

Typing of Innovations from Corporate Incubator

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Abstract— There are different organizational units to promote corporate innovations these days. Especially corporate incubators are one way to encourage radical innovations outside the core business. One of the major challenge thereby is the reintegration of innovations into the corporate process. The author therefore develops a model for a situation specific transfer process for innovation from corporate incubators that fit to the corporate strategy. Up to now it is not examined in literature which types of innovations are originally developed within corporate incubators. In this paper we therefore examine different types of innovations and identify which of them occur in different innovation environments, especially corporate incubators. By identifying 5 characteristic types of corporate incubators a more detailed allocation of the innovation types is made due to their distinctive competencies.

Keywords— *Typing, Innovation, Innovation Management, Corporate Incubator, Innovation Labs, Innovation Transfer*

I. INTRODUCTION

In the past, focusing on the development of incremental innovations was mainly enough for companies to hold their established position within a market. Using classical and established R&D processes enabled companies to optimize their product portfolio in regular intervals.

However due to decreasing product life cycles, rising customer expectations and rapid technological change, both technological and markets demands on competitive innovations are increasing [1] [2] [3]. It is therefore more and more important for companies to *explore* radical or disruptive innovations outside the core business and at the same time *exploit* already known technologies [4] [5]. Therefore, the demands and requirements of innovative companies are increasing.

Companies that pursue a growth strategy, which on the one side promotes radical innovations (*explore*) as well as incremental innovations (*exploit*), are confronted with the so-called Innovator's dilemma and looking for new ways to handle the increasing requirements [5] [6] [7]. Organizational ambidexterity represents a possible solution approach for the Innovator's dilemma [8]. By using an external development path beside the established R&D, companies are able to address both needs.

Different ways of external innovation units were therefore created and tested in the past few years by all kinds of companies. Corporate incubators are one opportunity to develop radical and disruptive innovations in a decentralized autonomous organizational unit far from the daily business [9] [10] [11]. In this paper, corporate incubator are defined as a decentralized unit, belonging to one corporate, which drives the ideation and development of radical innovations by using a separate development path [4] [13] [14].

The innovations developed in separate innovation units can be exploited in different ways. One common way is to transfer the innovation back into the corporate if it fits to the corporate strategy. However this transfer process is a major challenge for most of the corporates. To be able to control this transfer process, the author develops a model for a situation specific transfer process of innovations from corporate incubators. Some of the thereby addressed problems are listed below:

- Lack of available internal resources
- Different settings, processes within the corporate incubator and the corporate
- Lack of acceptance within the corporate
- Different speed of the development process
- Unclear assignment of the innovation to an existing unit

However to be able to address these problems the right way and to develop a suitable transfer model, different influences has to be taken into account. One major aspect which will be discussed in this paper is the type of innovation which will be transferred from a corporate incubator. The transfer process is a transmittance of, among other things, technological knowledge about an innovation from a corporate incubator as a sender to the parent company as a recipient [16] [17]. That implies that the innovation as the transfer object plays a major role in the process of developing a suitable transfer model.

Up to now, there is no definition which ideas should be developed within different types of external innovation units especially a corporate incubator. However the allocation of the right ideas to the suitable innovation path is an important step within the establishing of a right innovation unit.

In this paper we therefore identify different types of innovations and develop a model to allocate these innovation to a suitable innovation environment. For a more detailed analysis on corporate incubators, different types of corporate incubators were identified. The allocated types of innovations in corporate incubator are then further allocated to specific incubator forms.

II. LITERATURE REVIEW

To conduct these different types of allocations, a detailed literature analysis is required. In the following chapters, we will investigate four thematic areas, which are closely related to transfer process of innovations from corporate incubators, the typing of innovations and the different innovation environments.

A. Knowledge Transfer

Since the 1970s, knowledge and technology transfer have been a focus of scientific research. A major topic is the characterization and presentation of the transferred research objects (e.g. explicit or implicit knowledge, experiences, technologies, knowhow), transfer processes, participating actors (e.g. transmitter, recipient) as well as transfer media and mechanism [16] [17] [26].

Technology transfer is the goal-oriented transfer of technological and technology-related knowhow between partners [17]. In the literature, the transfer of knowledge or technology is often dealt with in the investigation of the Not Invented Here syndrome. The Not Invented Here syndrome is an aversion to foreign ideas, products and solutions [27] [28] [29].

