Complexity Challenges of Collaborative Research and Innovation Projects

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Summary

Post-globalization and instable business environments demand permanent improvements and changes of business processes and products. “Open the boxes” and exchange of information, ideas and set-up collaboration with stakeholders such as customers, end-users, clients, vendors, business partners, potential competitors – these are the main challenges of current organizations and their business environments. Modern, effective and efficient, organizations are becoming more virtual and flexible. Their boundaries are blurred and not closed as they were at the time of the industrial era. This paper discusses issues of complexity of research and innovation collaborative projects, related open innovation opportunities, and how to deal with the complexity of involved personal communities and networks as well.

Key words: projects, project management, collaboration, virtual organization, research and innovation, open innovation environment, communities, complexity

1. Collaborative Business Environment Challenges

Modern enterprises are permanently scanning their business activities and the situation on the global market and searching for opportunities to improve their competitiveness. In the wake of global financial downturn the enterprises are facing a constant competition from both, regional and global markets. This demands speeding up the pace to innovate, produce and provide higher quality products and services with a higher degree of customizability (Semolic, Imtiaz, 2010). In order to sustain a feasible growth, the leading enterprises have recognized the need to shift from classic organizational structures into being more diverse and distributed internally as well as externally, mainly depending on collaboration as a basis for competitive advantage in innovation (Mertins 2003, Firestone 2002). The main change drivers are:

- Fast technological changes – decrease of R&D lead time, product market window etc.
- Enabling technologies – ICT which allows the introduction of new innovative products, services, systems etc.
- Emerging industries – integration of new industries like mechatronics
- Globalized competition, etc.
For enterprises, this change is driven by directing and sustainable collaboration with their complementing entities holding relevant knowledge and products in the holistically observed value chain (Figure 1). The same holds true for all industries that need to collaborate with the stakeholders by collectively realign the organizational resources to innovate and to adopt more flexible business processes. Modern organizations are very often integral parts of a global supply and value chains. It is a question of survival for all involved players to be in line or lead the industry development and demanded investment cycles. Specialization, partnering and outsourcing are key elements of business nowadays. The concurrent enterprising of collaborative businesses, inter-organizational and interpersonal productivity are the main issues of such new business model. The word “collaboration” is becoming the “buzz word” in many industries. In the study prepared by Mercer and the Fraunhofer Society from 2008 (Bauman 2011), which was prepared for the needs of automotive industry, reported the identification of more than 20 new forms of cooperation and partnership identifiable between OEM (Original Equipment Manufacturer), TIER (rank of supplier) and service providers. This report recognized the relevance and future growth of cooperation and partnership between actors in the automotive industry.

Collaborative research and innovation projects are one of the most critical elements of such new business models based on partnership of different enterprises. Unstable markets and fast technological development need a reduction of time for research and acquisition of new technologies supported by agile project management with effective governance support.

Figure 1: Global collaboration and networking
The right placement of knowledge, information sources and their interaction to optimize the collective view of all involved collaborative project stakeholders is of key importance. The bigger impact of such structure could be foreseen at the virtual associations that are mostly objective and are based on knowledge resources (Duin 2008)

2. Collaborative Projects

What is collaboration?

Let see how Merriam-Webster dictionary define term »Collaborate«:

- To work jointly with others or especially in an intellectual endeavor,
- To cooperate with an agency or instrumentality with which one is not immediately connected and
- To cooperate with or willingly assist an enemy of one's country and especially an occupying force.

We can see the essence of modern understanding of the term collaboration in nowadays business, if we skip or delete the third definition of this phenomenon which very often gives a negative connotation to this term.

What is collaborative project?

We have a situation of collaborative projects in case of two or more business partners who are collaboratively working on the agreed project business case implementation. Such a project business case is jointly developed and co-created according to the business needs, available resources of each project partner. The level of project partner involvement depends on partner’s motivation, competences, available resources and multilateral project agreement. The business and project risks are shared among the all collaborative project partners. Such project is jointly managed and coordinated by one collaborative, partner – usually project initiator. These kinds of projects are co-financed by project partners and external co-financing or granting organizations. Typical examples of such collaborative projects are different industry foresight study projects, applied research projects, innovation projects, regional research infrastructure development projects, competences development projects etc.

3. Complexity and Projects

What is complex and complexity?

