

Operational Characteristics of Hungarian Innovation Clusters as Reflected by a Qualitative Research Study

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Abstract

Our paper is focusing on Hungarian innovation clusters which have also earned accreditation titles. Nowadays, one may say that the number of players recognising the advantages of a cluster membership among businesses as well as non-profit organisations is increasing; we can therefore witness a process of closing up in the development of clusters, similarly to other areas. The result and practical significance of our study is that highlights the potential of organising clusters – compared to business networks - and shows the opportunities of innovation and cooperation.

Keywords

innovation clusters · networks · cooperation · innovation lifecycle

1 Introduction

The exploration of the cooperation opportunities of enterprises with one another or with external partners such as educational institutions, research institutes, organisations of economic or regional development and businesses providing various services is a critical success factor of contemporary innovation processes, from the perspective of generating ideas as well as introducing them to the market.

The elaboration of innovations can be linked to the “5th generation model” (Rothwell, 1994), which puts the role of knowledge networks and innovation systems in the focal point. According to the open innovation paradigm, all enterprises need to develop deep and extensive connections with external knowledge networks and communities regardless of its internal efficiency (Chesbrough, 2003). The role of the external partners in shaping and circulating innovation may have a significant effect on the enterprise’s competitiveness (Laursen and Salter, 2006; Chesbrough, 2003). The first such attempts were Open Source Software (OSS) developments (von Hippel, 2005), which already foreshadowed the innovation opportunities in the cooperation of businesses of various industry branches.

As the correlation between networking and successful innovation came to the forefront, it also brought to life the organisational forms and cooperation structures promoting it (Dittrich, Duysters, 2007). The widely evolved organisational forms helping innovation initiatives open up are clusters (Freeman, Engels, 2007). By organising clusters, platforms may be created that enable the concentration of the R&D&I capabilities and where these may be utilised with greater efficiency thanks to the cooperation and knowledge integration efforts. They provide a favourable background for the evolution of confidential contacts, providing an incentive for the members to share their information, ideas, competencies and resources (Rychen, Zimmermann, 2006). Clusters provide opportunities first of all to micro-businesses and SMEs¹

¹ SME: A small or medium enterprise with a maximum number of employees of 250 persons and with annual revenue below 50 million EUR.

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by enabling concentration and in turn the more efficient utilisation of their respective R&D&I resources, a joint market entry and access to international markets (Schmitz, 1995).

Our research focused on Hungarian innovation clusters with several years of cooperation experience which have also earned accreditation titles. The process of organisation of clusters started in Hungary with a delay of 5-10 years in comparison to developed Western nations, rather in response to nationwide or regional direction than as a result of a bottom-up initiative. Nowadays, one may say that the number of players recognising the advantages of a cluster membership among businesses as well as non-profit organisations is increasing; we can therefore witness a process of closing up in the development of clusters, similarly to other areas.

The result and practical significance of our study is that highlights the potential of organising clusters – compared to business networks - and shows the opportunities of innovation and cooperation. We emphasize that clusters encompass a wide range of stakeholders, by promoting the flow of information and knowledge not only between businesses, but the business sector and universities, as well as R&D institutions. In addition, cooperation with local governments and regional development organisations is also significant from the aspect of implementing regional goals. We point out that both SMEs and multinational members can realize benefits, so there is a greater chance that innovation ideas are transformed into marketable products and services.

2 Cooperation in networks and clusters

The term “cluster” first appeared in literature related to competitiveness within specific industry branches and regional competitiveness. The classical approaches understand a cluster as a group formed by a network of local enterprises within a certain branch of industry (Porter, 1998). Today, clusters can be regarded as the basic units of global competition; they have opened up the way for a specific structural reorganisation in response to global challenges (Örjan, 2009; Europe INNOVA, 2008).