In scientific research, technology transfer is enlightened from many different perspectives. Reference [24] identifies different types of technology transfer organizations that offer services at different levels of the value chain. From this classification, strategic recommendations for the management of the technology transfer organization can be derived. A taxonomic literature analysis is also carried out on the knowledge transfer from New Product Development teams. This results in a basic overview of how and with which the knowledge transfer can be influenced [30]. Moreover, the internal reverse technology transfer is further investigated [31]. The influence factors and effects of the transfer are analyzed as well as instruments are presented with which the transfer process can be coordinated [31].

B. Technology Management

The relatively young field of technology management has become increasingly important over the last 20 years. The development of longterm advantages by providing required technologies in the area of products, production processes and materials at the right time and at a reasonable costs is becoming more and more popular. An important topic of this research area is the management of interfaces [26].

Reference [1] is investigating technology management as a part of the corporate management. Of particular importance are the parallels of the interface between technology development and product development and the interface between incubator and parent company [1]. Three interfaces of a product development process are already known: The contextual interface between technology and market, the technical system interface describes the interaction between product and

production system, the organizational interface links the activities of technology development with those of product development [36]. Reference [36] is developing a valuation model that enables companies to classify themselves in terms of specific product development challenges at every stage of the innovation process.

To compile a system for holistic, strategic technology planning, a complete technology classification is carried out consisting of descriptive characteristics and their characteristic values for the classification of technologies as a planning object [32]. Furthermore, Reference [33] uses the findings of six case studies in the field of technology development to develop a typology with the aim of being able to derive and select methods of action for various technology development companies. The results of empirical surveys allow conclusions to be drawn about the effects and correlations of the technological parameters of the transfer process between two organizational units [34]. Reference [35] also addresses the research question, which innovation process is suitable for which innovation project. To this end, eight types of different innovation processes are formed.

C. Typing of Innovations

Typologies are carried out in almost every scientific field. Typing is a method of internal and interoperational rationalization and is used both for delimitation and for order. Typologies can serve as a source in the context of technology management and innovation management. Characteristics, characteristic values as well as properties of the examined objects can be applied to innovations from corporate incubators [34] [40]. This is especially true for typologies of innovations, technologies and development projects.

However, scientific knowledge has so far been available mainly through product innovations [37]. This is also reflected in insufficient support in practice. Similarities and differences between product and business model innovations are examined systematically to analyze opportunities for the transfer of findings and best practices [37]. Since there are numerous taxonomies and classifications of innovations in the scientific literature, reference [38] clearly presents definitions and classifications with the greatest importance and analyzes them. From this analysis, deficits, conclusions, similarities as well as distinctive features of the individual taxonomies can be derived [38]. Reference [41] focusses on the historical evolution of concepts and aspects of innovation in a literature analysis. The presentation and the direct comparison of the categorizations of the studied literature should be emphasized here [41].

Reference [39] lays out strategies for the use of incubators and develops a typology based on a benchmarking survey of 77 incubators. Two strategic applications of incubators are identified: The exploitation of internal technologies through commercialization and the gaining of access to external technology to support R&D [39]. The typology includes four types of incubators, which are classified according to the proximity to core competences as well as to an internal or external source of technology [12] [39]. In addition to the analysis of innovations and incubators as types of investigation, the investigation of technological development projects offers a variety of implications for the development of a typology for innovations from corporate incubators [40].

D. Environments for Innovations

For corporates there are many ways to generate new ideas, innovate and develop new technologies or products. In the following, we distinguish three different environments for innovation. In addition to the conventional R&D of established companies, innovation ecosystems as well as corporate incubators will be discussed. However due to the focus of the paper corporate incubators will be analyzed in more detail.

Conventional R&D

According to [1], conventional R&D of established companies consists of the acquisition of new knowledge (research) as well as the application and practical implementation (development). In the context of the present scientific work, R&D is understood as a functional division or department within the corporate. R&D in companies are usually located centrally at one specific R&D lab. The main task of R&D is the production of new, higher-quality knowledge and technologies [23].