In Oxford Advanced Learner’s Dictionary we can read the following explanation of term »complex«. This term is explained as having many parts connected together in a particular pattern, a complex system or difficult to understand or explain because there are many different aspects or people involved. In the same source complexity is defined as the state of being complex. (Oxford ALD 1995)
The topic of «complexity» is a challenging issue for all modern communities of practice. Scientists encounter complexity as they probe the limits of our understanding of nature (Nam P. Suh, 2005). Cartwright explained complexity theory as the study of nonlinear systems, promises to be a useful conceptual framework that reconciles the essential unpredictability of industries with the emergence of distinctive patterns (Cartwright 1991). Levy and other scientists noted that this theory was originally developed in the context of physical and biological science, among others, have noted that social, ecological, and economic systems also tend to be characterized by nonlinear relationships and complex interactions that evolve dynamically over time (Levy 2000).

**Explosion of complexity**

Today we are facing the explosion of complexity by fast development of global markets and the continuous inflow of new technologies and products, supporting the emergence of new forms of organization. This complexity is related to these new products, services, technologies, emerging industries, new business models, organization systems, projects, etc. The study and explanation of the mix of these technical and non-technical areas of complexity should help practitioners how to deal with the complexity in their daily, sometimes chaotic, business environment.

**How to deal with project complexity**

We need knowledge insight into every segment of project complexity phenomenon if we want to understand and manage it successfully. This can be done (Figure 2) by systemic exploration, structuring and describing all aspects of the observed project complexity phenomenon and its explanation in different forms of system formalization. Such codified knowledge can be useful for practitioners as well as for further theoretical exploration.

*Figure 2: Systemic exploration and explanation of the project complexity phenomena*
Complexity of collaborative research and innovation projects

Projects and project management are originally an integral part of social sciences, and at the same time complementary part to other sciences like: natural sciences, engineering and technology, medical and health sciences, agriculture sciences or humanities. This dichotomy is inherent to all projects and depends on the application areas of the specific project business case. Therefore, complexity of projects and project management is related to the study and explanation of observed nonlinear dynamic systems and processes in an organizational environment from all aspects which are relevant to the specific project business case.

Generally, we can recognize six (6) levels of collaborative project and project management complexity, as follows (Figure 3):

1. **Level of physical processes and their outputs** – portfolio of physical processes of materialization of agreed incremental and final products or services;

2. **Level of research, innovation and implementation technologies** – processes of practical application and implementation of knowledge in course to introduce new knowledge base, products or services by the use of a portfolio of different technologies;

3. **Project level** – a unique collaborative enterprise to achieve specific collaborative business goals and objectives;

4. **Project management level** – comprises management and leadership processes of the collaborative project;

5. **Project governance level** – comprises collaborative controlling processes of project performance. Must provide resources, support and project visibility in all involved corporate environments. Their responsibilities are an integration of project outcomes with individual corporate strategies;

6. **Level of project stakeholders** – comprise the activities of internal and external project stakeholders’ identification, assessment of their expectations and integration into project implementation and management processes.
Described levels of project complexity can be recognized in any project. However, in collaborative research and innovation projects this complexity is much higher and needs careful assessment because of related potential project and business risks.

Hertogh and Westerveld (2008) experienced by interviewing numerous managers of large infrastructure projects in the EU that complexity has a clear subjective component as well.

4. **Complexity of Collaborative Project Involved Communities**

**What is community?**

In the Oxford advanced learner’s dictionary from 2005 we can read the following explanation of the term community: »Community is the condition of sharing, having things in common or being alike in some way (a community of interests etc.) «. We are dealing with the network of different types of communities in every collaborative project. These communities are:

- **Business community** – a group of individuals who are directly or indirectly involved in the processes of collaborative project governance, management, coordination and supervision;
• **Professional community** – a group of individuals who are belonging to different professions and are directly or indirectly involved in the processes of collaborative project implementation and

• **Social community** – is made of individuals who are affected by collaborative project implementation and connected through friendship or other common interests.

Individuals can be members of one single, two or of all three communities. This depends on their position in the observed collaborative project organization and is based on their personal activities, position in different communities (business, professional or social) inside or outside an organization.

Today we are living in the age of digitization and virtualization of workplaces and lifestyles. The share of personal or team work in a virtual environment has been increasing dramatically. Growth and development of different virtual communities are part of this trend. The term virtual community was first time introduced by Howard Rheingold (Rheingold 1993). Today we understand the virtual community as a network of individuals who interact by using the internet and other different modern social media without any organizational and geographical limitations. Their motivation is mutual interests and goals. We can make conclusion that virtual communities are an integral part of previously described business, professional and social communities (Figure 4).

![Figure 4: Collaborative communities](image)

The characteristics of high performing innovation communities demonstrate the presence of individuals who are members of business, professional and social community at the same time.

