



Paper to be presented at
the DRUID16 20th Anniversary Conference
Copenhagen, June 13-15, 2016

How to achieve organizational ambidexterity? Be fractal and dynamic

Lesya Dymyd
Universite de Strasbourg
Bureau d'Economie Theorique et Appliquee (BETA)
lesya.dymyd@gmail.com

Patrick Llerena
University of Strasbourg
Bureau d'Economie Theorique et Appliquee (BETA)
pllerena@unistra.fr

Abstract

The ability to combine exploration and exploitation is a critical factor for organizational sustainability and long term survival. For the large number of companies, achieving ambidexterity is a desired, but a highly challenging process. Many of them fail to compete for both agendas simultaneously. Our paper supports the idea that the main reason to the difficulties is the multidimensional perspective of exploration and exploitation and the inability of large firms to implement a fractal and dynamic ambidexterity. By crossing several levels of analysis, our research shows that ambidexterity can emerge simultaneously at the diverse organizational levels. Activities can take different forms and change their composition over time. To achieve the balance and to sustain it in the long term, an organization needs to adopt a fractal and dynamic ambidexterity, which is a solution to set the appropriate proportions of exploration and exploitation simultaneously at multiple organizational levels and be able to re-consider them overtime to meet the change.

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ABSTRACT

The ability to combine exploration and exploitation is a critical factor for organizational sustainability and long term survival. For the large number of companies, achieving ambidexterity is a desired, but a highly challenging process. Many of them fail to compete for both agendas simultaneously. Our paper supports the idea that the main reason to the difficulties is the multidimensional perspective of exploration and exploitation and the inability of large firms to implement a fractal and dynamic ambidexterity. By crossing several levels of analysis, our research shows that ambidexterity can emerge simultaneously at the diverse organizational levels. Activities can take different forms and change their composition over time. To achieve the balance and to sustain it in the long term, an organization needs to adopt a fractal and dynamic ambidexterity, which is a solution to set the appropriate proportions of exploration and exploitation simultaneously at multiple organizational levels and be able to re-consider them overtime to meet the change.

Key words: fractal and dynamic ambidexterity, structural separation, multiple levels

INTRODUCTION

Ambidexterity is defined as the organizational ability to pursue simultaneously the activities of exploration and exploitation. Ambidextrous companies are companies that have the ability to be both effective and innovative combining exploitation and exploration. Exploitation is necessary for short term efficiency and deals with the improvement and refinement of the existing knowledge, competences and technologies, etc. Exploration, in contrast, aims to create value in the long term and is based on the research, experiment and creation of new knowledge and skills.

The conventional wisdom is that a successful organization, that wants to sustain and survive in the long term, needs to pursue both activities. But because of the contrasting and even, contradictory and competing characteristics, the activities have difficulties to co-exist in an organization. For ambidextrous organizations, that want to be sustainably innovative, the main question is how to co-organize and manage exploration and exploitation in the long term?

To achieve ambidexterity, an organization can apply sequential, structural and contextual modes. The sequential ambidexterity is characterized by the switching periods between exploration and exploitation, depending on the organizational focus and industry needs. Unlike the sequential type, structural ambidexterity, proposes to address both activities in a simultaneous fashion by separating them in different business structures. Contextual approach makes the emphasis on a specific organizational context, where individuals can make their own decision on how to allocate time and resources between exploration and exploitation.

These are the different forms of organizational ambidexterity. The difference lies in the multiple organizational capabilities that can be used to achieve the balance. Particularly, in the sequential and structural approaches, ambidexterity can be achieved by means of

different combinations of structural elements in space and in time. In contextual type, ambidexterity is a matter of choices and decisions of the individuals.

Regardless of the applied types of organizational capabilities, the described modes of ambidexterity have a common objective - to perform both exploration and exploitation, which are the essential activities for the long term organizational survival. Although we still do not know which option is the optimal one, it is clear that to achieve ambidexterity, an organization will search for the means to combine and to co-organize both activities in a specific context. The critical question is how to co-organize them and sustain the synergies between the two activities with contrasting logics.

Existing literature defines exploration and exploitation as rival activities. They have contradictory nature and compete for limited organizational resources (Levinthal & March, 1993; March, 1991). At the same time, exploration and exploitation are not the self-exclusive activities, but more likely to be complementary to each other (Chen & Katila, 2008). Their mutual presence would be essential for an organization that wants to survive and to sustain in a long-term (March, 1991; Michael L. Tushman & O'Reilly, 1996).

Ambidexterity cannot only be achieved at the corporate level (e.g. by structural separation or shifting periods) and at the individual level (by creating of an organizational context), but it is more likely to have a multidimensional perspective. Studies shows that ambidexterity can emerge in projects (Liu & Leitner, 2012; Liu, Wang, & Sheng, 2012), in communities (Cohendet & Llerena, 2003; Cohendet, Llerena, Simon, & others, 2012; Cohendet & Simon, 2007) and at the leadership level (Cohendet, Llerena, & Marengo, 2000; O'Reilly & Tushman, 2004; M. L. Tushman, Smith, & Binns, 2011). In fact, ambidexterity can take multiple forms and formats and emerge at multiple organizational levels. Hence, our main assumption is that exploration and exploitation have the ability to be replicated simultaneously at different levels of a company.

In our paper we describe fractal and dynamic characteristics of organizational ambidexterity. We argue that exploration and exploitation can emerge simultaneously in the organization at its diverse levels and have different degrees of intensity. To balance exploration and exploitation over time, an ambidextrous organization should define the appropriate proportions of activities at each of the multiple levels.