Innovation ecosystem

The term "ecosystem" originally came from the field of biology and was brought into an economic context by Moore in the 1990s: an ecosystem is understood as diverse companies that cooperate in a network [59]. There are only loose relationships and symbiotic dependencies between the network participants. These interactions for the mutual benefit of the participants ensure the success of ecosystems [60]. Furthermore, a business ecosystem is characterized by the fact that companies jointly develop their innovative capacity across industries. The network participants work cooperatively and competitively to develop new customer-oriented innovations [61].

Corporate Incubator

Corporate incubators bridges the innovation barriers and support radical innovations by establishing an external development path [18]. Within this paper only corporate incubators (company-internal) are considered. In the literature various terms and definitions of corporate incubator exist [4] [42] [51].

In this scientific research a corporate incubator is understood as a business unit, that promotes the generation, development and commercialization of radical technology and product ideas by providing a separate development path [4] [13] [14] [19].

Incubators can be classified according to for-profit and non-profit incubators (Figure 2). Non-profit incubators are set up by governmental authorities with the objective of promoting regional development [52]. They are either part of a university or owned by the state. Corporate and independent incubators are profit-oriented institutions, set up by private organizations with the goal of generating a profit [15] [52].

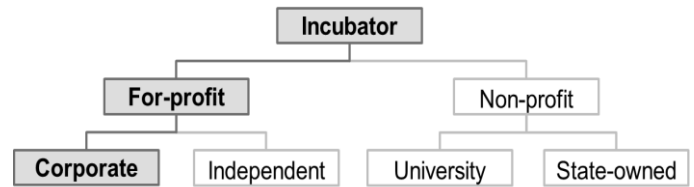


Fig. 1 Classification of incubators

Because there are major differences between one incubator and another, there are different typologies of environments for innovations in scientific literature. Reference [42], for example, compares existing typologies and broadens the viewpoint to human resource management within incubators. A large number of design instruments and different foci lead in practice to a large number of different incubators, which are characterized primarily by differing priorities and objectives [42]. The number of publications on the subject of incubators is increasing, as are the number of definitions and terms [43]. However, most of the definitions describe an incubator due to the services provided [43]. Four components of incubators have received particular attention in previous research: Shared office space, shared support services (to reduce overhead costs), professional business support (mentoring) and the provision of a network [51].

Incubators also pursue different strategies. Reference [45] formulates different incubation strategies for business spin-offs. Three basic incubation models are developed: Low selective model, supportive model, and incubator model [45]. Most of the scientific literature considers the process of incubation only from the resource-based view [46]. However, all management theories must be taken into account for a holistic analysis. Reference [46] defines future research needs on the basis of the resource-based view, the knowledge-based view and the theory of social capital. In particular, innovations and incubators must be examined with regard to the digital economy [47]. A detailed analysis and presentation of the development of different kind of incubators during the New Economy and Web 2.0 phase is relevant for this scientific work [47]. Reference [48] examines the definition and aspects of innovation as regards the object of innovation and the degree of innovation. The degree of innovation is derived by means of the characterization possibilities based on the following three criteria: Innovation perspective, innovation dimension, and influence on existing skills [48]. Different organizational forms support the development of different types of product and business model innovations. Reference [2] focuses on the integrated, cooperative and autonomous organizational model for the implementation of innovations with regard to organizational design features, application conditions as well as effects and assigns them recommendations for action.

However, caution is required in the nomenclature: Terms such as innovation lab, incubator, accelerator, etc. are assigned to ambiguous definitions. For example, incubation programs, which primarily focus on intangible goods, are often referred to as accelerators [49]. Mentors provide knowledge in the area of corporate management in a time-limited and knowledge-based incubation program and provide contacts from networks that provide access to potential donors and partners [29] [49] [51].

Furthermore, the influence of disruptive innovation theory in building an incubator must be taken into account in the encounter of the Innovator's dilemma [5] [7] [10] [22]. In particular, personnel management, organizational culture, resource allocation and organizational structure play an important role in the successful exploitation of disruptive innovations [22]. Further success factors of incubators are high flexibility as well as a customized segmentation and individualization strategy [21]. Incubators are often understood as a reaction to the growing market dynamics and complexity. Reference [4] investigates specific advantages of corporate and open incubators and derives approximate recommendations for the operation of incubator.

