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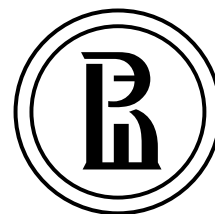
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Spin-off design as an organizational practice: A methodological approach

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Abstract

Marketing the results of research carried out within publicly funded scientific institutions (universities, laboratories, research centers, etc.) is widely considered by decision-makers as a sustainable base for developing and stimulating business growth. Experience shows that small, innovative enterprises split off from big industries or academic bodies are the element that links together research and the business environment; their creation process represents a perfect field for applying the Enterprise Engineering apparatus. Such enterprises can assume the risk of transforming an entrepreneurial idea into industrial prototypes without which it is impossible to evaluate the commercial potential of research results. This mechanism is implemented via spin-off companies.

This paper focuses its analysis on the creation of academic spin-offs as one of the most widespread ways to bring research results to the market place, and also represents a powerful instrument of their internationalization strategy for universities. The main aim of the work is to identify the main elements raised by the creation of such companies, from the point of view of both public and academic authorities. The article proposes to consider key properties of university and industrial spin-offs as business units with flexible organizational form in tight connection with the formal modeling approach of the Enterprise Ontology and DEMO methodology, which are based on the Language–Action Perspective. For the analysis, the authors apply the concept of the transactions mechanism and a particular enterprise design methodology. As a result of the research, the paper proposes the main elements of a spin-off reference model constructed using the DEMO methodology means and it describes future directions of this work.

Key words: flexible organizational forms, collaborative strategy, transaction costs theory, spin-off, technology transfer, DEMO methodology, Language–Action Perspective.

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Introduction

In the midst of the world economic crisis, one of the challenges frequently encountered by enterprises is cost reduction and, hence, the need for optimized organizational structures making businesses flexible. By flexibility we understand the capability of the enterprise to adapt rapidly their organizational structures to external or internal environmental changes. Consequently, the organizational structure itself must have suitable adaptation characteristics.

The present article details the methods of selecting suitable organization forms, and offers new principles of combining transaction costs theory and modern methods of business modeling based on the language action perspective. In particular, this paper addresses a research question about the applicability of Design and Engineering for Modern Organizations (DEMO) methodology [1] and we demonstrate that transaction analysis is the basis for decision support in DEMO applied to spin-off organizational choices.

The paper is structured as follows: after the introduction, part 1 analyzes the theoretical basis of organizational structure choice – the transactional costs. Part 2 provides a description of industrial and university spin-offs as a widespread flexible organizational form and introduces the DEMO methodology. Part 3 describes and provides new results linked to the choice of spin-offs' problem areas to which the DEMO can be applied. Part 4 formulates questions for future research and concludes the paper.

1. The transactional approach and its influence on organizational structures

Transaction analysis [2–8] may lead to the adoption of quite different organizational solutions. One is represented by spin-offs, which are referred to as flexible structures because they can rapidly redesign their organizational aspect as a response to changes in the external environment. In addition, organizational restructuring has a large social aspect. Therefore, the communication paradigms, patterns and policies used should be presented for decision makers explicitly during that process [9].

In studies influenced by the institutional theory, collaborations and networks encompass a broad range of inter-organizational relationships. Some authors [3, 10] have argued that institutions supply rules and resources upon which collaboration is built. Thus, to fully understand and explore the dynamics of different types of collaboration, alliances and networks, it is crucial to examine the institutionalized patterns of rules and routines,

emphasizing the objective and the external aspects of the institutional environment.

The characteristics of the national innovation system of many European countries explain the serious impact of the economic crisis on innovation [11, 12]. Policy responses were concerned with supporting innovation systems and developing innovation capacity, such as improving infrastructure, public investments in R&D and innovation, investment in education and training at all levels, as well as demand-oriented innovation policies, including public procurement, financial support to SMEs, venture capital and, an important factor, policies aimed at the development of enterprise agglomerations. They are seen as part of the national strategy for coping with the effect of the financial crisis in many countries, partly because the industries involved in such programs represent industries oriented towards global markets that were most affected by the crisis.

International experience shows that it is small, innovative enterprises splitting off from big industry or from a university that represent the element linking together research and the business environment. Such a setting demonstrates that spin-offs serve as a perfect application field for the Enterprise Engineering apparatus [1, 13]. They can assume the risk of transforming a business idea into the introduction of industrial prototypes without which it is impossible to evaluate how promising the research idea will be on the market and whether it is worth commercial realization. This mechanism is implemented via spin-off companies.

2. Spin-off as a flexible organizational form: Mechanisms of functioning and international experience

Business forms like spin-offs offer various advantages. First of all, the strong socio-cultural link to a limited area promotes rapid circulation of ideas and an easy interaction between individuals who share a certain “cultural zone”. It is based not only on the sharing of technical and production skills conveyed also through specific channels of training, but it includes as well a high entrepreneurial culture and better identification of the values and mutual interests of partners.