To discuss the concept of fractal and dynamic ambidexterity, we use the following structure. First, we review the existing literature and theoretical background on exploration, exploitation and ambidexterity. Second, we present our research method, called the “multilayer methodology” that crosses different levels of analysis and applies it to the case of an ambidextrous company. Third, we show the activities at different levels, interpret the results, draw the conclusions and define further research directions.

THE EMERGENCE OF THE THEORY ON FRACTAL AMBIDEXTERITY

To understand whether an organization can co-organize exploration and exploitation and to sustain the balance between them, we suggest to start from reviewing the essence of these activities. Organizational learning literature defines *exploration* as research, experimentation discovery and innovation; *exploitation*, in contrast, as activities of refinement, selection, production and efficiency (March, 1991, p. 71). The activities have different objectives. The goal of exploration is “experimentation with new alternatives” (p. 85) by taking risk, dealing with uncertainty and expecting returns in the distant future. The goal of exploitation is “refinement of existing competencies” (p. 85) by making a selection of the best possible option and performing its effective execution.

Exploration and exploitation are driven by contrasting logics, aim for distinct targets and differs in returns. They operate in different environments, use diverse search spaces and apply various processes to achieve the goals. Moreover, these activities are often in

competition for the scarce organizational resources such as funding, people and time. The primary task of organizations and their managers is to optimize the allocation of resources between both activities.

We argue that with all the contrasts and shades, exploration and exploitation are complementary and even, *continuing* organizational activities. The reasoning behind the argument is the following. First, as there is no exact definition, it is hard to define what exactly is exploration and exploitation. In different contexts the activities can take different forms. Second, if there is no such clarity, it is impossible to define the borders and scopes of the activities. Finally, as there is no pure form of exploration nor exploitation (Nonaka et al., 2014), it is hard to specify the exact results from these activities. It is particularly hard to predict the distant returns from exploration.

We argue that exploration and exploitation are coupled and continuing activities. As there is no clarity in the concept of the ambidextrous organizations, the essence of the organizational balance can be explained by the theory of knowledge creation. In the recent study, Nonaka et al., (2014, p. 139) suggest that exploration and exploitation “interact in spiraling continuity” and separation between them is “merely artificial”. Companies cannot do either exploration or exploitation, but they will “inevitably always do both at the same time” (p. 139). This process is complex because combinations of activities occur at all levels and in different periods of time. The difference lies in the degree of the intensity of exploration and exploitation in a specific context.

Our research proposes that ambidexterity is fractal and dynamic. Exploration and exploitation can emerge and replicate at multiple organizational levels, e.g. whole company, a business unit, a team or a group and at the individual level. The replication process is justified by the knowledge creation theory. In ambidextrous organizations, innovation is the result of synergies between exploration and exploitation that occur at diverse levels simultaneously.

Multidimensional perspective of ambidexterity

The evidence that exploration and exploitation can emerge at different levels and in different periods of time is found in the existing literature. Scholars in organizational and management studies describe ambidexterity at the corporate (organizational) level (e.g. (Boumgarden, Nickerson, & Zenger, 2012; Boumgarden et al., 2012; Michael L. Tushman & O'Reilly, 1996) individual (Gibson & Birkinshaw, 2004), managerial (leadership) level (Cohendet et al., 2000; M. L. Tushman et al., 2011) in projects (Liu & Leitner, 2012; Liu et al., 2012) and in communities (Cohendet et al., 2012; Cohendet & Simon, 2007).

In particular, at the *corporate level* ambidexterity can take a form of the sequential or structural solution. In sequential mode, the activities can be co-organized by means of shifting periods of exploration and exploitation (Boumgarden et al., 2012; R. A. Burgelman, 2002; Chen & Katila, 2008). Another stream of literature argues that ambidexterity needs simultaneity of activities and proposes the structural separation. (O'Reilly & Tushman, 2004; Michael L. Tushman & O'Reilly, 2002). By performing activities in separate business units, a company can exploit existing capabilities and at the same time explore new domains. Studies show that for the research and experimentation (exploration) the appropriate structure is young entrepreneurial unit; whereas production and execution (exploitation) should be devoted to the old efficient entities (see Michael L. Tushman & O'Reilly, 2002).

The critics of ambidexterity at the corporate level can be found in the concept of contextual ambidexterity. Scholars argue that exploration and exploitation are so dramatically different activities, that they cannot exist together neither in one, nor in similar structures (Birkinshaw & Gibson, 2004). As an alternative solution, they propose to achieve ambidexterity at the *individual level*. By using a contextual mode, an organization creates a specific context where individuals can make their decisions on allocation of time and resources between exploration and exploitation (Gibson & Birkinshaw, 2004).

Although the debates on the temporal or simultaneous types of exploration and exploitation are still open, scholars continue to expand beyond the existing knowledge and propose that ambidexterity can also emerge at the leadership and the *executive level* (e.g. (Cohendet et al., 2000; M. L. Tushman et al., 2011). The ambidextrous leaders have the ability to cope with the exploration-exploitation tensions and solve the conflicts at the higher levels of a company (M. L. Tushman et al., 2011). Scholars propose that not only managers at the executive positions (e.g. CEO) should be ambidextrous, but also those, who hold the senior management roles. Ambidextrous senior managers should combine executive and entrepreneurial thinking and search for the balance between contrasting objectives (O'Reilly & Tushman, 2004). In addition, in the ambidextrous companies, managers can apply different leadership styles to facilitate both activities e.g. transformational leadership to encourage exploratory innovation; transactional – to stimulate exploitation of existing competencies (Jansen, Vera, & Crossan, 2009).