III. MODEL OF INNOVATION TRANSFER FROM CORPORATE INCUBATORS

The described problem of integrating innovation from corporate incubator into the corporate is a major challenge for most of the innovative companies with corporate incubators. The authors therefore develop a model for a suitable innovation transfer between corporate incubator and corporate [19]. The aim is to increase the likelihood of a successful implementation of innovations from corporate incubator by giving companies the opportunity to identify potential design parameter for the

transfer process, adapted to a situation-specific context [19].

The model consist of six sub models which influence the transfer process. In this paper we will focus on the first sub model – the transfer object. The first step for a transfer process is to identify what is going to be transferred between two parties. In this case an innovation was developed within the corporate incubator and shall be transferred to the corporate. The extend of the innovation can differ in many ways, from knowledge, a technology up to a physical product and will not be further discussed in this paper.

Therefore the purpose of this paper is to identify the types of innovations that are developed within a corporate incubator and can be transferred into the corporate. Figure 1 shows the model of innovation transfer from corporate incubators.

IV. TRANSFER OBJECT

To identify what kind of transfer objects are transferred between corporate incubator and corporate, a detailed analysis of which types of innovation exists and which are developed within a corporate incubator takes place in the following chapter. The scientific approach thereby focuses on three research questions:

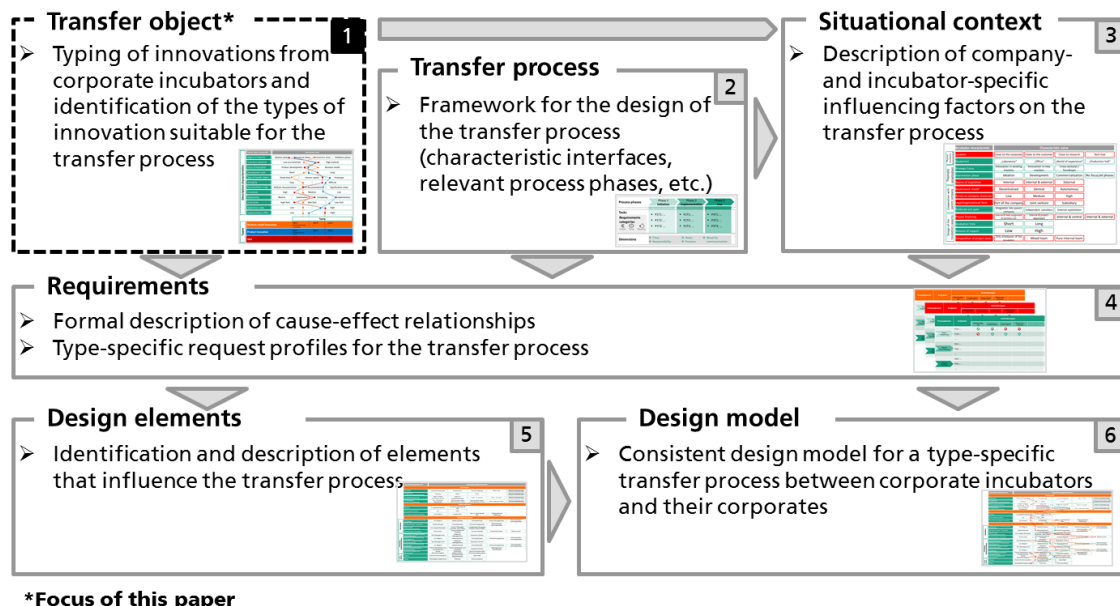
1. Which innovations are identified in the literature and how can these innovations be typed?
2. How can the identified types of innovation be allocated to various environments for innovation?
3. What are the different forms of corporate incubators and how can these forms be allocated to the innovation types identified?

A. Typing of Innovations

In a first step we identify what kind of innovation exist in total. Through literature review specific type forming factors for innovations were analyzed and evaluated. Thus an overall identification of 16 innovation types was done. In the following the identified type-describing characteristics are described in detail.

Types of Innovations

It is possible to distinguish innovations based on their dimension or scope [44]. The typing therefore takes place based on the two type-forming characteristics of scope and degree of innovation. A superordinate distinction is made according to the scope of innovations (Figure 3). In the literature these innovations are called the 4Ps: Product innovation, process innovation, position innovation, and paradigm innovation [44] [50]. Product, process, position, and business model innovation have generally distinctive characteristics [44]. The type-describing characteristics are then allocated to the four superior categories of product, process, position, and business model innovations [44].