A second growth factor is the existence of a systemic approach in inter-business relations, that all the mentioned forms present, according to the logic of flexible specialization. The split nature of organizational structures often comes not from specific design patterns guided by a chief manager or head enterprises, but as a spontaneous response to the competitive environment.

Thus, one ensures the possibility of replacing a company with others which are able to perform the same activities along the production process. At the same time, there is a remarkable stability of relationships, often based on a relationship of mutual trust which can facilitate the search for forms of coordination that increase the overall efficiency of the business scheme [4, 14].

Universities and other research institutions have always given more emphasis to technology transfer mechanisms to establish cooperation between university research and industry. Although very different in terms of methods and purposes, these alliances have often proved a success for both industry, which gains in competitiveness and technological advancement, and the university, which has the ability to use the abundant intellectual property available to it to finance its research and train its students by making them more competitive and prepared for the industrial world.

Spin-offs are exceptionally important in the topic of academic entrepreneurship. Spin-offs are more likely to develop basic research technologies that are not favored by established companies due to its lower profitability or which lack a readily available market. Through spin-offs, the gap between university research and industrial commercialization may be reduced. Furthermore, spin-offs also bring social and economic advantages, including employment creation, especially for highly-educated graduates and they strengthen the local economy.

Thus, spin-off means the creation of a new business unit by people who abandon their previous activity carried out within an already existing company or other institution (e.g. universities, research laboratories, etc.).

There are two aspects that characterize a spin-off:

- ◆ support for the founders of the new enterprise;
- ◆ the process by which a spin-off is created.

So, the essence of a spin-off is to help an aspiring entrepreneur to transform an idea, a potentiality, a production, technological or market opportunity that someone else does not want or cannot use in commercial terms into a new company.

The spin-off typology includes two different types:

- ◇ industrial spin-off;
- ◇ university spin-off (USO).

The first type is an enterprise generated from a pre-existing one; as distinct from the USO which constitutes the subject matter of the present analysis and is an enterprise established by a group of researchers, professors or PhD students. An USO is a start-up company formed on the basis of the formal transfer of intellectual proper-

ty rights from the university, and in which the university holds an equity stake [15, 16].

Thus, USOs can strengthen the relationships between universities and companies to improve knowledge transfer and achieve competitive advantages.

In France, Mustar [17] analyzed 200 cases of USOs and highlighted how the success of those companies depended on their ability to establish links with a variety of participants (research lab, clients, other companies and financial institutions). In Sweden or in Scotland [18], USOs are small companies, with only a few of them showing relative growth prospects. The most relevant USO cases originated in the USA [19, 20].

Universities in the USA are more structured and organized to create new companies. Therefore, researchers, PhD students and professors who want to improve commercial activity based on their research results can count on incubators, science parks, etc. In Italy, USOs are often rapidly growing small companies with not many employees.

The first category relates to the structure of USOs. USOs are often small because the proponents do not really analyze and define the relationship between the participants who will operate in the company. This implies an unclear definition of roles and lack of responsibility, which may give rise to problems, particularly when it comes to clients or trying to obtain financing. Furthermore, founding a university spin-off is a dynamic process developed in a highly complex environment. It involves numerous interactions within the university and with the external environment which may be subtle enough to be easily pointed out. Time lag may also occur between action and result, adding complexity to the process, especially regarding consequences of one policy. These problems can be successfully solved by applying Enterprise Engineering mechanisms, in particular, the DEMO methodology (part 3 of the present contribution).

Before analyzing the USOs' process, we need to describe the steps that a USO idea has to take in order to be approved (Italian experience [21–23]).

In the preliminary phase we can find three different promoters:

- USOs' Academic Commission;
- Academic Board of Governors;
- Academic Senate.

First of all, the Commission analyzes and selects all the USO proposals in order to determine which one could become a company, and whether the university will have an equity stake therein.

Second, the Commission submits all ideas that completed the first step to both the Academic Board and the Academic Senate. They will finally approve only the most interesting ideas and enter these in the USO register. Lastly, the university prepares an academic convention with the approved USOs in which it regulates all details of the partnership, as well as the possibility for the USO's members to use the university's brand.

Hence, the USO's process comprises three phases:

- ◆ pre-incubation phase;
- ◆ incubation phase;
- ◆ post-incubation phase.

During the pre-incubation phase, the focus is on organizing support activities and on all fundamental information required for the development of an action plan.

The incubation phase is the central step of the process and the most important one. In this phase the staff develops their activities based on the business plan, and the link between the USO and the university becomes strategic. Finally, in the post-incubation phase, the USO is ready to start its activities and to sell goods and services.