In addition to corporate, individual and executive levels, ambidexterity can also emerge in *projects, in particular* when a project team needs to address two types of activities at the same time. The study from Liu et al., (2012) argues that ambidexterity is typical for large and complex engineering projects, where teams have to deal with exploration and exploitation to fulfill specific requirements and to meet the targets of a complex project. By exploring a project team is able to identify a solution to the unique problem; by exploiting a team replicates a solution and to applies it into a mass production.

The project ambidexterity is achieved by temporal cycling between separation and integration of exploration and exploitation (Liu & Leitner, 2012). Separation is necessary to engage in such activities as the search for (exploration) and execution (exploitation) under the specific constraints as during the complex engineering projects. Integration is needed to link and coordinate both activities. To increase the effect from synergies, managers should

promote collaboration and encourage different project teams to work together for a common goal (Liu & Leitner, 2012; Liu et al., 2012).

Exploration and exploitation are also emerging in *communities*. Communities are the intermediate level which is considered “as the result of the permanent interaction between the individual and the organizational levels, where routines are shaped and deterred” (Cohendet & Llerena, 2003, p. 273). These are the groups of individuals based on the functional affiliation, similar practices and/or driven by the creation of common knowledge.

In communities, two activities can be co-organized in a similar way, as in project ambidexterity (Liu et al., 2012) by separation and integration. Studies show that in an organization, communities have a specialization in a specific domain of knowledge (Cohendet & Simon, 2007). Separation based on specialities is as important as their integration. Integration takes place at the collective level (e.g. in common projects) and guarantees systematic coordination between different teams and goals. A solution to integrate different communities and activities can be found in hybrid projects. These types of projects allow managers to separates activities in decentralized structures and at the same time, integrate them by using the informal structures (Cohendet & Simon, 2007).

After reviewing the existing literature, we identified at least five different organizational levels, where ambidexterity can emerge. These are the corporate (organizational), individual, executive or leadership levels, project and communities. Based on the existing knowledge, we propose that for a sustainably ambidextrous organization, a critical factor is the ability to achieve synergies between exploration and exploitation at the different levels and in different periods of time.

In our research, to allow the definition of a fractal and dynamic ambidexterity, we suggest to use a multilayer methodology that crosses several levels of analysis and address the question on the long term balance. By using a case of an ambidextrous company, we show the

practical evidence on the multidimensional ambidexterity. Further in our research, we identify the co-existence of exploration and exploitation at different levels and find out whether a company can sustain the balance over time.

MULTILAYER METHODOLOGY: CROSSING LEVELS OF ANALYSIS

Our research uses a case study method to explore a phenomenon (Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Yin, 1994) of the fractal and dynamic organizational ambidexterity. We develop and apply a specific research method, called in our paper as “the multilayer methodology” that crosses several levels of analysis and take into account the time factor. In contrast to the existing studies on ambidexterity, which mainly have focused only at one level of analysis (e.g. corporate, individual, project, etc.), we combine three different organizational levels and analyze them simultaneously. This multilayer methodology emerged as the approach to detect and to validate the variables at diverse levels of the company.

The structure of the multilayer methodology (see Figure 1.) includes three independent, but interrelated areas. These are the corporate, the project and the executive levels of the ambidextrous company considered in our case. Each section consists of different elements such as structures, activities, processes etc., which are associated with exploration and exploitation at each level. To collect the data, we use multiple research tools and methods that are appropriate for a specific context.

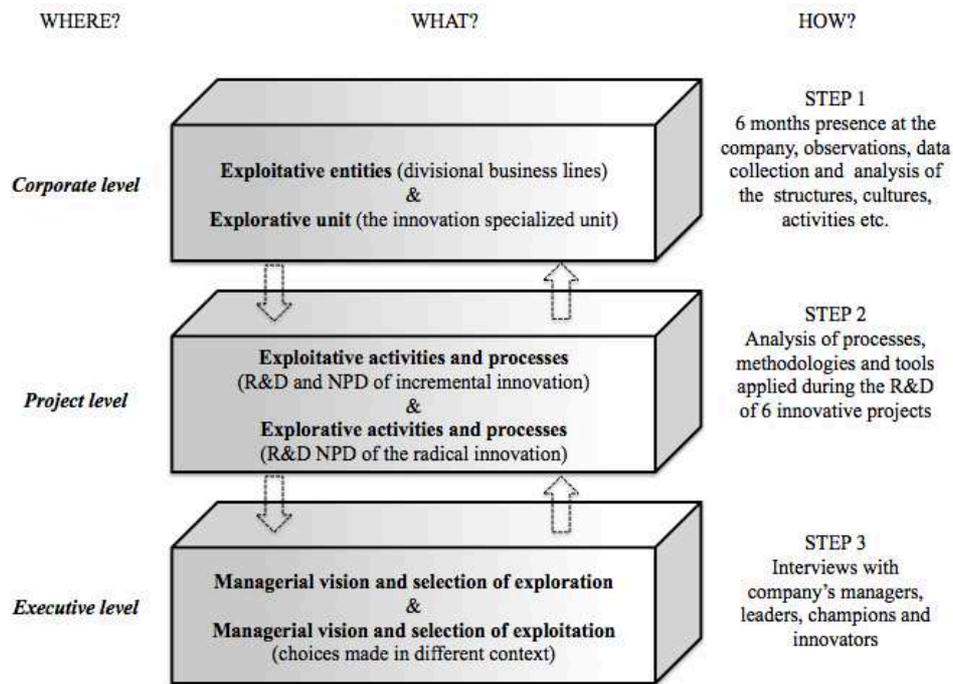


Figure 1.The structure of the multilayer methodology

Technology-based service company

- is an international oilfield service company that provides equipment, technologies, hardware solutions and software services for exploration and production of oil and gas reservoirs. The company is a fully integrated service provider with its own development, production, processing and interpretation oilfield services. The core business is the seismic acquisition services on the onshore and offshore markets.