Product innovations relate to the introduction of new products and services, or changes in existing products and services that offer advantages to the customer or meet needs of the market [50]. The introduction of a new device, a new method, a new tool or knowledge to manufacture a product or provide a service is described as a process innovation. By (re-) positioning a product or service in an industry, the context in which products and services are introduced shifts [50]. This is called a positioning innovation. A shift of long-term assumptions about the mode operandi of an industry is called business model innovation. A business model is the model-based description of a business that consists of three components: Value contribution, value-added architecture and profit model [54].

The second type-forming characteristic, the degree of innovation, is now used to create 16 innovation types (Figure 3). Product and process innovations are often distinguished in the literature because of the linkages within the innovation [40]. This means that architectural and modular innovations can only be clearly distinguished in the case of product and process innovations [48]. Position and business model innovations, on the other hand, cannot be distinguished based on internal links [48] [55]. In the following, they are distinguished based on the discontinuity from the customer's point of view and the discontinuity from the industry's point of view. The larger the structural breakup of innovation, the greater the discontinuity [55].

Product innovation	Process innovation	Position innovation	Business model innovation
Incremental product innovation	Incremental process innovation	Incremental position innovation	Incremental business model innovation
Modular product innovation	Modular process innovation	Industry Break-through-position innovation	Industry Break-through-business model innovation
Architectural product innovation	Architectural process innovation	Market Breakthrough-position innovation	Market Breakthrough-business model innovation
Radical product innovation	Radical process innovation	Radical position innovation	Radical business model innovation

Fig. 3 16 identified innovation types

For each of the 16 innovation types an example from real life can be derived. An example of a Market Breakthrough-position innovation is the repositioning of the Levi Strauss brand [55]. When Levi Strauss positioned itself as a fashion brand, this led to strong structural break-ups from the customer's point of view and weak structural break-ups from the industry's point of view [55].

Distinctive Characteristics

For a more detailed description of the types of innovation, the literature specifically identifies type-describing characteristics for each scope [53]. These characteristics are criteria which serve a further explanation of the two type-forming characteristics.

As an example of the scope "Business model innovation", the type-describing characteristic "Strength of the innovative effect" indicates the range of the business model innovation in the organization [48]. The characteristics "Micro level", "Meso level" and "Macro level" are characteristic values of the range in the organization [48].

The entire typology of the type-forming and type-describing characteristics of innovation is presented in the form of a morphological box (Figure 4).

Characteristic	Characteristic values to classify the findings								
Scope	Product innovation	Process innovation	Position innovation	Business model innovation					
Product innovation									
Degree of innovation	Incremental innovation	Modular innovation	Architectural innovation	Radical innovation					
Application level	Component level		Module level	System level					
Competitive situation	Pacemaker technology		Key technology	Basic technology					
Degree of maturity	TRL1	TRL2	TRL3	TRL4	TRL5	TRL6	TRL7	TRL8	TRL9
Disruption	Supporting innovation			Disruptive innovation					
Process innovation									
Degree of innovation	Incremental innovation	Modular innovation	Architectural innovation	Radical innovation					
Field of knowledge	Organizational innovation		Marketing innovation	Technological innovation					
Organization level	Minor improvements	Improvements of subprocesses	Redesign of processes	Redesign of a business area	Redesign of the value chain				
Disruption	Supporting innovation			Disruptive innovation					
Position innovation									
Degree of innovation	Incremental innovation	Industry breakthrough	Market breakthrough	Radical innovation					
Direction of positioning	Addressing an underserved market	Shift to the mass market	Creation of a new market	Online distribution					
Impulses for innovation	Market pull		Technology push	Anticipation					
Disruption	Supporting innovation			Disruptive innovation					
Business model innovation									
Degree of innovation	Incremental innovation	Industry breakthrough	Market breakthrough	Radical innovation					
Strength of the innovative effect	Micro level		Meso level	Macro level					
Direction	Economic		Operational	Strategic					
Development trend	Value innovation	Architectonic modification	Coordination mechanism	Profit model innovation					
Disruption	Supporting innovation			Disruptive innovation					

Fig. 4 Typology of innovations

B. Allocation to Environments of Innovation

In the following, the types of innovation identified are allocated to environments for innovation. In addition to the conventional R&D department of a company, incubators and innovation ecosystems are also considered as environments for innovation. Incubators are decentralized organizational units that promote the generation and development of radical and disruptive innovations by providing them with a separate development path [12] [42]. Innovation ecosystems are understood as cooperation between companies in order to drive innovation together [56] [57].

