selecting target markets / market segments (market intelligence); Identifying lead customers; Defining and implementing the appropriate marketing mix for targeted market segments: products, price, distribution and promotion; Developing an appropriate sales strategic and structure; Developing adequate contractual arrangements related to IP / liabilities pertaining to sales activities
<u>Networking / collaboration with regional and global partners</u>	Elaborating the collaboration with investment / financial and industrial partners; participating in clustering and exchange (cross-fertilization) efforts as well as technology transfer oriented collaborations with firms.	<u>Production</u>	Assisting / supporting the “make or buy” production decision; Setting-up production facilities abroad; Setting-up logistic infrastructure; Selecting the appropriate location of facilities (taking into account local legislation related to industry, environment, etc and local support / incentive schemes) Identifying and selecting relevant partners for outsourcing; Developing adequate contractual arrangements related to IP/liabilities pertaining to production activities (including production partners)
<u>Active involvement in regional / national policies stimulating entrepreneurship and innovation</u>	Co-operating for the development of an appropriate infrastructure for young high-tech firms (science parks /	<u>Organisation, Governance, Finance & Administration</u>	Formation of a Board of Directors with international management experience; Formation and development of a senior management team with international experience; Recruiting and selecting “foreign” employees; Developing adequate HR

	incubators), contribute to the establishment of a legal framework that supports entrepreneurial activities of universities (e.g. IP protection, financial participation of universities in spin-offs).		administrative procedures and arrangements (incl tax/legal aspects); Developing management capabilities Identifying, selecting and convincing investment / finance partners during the pre-seed, seed and growth phase; Identifying and accessing grants/subsidies for export, R&D; Identifying, developing and installing accounting /administrative /legal procedures pertaining to (global) activities (VAT, legal, import/export regulation)
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