R&D and Innovation

The company is a science-based organization with more than 600 employees involved in the R&D activities. To develop radical and incremental technological innovations, the company uses two types of R&D structures: 1) specialized divisional business lines perform incremental type of development for existing markets; 2) the innovation specialized unit develops radically new technological products and services that creates new markets

In particular, at the *corporate level*, our research includes a single in-depth case study of an incumbent organization. The unit of analysis is a technology-based service company from the energy industry and its separate business structures, which focus on exploration and exploitation. To explore and exploit, the company uses structural separation of activities.

Exploitation and execution of short term targets is dedicated to the divisional business lines. These are the exploitation-oriented entities, which improve and refine existing technologies for the current markets. Exploration and experimentation with technologies of the future

occurs at the innovation specialized unit. It is an innovation-driven and an entrepreneurial unit. To explore radically new ideas and strategic technologies, it relies on the support and protection of the top management team.

At the *project* level, we make the analysis of 6 innovative projects of the company. These are the incrementally improved and radically new technological projects. At that stage our goal is to understand the differences and similarities between the intensity of exploration and exploitation during the product development process of different types of technological innovation. Finally, at the *executive* level, our research identifies the managerial vision on the ambidexterity and their practices on balancing between exploration and exploitation. It describes managerial motivation and decision making on the allocation of resources between the activities in a given context and under the specific organizational conditions and also serves for the validation of the results from the previous two levels. In addition, our multilayer methodology takes into account the time factor and allows us to observe the dynamics of ambidexterity, localization and evolution of exploration and exploitation in the company and at the innovation unit.

The advantage of the proposed multilayer methodology is the holistic approach to the question allowing the emergence of a fractal concept of ambidexterity based on our case study. To increase the robustness of our findings we apply diverse techniques and methods. The multiple source of evidence and convergence of facts help us to make our analysis and findings convincing and accurate (see also Eisenhardt, 1989; Yin, 1994).

We collected the data in three steps. The *first step* was at the corporate level. It started from the actual presence of our researcher in the innovation specialized unit of the technology-based service company. During 6 months (in 2013) our researchers was a member of the innovation team from the innovation specialized unit of the company. The researcher worked closely with the senior manager, responsible for innovation management, participated

in daily activities, led few project, was involved in structuring and formalization of the activities on exploration, attended formal and informal meetings and events. During this period, the researcher collected and analyzed data on structuring of the company, organization and localization of different R&D activities, firm's strategic orientation, cultures, values, processes and procedures for development of the technological innovations.

The *second step* of our data collection had a project orientation. With the help of the senior innovation manager, we selected 6 innovative projects (3 radical and 3 incrementally improved technologies) and analyzed how exactly they were developed in the company. The differentiation of the innovative projects (radical and incremental) is based on the degree of the technological novelty of the selected projects for the company and for its core business.

For our research we define ***incremental innovation*** as the improvement of the existing market technology (current market segment and existing clients). ***Radical innovation*** – is a brand new technology for new markets and clients. To draw these definitions we rely on the existing literature and take into account the specificities of the development process and change in the context of technological innovation (Abernathy & Utterback, 1978; R. Burgelman, Christensen, & Wheelwright, 2004; Ginsberg & Baum, 1994; Henderson & Clark, 1990; Schumpeter, 1934). We assume that for different types of technological innovations, the intensity of exploration and exploitation is different during the phases of the development process.

To study how the company creates different types of innovations, we selected and invited to discussion the members of the cross-divisional project teams. The employees had different functions and represented different R&D departments. Among them were initiator and/or project leader, scientists and engineers, technical support specialists, representatives from sales and marketing and operational departments. Some of the interviewees were involved in the development of more than one technological project. The interviews with the

members of the project teams had a semi-structured format and included 10 open questions on the creation process and covered the phases from ideation to commercialization. Individuals were asked about the decision-making, allocated resources and coordination between different activities, processes, exploratory and exploitative R&D structures of the company.

After the interviews with the project teams we moved to our final, and the *third step* of data collection, that was the interviews with the executives. The executive is a complementary level to increase the robustness of our results from data collection during the first and second steps. The contribution of this step is the investigation of the actual managerial behavior, decision making and selection practices. The interviews with managers had a semi-structured format and included 10 open questions.

In contrast to previous step, the discussion with executives were not linked to specific projects, but had more general focus on the ambidexterity in the company. We asked senior and executive managers the questions about the different types of innovations, R&D structures and activities, localization, coordination and integration mechanisms. We did interviews with the leaders of the divisional business lines, senior manager responsible for corporate strategy and integration, senior innovation manager, technology development manager, chief scientists, chief engineer, senior engineer and a senior scientist from the divisional business lines, etc.

In general, at the second and third steps, our research includes interviews with 24 employees, who hold different positions in the company and represented the innovation unit (exploration) and the divisional business lines (exploitation). Some of senior and executive managers were involved in management of the selected innovative projects. All discussions had a minimum duration of one hour and a maximum duration of two hours. Interviews took place in the company's premises and were held by two researchers. The interviews were recorded and transcribed for further interpretations.