At first, the 16 types of innovation were put within a matrix of four innovation groups. This simplification makes it possible to derive more clear statements. In addition to incremental and radical innovations as extremes of the degree of innovation, disruptive innovations and game changers (as disruptive innovations with a high technological demand) are distinct groups of innovations.

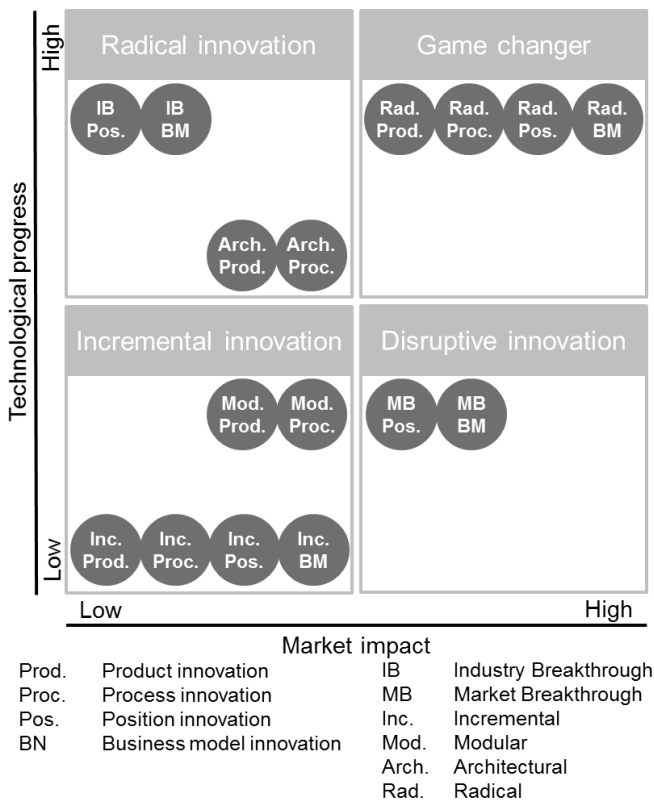


Fig. 5 Allocation of innovation types to innovation groups

After that innovation drivers were derived through a literature study and through an assessment of project experiences from the Fraunhofer IPT, the eight most powerful were selected. Innovation drivers are factors that influence the innovativeness of an organization, such as capital, creativity or image.

On basis of these eight drivers, we first examined how demanding the respective groups of innovations are for innovation drivers (Figure 6, left). For example to develop disruptive innovation in a first stage a lot of creativity or good market access is needed, however a lot of capital is not that important. Subsequently, the different environments were evaluated for their provision of the innovation drivers (Figure 6, right). Conventional R&D for example is normally equipped with great infrastructure however does not employ the highly motivated and creatively employees.