The most essential step is the central one because it involves business plan development. In this way, USOs can strengthen the relationships between universities and companies to improve knowledge transfer and achieve competitive advantages.

In Europe, attention given to this type of technology transfer is evident both in regional politics, that perceive USOs as an important mechanism of development of university-industry relations and creation of jobs and wealth, and in academic circles whose aim is to obtain the best results out of university research [12].

The significant increase we have witnessed in recent years in these realities is primarily due to the new role that universities are taking in the commercialization of their research activities or, in other words, to their new, more entrepreneurial approach.

Secondly, it is linked to the lack of stable tenured positions in universities, a factor that pushes researchers-entrepreneurs to expand their possible range of activities beyond the mere academic role. Finally, it is important to stress that the increasing autonomy of universities will enable them to decide freely whether to endorse and support the development of USOs [24].

3. Spin-off design: A methodological proposal on the DEMO base

We wish to study the phenomenon of spin-off from the enterprise engineering point of view and here the

DEMO (Design & Engineering Methodology for Organizations) represents a valid support. It is a methodology for the design, engineering, and implementation of organizations and networks of organizations. Entering into commitments and complying with them is the operational principle for each organization. These commitments are established in the communication between social individuals, i.e. human beings [1, 4, 25, 26].

Thus, as was mentioned before, in the case of creating a university spin-off the main actors are USO's Academic Commission, Academic Board of Governors and Academic Senate. Basic transactions can be composed to account for complex transactions. The DEMO methodology gives the analyst an understanding of the business processes of the organization, as well as the agents involved. Analysis of models built on the methodology of DEMO allows the company to obtain detailed understanding of the processes of governance and cooperation and serves as a basis for business reengineering and information infrastructure development consistent with business requirements. *Figure 1* demonstrates a basic pattern of transaction as a single communication act between different actors.

In this figure "rq", "pm", "st" and "ac" mean different coordination acts and facts of a single transaction "request", "promise", "state" and "accept" while the grey box and diamond represent a production act and fact. The transaction itself evolves in three phases: the order phase (O-phase), the execution phase (E-phase), and the result phase (R-phase).

Another element useful to apply the DEMO methodology is the Transaction Result Table (*Table 1*).

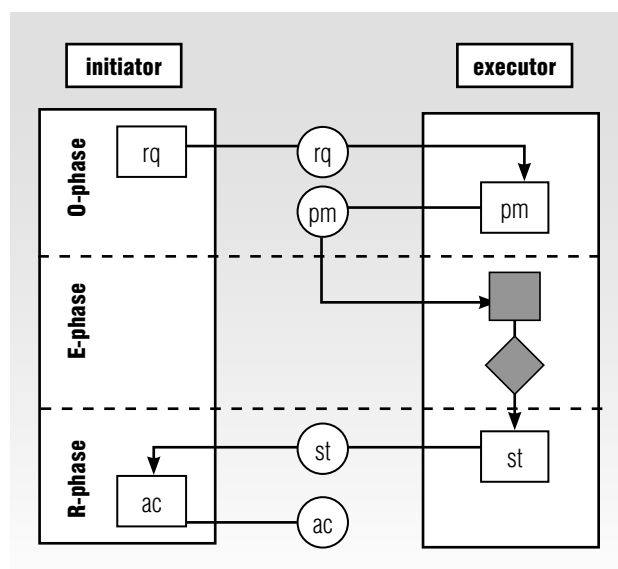


Fig. 1. The basic pattern of a transaction adopted from [1]

Table 1.

The Transaction Result Table of university spin-off creation

Transaction type	Result type
T01 USO's proposal registration	USO's registration has been started
T02 USO's approval	USO has been approved
T03 USO's start	USO has been started

All elements listed above represent a base for ontological model creation using the DEMO methodology. It consists of four following models:

1. the Construction Model (CM) which specifies the identified transaction types and the associated actor roles, as well as the information links between the actor roles and the information banks;
2. the Process Model (PM) which contains, for every transaction type in the CM, the specific transaction pattern of the transaction type;
3. the Action Model (AM) which specifies the action rules that serve as guidelines for the actors in dealing with their agenda;
4. the State Model (SM) specifies the object classes and fact types, the result types, and the ontological co-existence rules [1].

Below we present one element of the Construction model, the Actor–Transaction Diagram. It expresses the main initiators and executors (CA) of the transactions individuated in the Transaction Result Table (Figure 2).