RESULTS AND INTERPRETATIONS

Our research shows that ambidexterity is multidimensional and in the technology-based service company it occurs at diverse levels simultaneously. In particular, at the corporate level, exploration and exploitation are co-organized in structurally separated units (structural ambidexterity, see O'Reilly & Tushman, 2004; Michael L. Tushman & O'Reilly, 2002). At the project level, we identified ambidexterity as the ability of the innovation unit to combine different activities and to develop both radical and incremental technological innovations. Ambidexterity at the executive (leadership) level represents the ability of the managers both to explore and exploit, independently from the fact whether they belong to the exploration-driven or exploitation-oriented business structures. At this level, the notion of ambidexterity is similar to the contextual approach (Gibson & Birkinshaw, 2004). Further, we propose a detailed review of ambidexterity at each of three levels.

Ambidexterity at the corporate level

At the corporate level, the technology-based service company applies structural ambidexterity. Exploration of new domains of business, search for and experimentation with radically new technologies is the mission of the innovation specialized unit. Exploitation of the core-business, incremental improvement and refinement of the existing solutions is dedicated to the divisional business lines.

The separation between the exploratory and exploitative business structures is justified by the fact that different innovations (as in our case radical and incremental) need different set of capabilities, skills, knowledge, competences and resources. Studies show (Michael L. Tushman & O'Reilly, 2002) that incremental innovation and change needs formalized and efficiency-oriented organizational structures, which are often large in size, have long and successful histories and characterized by the efficiency-driven cultures. For these structures, radical innovations and change are extremely difficult. The processes and activities, which

are necessary for the development of new ideas do not fit into their formalized and routine type of work. In contrast, the creation of new ideas needs flexible and entrepreneurial approach. For exploration and experimentation, the more appropriate structure is the entrepreneurial unit(s), which is often young, small in size and have the search-driven cultures. Another important condition is that in structural ambidexterity, the top management of company should protect and legitimize the exploratory function of the entrepreneurial unit, in order to preserve the potential from new ideas and innovation and to avoid their rejection at the early stages of their maturity (see also Michael L. Tushman & O'Reilly, 2002).

In the case of the company from our research, the separation of activities in the innovation unit and in the divisional business lines is a strategic decision of the top management teams and the CEO. In the interview (2013), the head of the innovation unit explained why the company separated activities in different structures:

“If our radical innovations have been led by the R&D departments of the divisional business lines, they would have been killed by business”

The divisional business lines of a company are large and established entities. They do not have the appropriate structure, skills and competences to develop radically new technologies that are out of the scope of their routine activity. They have short term objectives and orientation on the existing business needs. These structures are highly specialized and formal, they refine and improve the design and the operational efficiency of the technologies that already exist on the markets. Divisional managers have a strong focus on the execution of the short term plans and try to avoid new projects with high degree of uncertainty and risk.

The dramatic difference is in the organization of the innovation specialized unit. Founded in 2009, this unit has more than 30 individuals (internal data, 2013), who work as the internal entrepreneurs and are driven by innovation. They have competences, knowledge and skills and the experience on the development of radical technological innovation. The

main activity of the unit is the development of strategically important projects, complex and radically new technologies. It co-develops projects in partnerships with the universities, private and public organizations. To perform its exploratory activity, the unit relies on the strong support and protection from the top management of the company.

Structural separation of exploration and exploitation is justified by the necessity to combine different activities, processes and types of innovation. In 2014 in the of the interviews, an R&D project leader from the innovation unit explained the drastic difference between two structures:

“In divisional business lines we use rather basic technologies and focus on the current business needs of the existing markets. Their primary objective is to deliver new technology in the short terms. In the innovation unit, we create advanced technologies that can completely change the industry. This process can take us 5 to 10 years...”

Existing literature describes separation of activities as a way to cope with tensions and conflicts between exploration and exploitation (e.g. Andriopoulos & Lewis, 2009; Raisch, 2008; Michael L. Tushman & O’Reilly, 1996). However, some scholars propose that separation is important, but not a sufficient condition to achieve and sustain ambidexterity (Kauppila, 2010). Organizational learning literature described that solely exploration often results in high costs of experimentation and as the rule, has low returns (Levinthal & March, 1993; March, 1991). Moreover, the separate exploratory structures can suffer from isolation and be incapable to implement and to exploit the results of their research and experimentation at the other parts of the company (Birkinshaw & Gibson, 2004).

This leads us to our next assumption that in the ambidextrous companies, the separation of activities is as important as their integration/coordination. To benefit from both, organizations and managers should search for integration/coordination and for synergies.

Uncoordinated activities, in contrary, imply the isolation of the entrepreneurial unit and unprofitable exploration.

To avoid the isolation of the unit and the “ivory tower” syndrome from uncoordinated activities, an organization can apply mechanisms for integration/coordination. The company from our research linked two activities at the process level. The stage-gated process of development of innovations, that exists in the company aims to integrate the results from exploration in the innovation unit and the exploitation activity in the divisional business lines. In the interview in 2013, the head of the innovation unit described:

Radical innovation means that we break the barriers and create completely new markets. But the innovation unit does not work alone. Our process is linked to the divisional business lines. We stop exploration in a specific phase of the development and then transfer a successful technology to the business lines for further exploitation”

By direct observations, collection of internal data and interviews we identify that at the corporate level, the technology-based service company explores and exploits in different structures. This approach helped the company to put in place the ambidextrous design and to co-organize exploration and exploitation and the development of different types of innovations simultaneously. Separation in specialized functions and structures and their integration during the phases of the stage-gated development process aimed to support the execution of exploration and exploitation in parallel. But, at the project level, our research got the contradictory results, particularly about the actual exploratory activity of the innovation unit.