**Formal and informal communities**

Communities can operate in formal, corporate environment or can be informal, open and available to all who are sharing such community interest. We are cognizing three types of communities (Figure 5):

• **Formal communities** – these communities’ are connected to the formal structure of collaborative project organization;
• **Open innovation communities** – these communities’ present extension of formal communities by external collaborating individuals who are coming from different organizational environments or can be freelanced knowledge workers;

• **Informal communities** – these are independent communities’ initiated and organized by individuals or groups of individuals with a specific interest.

Communities are sharing data, information, knowledge and ideas of common interest. They are creating open discussion forums, different collaborative working groups and co-creating different project solutions and suggestions.

![Diagram of formal and informal communities of collaborative projects](image)

*Figure 5: Formal and informal communities of collaborative projects*

**Innovation potential - Internal and external talents exploration**

Collaborative project Internal and external talents coming from different project stakeholders’ communities present the innovation potential which needs to be explored and used in all phases of project implementation (Figure 6).

The innovative, high performance community has characteristics of the harmonized combination of business, professional and social communities. The theory and practice of open innovation introduced by Henry Chesbrough should be utilized for this purpose. Open innovation is the use of purposive inflow and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough 2006).
Figure 6: Pool of internal and external talents

Pool of internal and external talents should be identified, fostered and exploit. This can be done with their motivation for active collaboration and participation in different areas of project performance. The formal project organization should be extended and virtualized by an organized portfolio of open innovation communities.

**Semi-formal open innovation community and virtual collaboration platforms**

Open innovation communities and related networks need to be organized and coordinated properly if we want to exploit them successfully. They need to be clearly positioned as an extension of the exiting formal project organization. Critical success factors for creation of a successful open innovation community:

1. Identify and define the list of open innovation interests related to the needs and expectations of the observed project,

2. Identify open innovation networking potential and support for each identified collaboration interest,

3. Appoint integrators who are coordinators and leaders of each appointed open innovation collaboration interest. These coordinators need to be talented, competent and highly motivated persons with the right aptitude and attitude towards this job. They should be active, recognized and respectable members of existing communities in the project business ecosystem;

4. The main responsibility of each appointed Integrator is to build-up, foster and coordinate the work of observed open innovation communities, according to the needs and opportunities of the actual project;
The networking and collaborative work of such recognized open innovation communities need to be supported and organized in the form of adequate virtual collaboration platforms. Virtual collaboration platform represents the collaborative working environment to work in selected areas of collaboration, supported by an appropriate organization of work and e-services;

Adequate ICT literacy of all involved parties is one of the critical elements of effective work and the use of a such virtual collaboration platform;

Collaborative corporate culture which is based on partnership, trust and sustainability from all aspects is strongly needed and recommended.

The project management strongly supported by project owners is responsible for building and performance of such project based open innovation environment and related communities. The efficiency of such collaborative system and openness to the others who are coming from the project environment is sensitive to regional culture. By using Hofstede's classification of cultural dimensions (Hofstede 1994) we can expect more obstacles and problems in regions with the high power distance and uncertainty avoidance culture.

Conclusions

In the wake of global financial downturn the enterprises are challenged by constant competition from both regional and global markets. The constant and simultaneous inflow of new technologies generates the need to speed up the innovation processes of their products and permanent search for more innovative business models. We are facing the phenomena of complexity on all areas and levels of corporate activities. We focused on the challenges of emerging collaborative projects. Maintaining global competitiveness needs intensification of research and innovation efforts and related investments from all global market players.

Organizations are beginning to work jointly on such collaborative projects on course to decrease their related research and development costs, risks and increase their own innovation potential. We are dealing with several levels of complexity in such collaborative projects. Collaborative projects are represented by social-technical endeavor with the challenges of technical, organizational and behavioral complexity.

The strong presence of knowledge and innovation is one of the critical aspects of such knowledge based projects. One of the main challenges is how to identify, organize and exploit knowledge and innovation potential inside and outside project organization. We introduced our view how to deal with these challenges by organizing different communities and collaboration platforms where internal and external knowledge potential can search for new ideas, solutions, support and synergies. This kind of work needs partnership of all project stakeholders and different corporate culture like a traditional one. Some regions are closer to this kind of work and collaboration because of their regional cultural characteristics.


Literature

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Brane Semolic, PhD, is currently head of LENS Living Lab - international R&D living laboratory, professor at the Faculty of Logistics, University of Maribor in Maribor, Slovenia, professor at the Cranefield College, Johannesburg and procurator of INOVA Consulting. He is President of the Experts Council of Project Management Association of Slovenia (ZPM) and IPMA & ICEC (International Cost Engineering Council) Strategic Alliance Coordinator. He serves as the first assessor in the IPMA 4-level PM certification program since 1997.

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