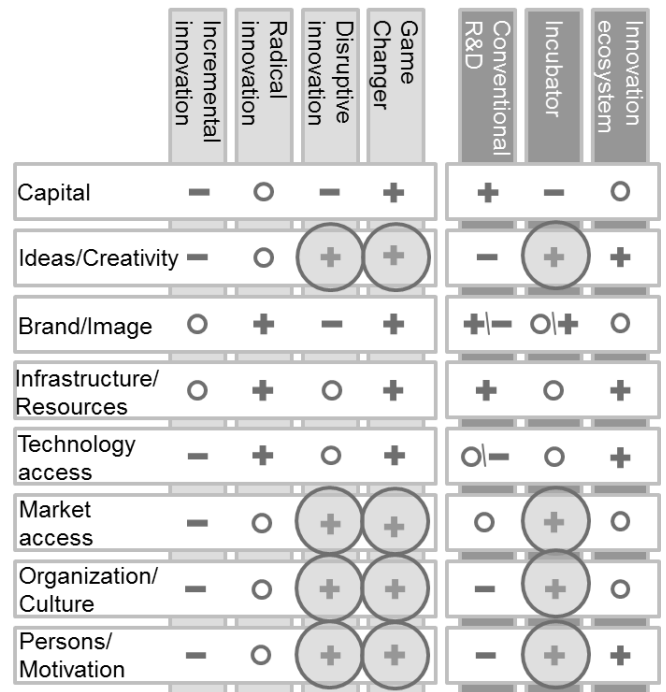


Fig. 6 Allocation of innovation groups to innovation environment

Through a comparison of the results of the needed as well as the provided innovation drivers, an allocation of the innovation groups to the innovation environment was made. Due to their high intense of creativity, good market access, a lean organization and motivated employees, incubators are highly suitable for disruptive innovation and game changer. Incremental innovations put not much requirements on the innovation process and therefore fit best into the conventional R&D. Radical innovation however need a lot of technology access and infrastructure which is best delivered by an innovation ecosystem.

Transferring this result to figure 5, a detailed allocation of the innovation types to the innovation environments can be made. Incubators are therefore highly recommended for 6 innovation types: Radical product, process, position, business model innovations as well as Market Breakthrough-position and Market Breakthrough-business model innovations.

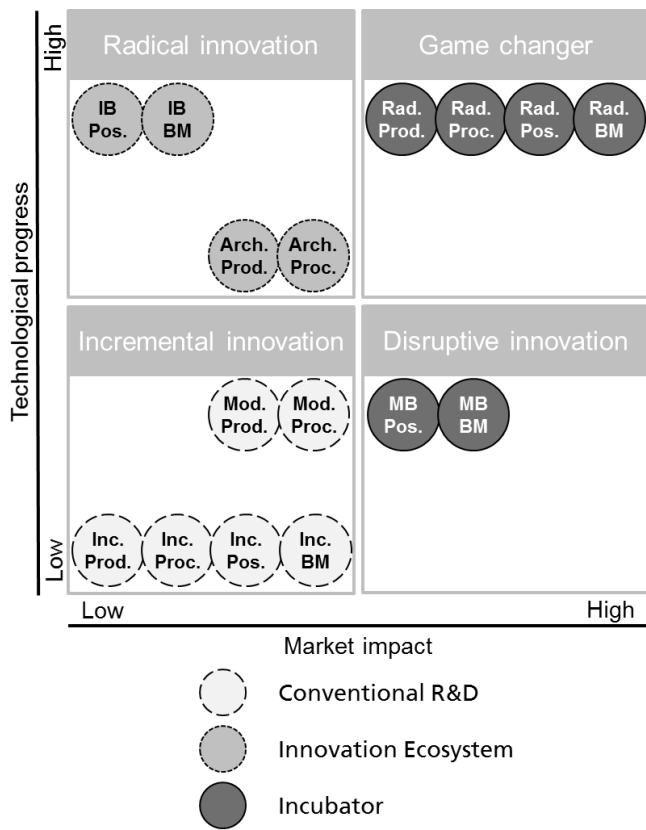


Fig. 7 Allocation of innovation types to innovation environment

C. Allocation to Corporate Incubators

Due to the fact that corporate incubator is a modern hype, there is no exclusive definition of what is a corporate incubator. In praxis we actually find a lot of different types of corporate incubators.

Through a detailed study of different existing corporate incubators 5 simplified types of corporate incubators were discovered. Among corporate incubators, a distinction can be made between Startup-, University-Outpost-, Intrapreneur-, Diversification- or Megatrend-Incubator. Startup incubators attract and collaborate with external entrepreneurs (Startups) using venturing and open innovation. They provide assistance for organizational support and access to a wide competence network. Often these are company-supported programs with limited duration [20] [58]. University incubators boost innovation through cooperation with research institutes. They are characterized by the proximity to a university and thus gain a favorable access to the environment, the competencies and employees of the university [20] [58]. Intrapreneurship incubators boost innovation through driving entrepreneurial thinking and culture within internal corporate employees. Diversification incubators use new business models or organizational structure to address new markets. The focus is on the acquisition and application of market knowledge outside the core competences [9]. Megatrend incubators on the other hand tackle a strategic topic, mainly focused on a technological competence for e.g. digitization [58].