Ambidexterity at the project level

At the project level, we analyzed the development of 6 different projects, including 3 radical and 3 incremental technological innovations. These projects were initiated at different parts of the company, but all of them were developed at the innovation unit. At this step, our

objective was to find out what was the intensity of exploration and exploitation in different innovation project. The study of the innovative projects shows that, in fact, the innovation unit develops not only radical innovation, which is its primary goal, but also performs research for the incrementally improved existing technologies.

In our research, there is an important distinction between radical and incremental types of projects, which is the degree of exploration. During the development process of radical innovations, the large portion of resources is dedicated to the research, discovery, creation of new knowledge and experimentation. At that stage, a new technology is not yet defined. To explore new ideas, the innovation unit organizes cross-divisional brainstorming sessions, invites experts in specific fields to work together on solving a problem and proposes some solutions to the emerging technological challenges. The unit works with partners to create new knowledge and competences in a new domain. In large scientific projects, it co-develops with the research institutions, clients-petroleum companies and works with subcontractors to perform specific studies and experiments.

The process of development of radical innovations has high intensity of exploration. For radically new technologies, the initial phases are time and resource consuming, have high degree of uncertainty and risks. The analysis of the projects shows that the approximate duration of the research and experimentation at the early phases of the product development is 2 - 3,5 years. After that period, the unit is able to demonstrate technical feasibility of a new technology. The process is fully supported and protected by the top management of the company. Usually, the executives are the sponsors for the strategic projects. They allocate large portion of resources for the development of such projects.

Our analysis shows that except radical technologies, the innovation unit works also on the projects of incremental innovation. For these projects, the function of the unit is to search for new approaches on how to improve and to refine already existing model of a technological

solution. In contrast to the brand new products and services, the development process of the incrementally improved technologies do not require heavy research and experimentation, have less risks and low degree of uncertainty. The exploration is less consuming because in these projects, the main concept and technology is already exist and is utilized on the markets. For the analyzed incremental projects, the phases of exploration takes approximately 1-2 years. After that period, the unit is able to prove the feasibility of the improved technology and transfers a project to the divisional business lines for exploitation and market launch.

Except the difference in the intensity of activities between radical and incremental innovative technologies, another contrast is in the allocation of resources for these projects. The innovation unit does not own the development of the incremental innovations, but organizes the process in the cross-divisional development and serves as a hosting and the advisory board. It creates the linkage between the diverse divisional business lines, facilitates the development process, performs and sponsors the research and experimentation phases, ensures the technological feasibility and business efficiency of the refined technology.

Our analysis at the project level shows that the innovation unit has a mix of exploration and exploitation. With time, it re-defines the focus and its “purely” explorative knowledge, competences and skills and applies these capabilities to the projects with lower degree of risk and uncertainty. By creating both radically new and incrementally improved technologies, the innovation unit shifts from exploration to a combination of activities. To understand why there is a contradiction between corporate and project levels and to verify our findings, we interviewed the senior and executive managers, who had a power to make decisions on allocation of resources for exploration and exploitation.

Ambidexterity: A view from the top

To extend our cross-level study on ambidexterity, we analyzed exploration and exploitation at the executive level. It is a complementary level, which focuses on the decision-

makers, on the senior and the executive managers of the explorative and exploitative structures and of the whole company. The managers were asked about separation of the activities, functioning of structures, their efficiency and about the development processes for different types of technological innovations. Our main goal was to find out why did the innovation unit develop radical and incremental projects and with time, became ambidextrous. We needed to re-consider the analysis at the previous two levels to understand the dynamics of ambidexterity,

As we defined earlier, at the corporate level, exploration of brand new products and services is dedicated to the entrepreneurial-driven innovation unit. Exploitation and improvement of the existing technologies is the job of the efficiency-oriented divisional business lines. There is a clear differentiation of R&D functions, processes and projects between the structures. In an interview (2014), the chief engineer who was a member of the innovation unit explained:

“In the company, we started to have emerging a nice idea that divisional business lines are mostly here to do incremental improvement. Radical innovation and the really risky stuff could be done in the innovation unit, where we explore and prove a feasibility of a new technology and then decide how to make it faster to a market”

The differentiation is present not only in the functions and missions of the different entities, but also in their R&D processes and approaches to execute plans. A manager, who was responsible for the technical development at the innovation unit, explained:

“Divisional business lines have to deliver benefits and results in the end of each quarter. They do not put money into high risk and long projects, knowing that in some point of time they will get those strategic projects from the innovation unit. This is a purely financial aspect. People in the business lines have to deliver results”

On the one hand, the company used structural separation to cope with tension between the activities. On the other hand, the sharing of a stage-gated innovation process was not sufficient to coordinate and integrate the activities in different structures. As the result, the exploratory activity of the unit had low returns. The unit started to experience the increasing costs for research and experimentation and low exploitability of the new projects at the divisional business lines.

With time (mid. 2014), the innovation unit got isolated from the rest of the company. For the divisional managers, the unit turned into a risky and unprofitable structure. The results from its exploration were not well utilized in the divisional business lines, and projects of new technologies got rejected or stoooped before their actual exploitation.