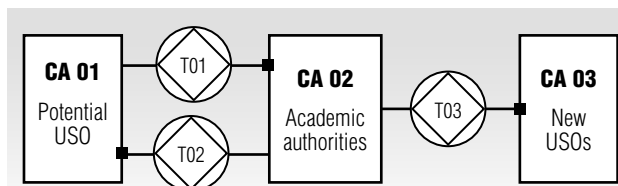


Fig. 2. Actor–Transaction Diagram

Such a setting has its practical applications. In the University of Tuscia in Viterbo, the process of creating spin-offs started thanks to a project carried out in cooperation with the local Chamber of Commerce and aimed at stimulating the creation of new companies capable of performing the entire cycle of activities: from carrying on research up to marketing and selling the results [23]. This project led to creation of university spin-offs in various business sectors like forestry and agro-environmental inventory (BioforItaly Ltd.), renewable energy and biomass (Sea Tuscia Ltd.), paper production (Tusciazyme Ltd.), consultancy services for archives management and organization (Tecnelab Ltd.) and others.

All these initiatives followed in the preliminary phase the scheme described above and the same actors were involved. From this point of view, the ontological approach expressed by means of DEMO methodology [1] represents a conceptual model that only shows the essence of an enterprise or a business process and is coherent (it constitutes a logical and truly integral whole), comprehensive (all relevant issues are covered), consistent (the aspect models are free from contradictions or irregularities) and concise (no superfluous matters are contained in it). These properties allow it to reduce the design costs and can be applied to the modelling of spin-off activity in its operative phase as well.

Thus, analysis of DEMO models provides decision makers with particular means of organizational transformations and the best strategy of splitting enterprises. Such choice unavoidably deals with information systems management and from such positions the use of the DEMO methodology for both enterprise structure modeling and individuation of the most suitable information system use is quite advantageous. DEMO is easily reproducible, and it can be applied regardless of the business segment of the enterprise, all of which is extremely important in the case of university spin-offs operating, as we've seen in the University of Tuscia case, in very different fields. In addition, the majority of SMEs adopt advanced information technologies such as electronic data interchange (EDI), enterprise resource planning (ERP) and e-commerce with the objective of improving their own supply chain efficiency first and then the supply chain of their partners.

Conclusion

Market and learning-oriented SMEs (like USOs, the subject of the present work) under strong competitive conditions tend to be more innovative both in management and organizational techniques. Progressing in information technologies and information systems, entrepreneurs and academic authorities are interested in developing a virtual enterprise with suitable strategic alliances that are based on research competencies.

We have demonstrated how DEMO transactions facilitate comprehensive analysis of different weak points of processes and, hence, the possibility to apply it to spin-offs. In comparison with other prevalent qualitative approaches like the Delphi method, panels or expert evaluation which have as their main weakness subjectivity, our proposal uses quantitative metrics to evaluate enterprise restructuring and future operational costs. This leads to better understanding by enterprise stakeholders and more accurate and objective planning of changes.

Our analysis delivers the main elements for a reference model of creating spin-offs. This technique may be applied both to industrial and academic spin-offs and the direction of future research may be found in the specifications of actor roles and transactions specific for each

type of spin-off. In this way, the DEMO methodology could cover the entire field of spin-off analysis. In addition, from the economic point of view the described solution provides an opportunity for the most efficient control of organizational costs. ■

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Проектирование спин-оффов как организационная практика: Методологический подход

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Аннотация

Проблема коммерциализации результатов научных исследований, реализованных в общественных исследовательских институтах (университетах, лабораториях, исследовательских центрах и т.д.), широко признана лицами, принимающими решения, как устойчивая база для развития и стимулирования роста бизнеса. Практика показывает, что малые инновационные предприятия, отделяющиеся от крупных компаний или академических учреждений, являются связующим элементом между научными исследованиями и бизнес-средой, а процесс их создания представляет собой идеальное поле для применения аппарата инженерии предприятий. Такие предприятия могут принимать на себя риск преобразования предпринимательской идеи в промышленные прототипы, без которых невозможно оценить коммерческий потенциал результатов научных исследований. Этот механизм реализуется с помощью создания спин-оффов.

В настоящей статье анализируется создание академических спин-оффов как одного из наиболее распространенных способов размещения на рынке результатов научных исследований, также представляющего собой мощный инструмент интернационализации университетов. Главной целью работы является определение основных элементов, возникающих при создании таких компаний, с точки зрения как общественных, так и академических органов управления. В статье рассматриваются ключевые свойства академических и промышленных спин-оффов как бизнес-единиц с гибкой организационной формой, в тесной связи с формальным подходом моделирования онтологии предприятия и методологии DEMO, которые основаны на перспективе «язык–действие». Для анализа авторы прибегают к концепции транзакционного механизма и особой методологии проектирования. В качестве результата исследования предлагаются основные элементы построения референтной модели спин-оффа с использованием методологии DEMO, а также описываются направления дальнейшей работы.

Ключевые слова: гибкие организационные формы, стратегия сотрудничества, теория транзакционных издержек, спин-офф, технологический трансфер, методология DEMO, перспектива «язык–действие».

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