Subsequently, we have allocated these forms of corporate incubators to the six types of innovation recommended for incubators by investigating characteristic properties of the type of corporate incubator as well as the type of innovation (Figure 8).

In the following, the allocation of radical product or process innovations to University-Incubators is presented as an example: University incubators offer great technological knowhow and access to expensive resources, radical product or process innovations on the other hand are research-intensive projects. Due to the proximity to the environment of a university as well as the technological background, company-supported university incubators are suitable for technologically sophisticated product and process innovations [15].

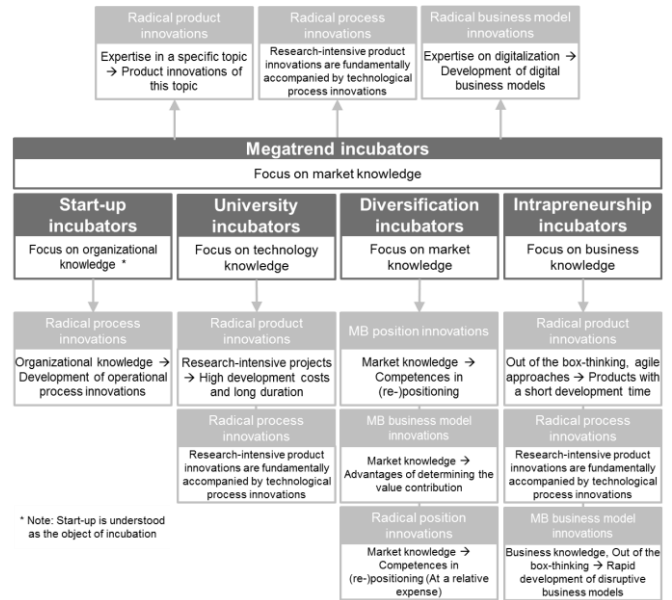


Fig. 8 Allocation of innovation types to types of incubators

V. RESULT

For the model of innovation transfer from corporate incubators it is important to know what kind of innovations are developed within a corporate incubator and usually transferred to corporate. With this paper a first step of identifying innovations within a corporate incubator was done. At first different types of innovations were identified. Through a literature study, a progressive typing of innovations was carried out. In addition to the two type-forming characteristics, the scope as well as the degree of innovation, which are constitutive for the existence of an innovation type, type-describing characteristics were specifically determined for each scope. The combination of the two type-forming characteristics, each with four characteristic values, resulted in 16 types of innovation. These 16 types were then described through three to four type-describing characteristics. Due to the allocation of the 16 innovation types to innovation groups as well as a comparison of specific characteristics of innovation environments an allocation of the innovation types to the three innovation environments, conventional R&D, incubators and innovation ecosystem was made. For the model of innovation transfer 6 innovation types could be identified which are suitable for the development within corporate incubators.

Subsequently, various forms of corporate incubators were identified and an in-depth allocation of the 6 innovation types to the specific corporate incubators took place.

With this paper it was therefore possible to identify types of innovations within a specific corporate incubator. If these innovations are transferred from the corporate incubator to the corporate they become the transfer object.

A. Future research needs

To establish a complete model of innovation transfer from corporate incubator to a corporate, further research is needed. In this paper we identified which innovations are developed within a corporate incubator. For the transfer process the next step is to identify how these 6 types of innovations in corporate incubators are normally exploited and which are transferred into a corporate.

When investigating the transfer object in form of innovations from corporate incubators, the investigation of the transfer process of these innovations must also be mentioned. To this end, specific process phases must first be derived. Process parameters for the transfer process are allocated to these process phases.

For the situation-specific and company-specific design of the transfer of innovations from corporate incubators, it is necessary to identify characteristics of the company and its environment which influence the transfer process. The objective is to determine a suitable number of characteristics which have a specific influence on the transfer process and allow a valid statement in this regard.

The existing findings are incorporated into the work package requirements. The indicators determined shall be translated into the tasks of the transfer process in type-based requirement profiles.

The objective of the subsequent work package design elements is to describe transfer elements and design elements for the design of the transfer process and to evaluate their fulfilment requirements.

The final design model consists of a combination logic that develops meaningful combinations of the different design elements. This combination logic is used to develop the final configuration model. Finally, a validation of the model is necessary, which proves the practical applicability.

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