Moreover, the innovation unit became an internal competitor for the exploitative structures and competed for the R&D resources, allocated by the top management of the company. In one of the interviews, the chief engineer from the innovation unit explained the emerging gap between the disconnected activities:

“In the innovation unit we have a good knowledge on complex product development compare to other parts of the company. The bad news is that we are not really closely linked to the rest of the company. People think that we are an “ivory tower”. Another problem is that our product development knowledge are not always well utilized and engaged in the divisional business lines”

It is the phenomenon, called the “ivory tower” syndrome, when in structural ambidexterity, the separate exploratory and exploitative units suffer form the lack of synergies. Weak integration between the processes leads to the disconnected activities and inability to exploit new ideas prom the entrepreneurial unit. In more practical terms and for the innovation unit it means first, the increasing competition for the resources, allocated from the top management and second, the necessity to demonstrate the legitimacy, creditability and efficiency to the executives and the divisional leaders. To survive without previously strong

support from the executives, the innovation unit has started to develop the incremental projects in parallel to the development of radical innovation. Hence it became itself ambidextrous.

EVOLUTION TOWARDS THE FRACTAL AMBIDEXTERITY

After questioning and observing the co-existence and coordination of exploration and exploitation simultaneously at different organizational levels, we argue that ambidexterity is in fact, fractal and dynamic. Fractal is a phenomenon of the repeating patterns that can emerge at different levels. The proportion, degree and localization of exploration and exploitation can change over time and might depend on the influence of the environment. *Fractal and dynamic ambidexterity* is the ability to explore and exploit at multiple organizational levels simultaneously and over time, to change the proportions of these activities to meet the change.

In case of the technology-based service company, fractal ambidexterity is represented by the repeating exploration and exploitation at the corporate and at the project levels (see Figure 2). The dynamic aspect is explained by the re-configuration of the capabilities in the explorative structure, when the innovation unit shifted from being exclusively focused on development of radical innovation to a combination of processes on development of both radical and incremental innovations.

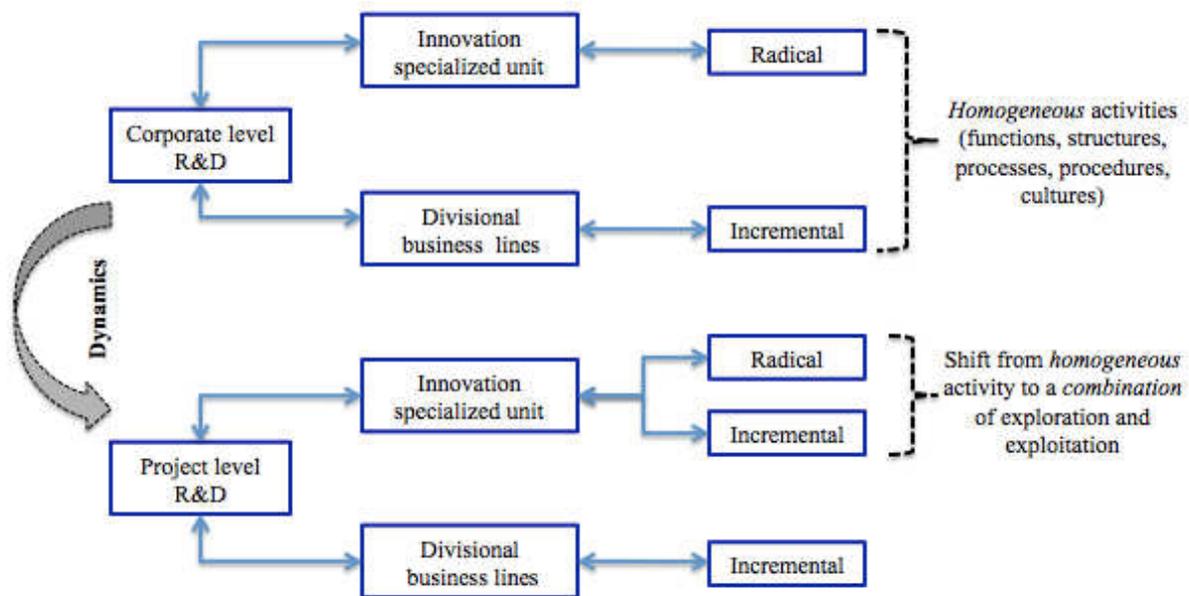


Figure 2. Fractal ambidexterity: localization and dynamics of exploration and exploitation (case of the technology-based service company)

The results of our research are the following. At the *corporate level*, ambidexterity is organized in structurally separate unit: exploration in the innovation unit and exploitation in the divisional business lines. Integration between these two structures occurred at the level of a process. These entities were sharing the stage-gated development process, where the innovation unit was responsible for exploration at the initial phases and the divisional business lines worked on exploitation and market launch of an innovation.

Our analysis showed that at the *project level*, the linkage and coordination was not sufficient to sustain ambidexterity and in particular, the effect from the exploratory activity. Because of the unutilized results from exploration, the innovation unit got isolated from the divisional business lines. Very often, it was unclear how divisional R&D managers could exploit new concepts and prototypes of radical innovations, received from the unit. The projects of new technologies were postponed or got rejected and assessed as not enough mature for the phases of technological development and market launch in the divisional business lines.

To decrease the emerging gap between the structures and to demonstrate the efficiency of exploration, the innovation unit decided to perform a portion of research and experimentation for the projects of incremental improvement. In parallel to the development of strategic and radical innovation, the unit initiated the development of incremental projects in cooperation with the divisional business lines. In cross-divisional projects, the unit served as a sponsor and as the advisory board during the phases that were linked with the exploratory activities.

At the *executive level*, we found out that isolation of the innovation unit from the divisional business lines was not the only reason that caused the difficulties of its ambidexterity. Another, more important factor was the decreasing support from the top management and the need to demonstrate the efficiency from the activity of the unit. After 4 years from the date of the official launch, the innovation unit got into the phase of its maturity. . For the unit it was the period to prove its efficiency and to pay back the large amount of investments, allocated by the executives for the exploration of radical innovation.

This processes occurred in parallel to the important change in the industry. Declining support of the exploration from the side of the top management is explained by the drastic shifts in the oil and gas industry as well as in the organizational capability to continue the funding for the R&D of strategic innovations. Industry crises and the dramatic drop of oil and gas prices (beginning of 2014) put the pressure on the large and small organizations that operate in this sector. The shift in the environment had a significant impact on the company and in particular, for the activity of the innovation unit. The executives decided to re-consider the strategic choices of the company, mainly by cutting down the amount of resources and the number of projects that required long and costly phases of exploration. In 2014, in the interview with the executive manager, responsible for the corporate strategy, he explained the shift in strategic choices:

“Today we do not have any innovations in our current strategic plans because our markets and the industry are not in a great shape. It is more a follow up approach...”

In conditions, when the financial and business operations of the company have decreased, the activity of the innovation unit was put under the pressure. In times of industry crises, the top management decided to cut down the resources for R&D of strategic and radically new technologies. For the innovation unit it resulted in competition for the resources from the top.

Without previously strong support and protection from the executives, the unit needed to demonstrate its legitimacy and credibility. A solution was found in the re-configuration of the exploration and combination of both activities. To show the profitability and efficiency of exploration to the divisional and the executive managers, the innovation unit started to work on projects of incremental technological innovation. To survive in times of organizational change, the unit switched to a combination of exploration and exploitation and became itself an ambidextrous structure, and contributed to the emergence of a fractal structure of ambidexterity.

CONCLUSION

By using a case of the technology-based service company and by applying our multilayer methodology we were able to demonstrate the existence of the fractal and dynamic patterns of ambidexterity. We saw ambidexterity at the corporate level when the company separated exploration and exploitation in different organizational structures. Similarly, we identified ambidexterity at the innovation unit, which combined the development of radical and incremental innovations. Our research defined *fractal and dynamic ambidexterity*, where exploration and exploitation have the ability to replicate simultaneously at different organizational levels and change their proportions depending on the internal and external factors.

The example of the technology-based service company shows us that ambidexterity can replicate and change over time. It can emerge at the corporate level, at projects and at the executive level. The proportions and intensity of exploration and exploitation can change over time and depend on the available factors, e.g. as internal capabilities and the change in the environment.

Another lesson learned is that structural solution to explore and to exploit simultaneously (structural ambidexterity) can sustain only if there is a permanent strong support, protection and legitimization of the exploration activity from the top management of an organization. Without protection from the executives, the entrepreneurial innovation unit will not be able to survive in the long term. Separated and uncoordinated exploration and exploitation will result in the isolation of the explorative structure and in the inability to utilize and to exploit its results. The unit can be restructured or fully liquidated as unprofitable organization if is not able to prove its legitimacy and credibility and to enable to compete with the efficiency-driven entities.

It seems that for ambidexterity, the most critical is the ability to sustain the appropriate degree of exploration. Similar points are explained by scholars in the organizational learning (Levinthal & March, 1993). Many companies tend to prioritize exploitation and devote little attention to exploration. Execution and operational efficiency have higher impact on the organizational performance in the short term. For companies, exploitation is more a preferable activity, than uncertain, high risk exploration with distant returns. Organizations should learn how to sustain the appropriate proportion of exploration, even in times of change and shifts of the environment.

For organizations, that want to be both innovative and at the same time, effective in the long term, we suggest applying the logic of fractal and dynamic ambidexterity. The continuously ambidextrous organizations should be able to set the appropriate intensity of

activities and to re-combine the proportions of exploration and exploitation at each of the organizational levels, depending on the available internal and external factors.

Our theory on fractal and dynamic activities is justified by the fact that exploration and exploitation are different, but not the opposite activities. They are more likely to be the continuous activities, as exploitation will always contains a part of exploration (see also Nonaka et al., 2014). An innovation, a product, a technology cannot be improved without being explored and invented first. Any organization will inevitable do both exploration and exploitation, but in different proportion and with different intensity. Both activities will inevitably emerge together because neither a company, nor a business unit, a project team and even an individual can engage only in one activity, if it wants to survive in the long term.

To sustain and survive over time, an organization should establish the right degree of the activities at the different organizational levels and be able to re-configure them when necessary. For managers this means that they need to pay more attention to the intensity of activities and be more reasonable in the allocation of resources at each of the levels. Even March (1991, p.72) did already propose that it is particularly difficult to find the balance, because “the same issues (selection and choice between exploration and exploitation) occur at the levels of a *nested system*-at the individual level, the organizational level and social system level”.

We argue that for organizations, it would be inappropriate to search for the best approach to balance and to achieve ambidexterity, ignoring its different organizational levels. The managerial favorable solution is to search and to set up the appropriate proportions of exploration and exploitation at the levels of a company in order to optimize the processes from multidimensional ambidexterity.

The limitation of this paper is a single case of a company. To expand the knowledge on the proposed concept, it is necessary to make additional analysis with a larger number of

organizations and with a similar cross-level methodological approach. Further research should demonstrate the evidence on the replication of fractal and dynamic ambidexterity. We insist on the fact that this concept is a promising one and needs further investigation. To achieve organizational ambidexterity that will sustain in the long term, it would be critical to understand how organizations replicate exploration and exploitation and what is the priority of these replications that occurs simultaneously at diverse organizational levels.

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