The process of cluster development went through a phase of organic development in the developed Western countries. Various cluster formations have come into general use and continued to develop on their own; parallel to this, the terminology also became more fine tuned (Bell et al, 2009). The definition of a cluster by the Enterprise Directorate-General of the European Commission (2004) focuses on innovation, technology transfer and network building but also emphasizes specialisation and the conditions necessary for equilibrium. According to the definition by UNIDO (2007), clusters are enterprises concentrated in terms of their geographical locations or the industry branches they belong to, producing linked or complementary products, facing common challenges while also having a common set of opportunities.

The fundamental goal of the *innovation clusters* is to help development and market introduction of knowledge intensive

products as a result of common research and development. Cluster members are sharing their intellectual capital, mainly because it is one of the sources of innovation and strategic renewal (Tóth, Kövesi, 2009). From a market perspective, cooperation brings about the improvement of the domestic and international competitiveness of the cluster members and the progress of their market achievements and also contributes to the proportion of applied research and the number of patent applications from a research and development aspect. The Hungarian experts of this field also mention that the aspect of promoting the employment of researchers with significant achievements should not be neglected (Dobronyi et al, 2012). Innovation clusters are highly region dependent. A number of studies have proven that the regions where intensive cluster activity is observed are also considered the leading regions in terms innovation, whereas regions with little cluster activity are less active in the field of innovation as well (Horváth et al, 2013; MAG Zrt, 2012; Weisz, 2008).

Clusters and networks are closely linked terms. The fundamental cornerstone of both is the connection and cooperation between the players. However, while networks rather function as relatively closed and stable organisations established to achieve common business goals, clusters are *open and more flexible* forms of cooperation *expansive in a number of directions with a collective vision* (Lengyel, 2002). An important difference is that in the clusters, the cooperation is not narrowed down to economic entities, but extends to further players organised within the industry and along the value chain. Clusters offer a formal coordinating framework for the members, comprehensively spanning across entire activities and help the network building activity of the members with a range of solutions. An institutionalised form of open *information flow and knowledge sharing* is conducted in clusters (Sölvell, 2009; Grosz, 2005), which may be promoted by the cluster management with the help of formal and informal mechanisms. Intensive communication is conducted among cluster members via several channels. In contrast to the above, contemporary networks “do not emphasize functions aimed at information flow; their roles are rather definitive in generating new knowledge and innovation” (Andó, 2013, p. 72). An additional difference is that while rivalry is not an apparent feature of business networks, it may be characteristic of clusters if there are competitors among its members. Barabási (2003) states that networks are without a central hub; therefore, if one element is “removed” from the net, it will not paralyse the entire network. This cannot be said of clusters, as it is the cluster management that functions as this very hub, connecting the members and ensuring the background for cooperation. Finally, it is worth mentioning that “free riders” may appear in clusters, which may benefit from the synergic effects and the advantages of agglomeration without actively participating in the cluster’s work and the common projects (Roncz, 2007).

Clusters may be grouped according to a number of aspects. Horizontal and vertical clusters are differentiated based on the *value chain* (Porter, 1990). Based on this definition, the cluster is “a cooperation network organised along the value chain, encompassing the various economic associations, institutes and non-profit organisations in a territorially concentrated fashion, not only contributing significantly to the increase of the competitiveness of the participants, but to that of the entire region” (Grosz, 2000, p. 55). Within clusters organised along the value chain, the *vertically based* ones are formed of small and medium enterprises organised around a large corporation functioning as a hub. The most frequent examples of these are suppliers’ networks (Porter, 1999). *Horizontal clusters* enable the organisation of companies of the same rank in order to achieve a certain goal (Rosenfeld, 2001). Suitable organisational forms are for example the cooperation of the institutions and enterprises functioning in the service sector of a given same region, e.g. tourism (Roncz, 2012). In case of supplementary or symbiotic activities, diagonal clusters may also be established based on the value chain.

For classification based on orientation, examples to quote are *industrial and regional clusters* (Porter, 1990). The cohesion elements of industrial clusters defined based on orientation are made up of supplier-buyer connections, common technologies, sales or distribution channels and the labour market (Enright, 1996). In Lengyel’s approach (2002) the core of the clusters are the member companies themselves, which function embedded into the business partnerships, related industries and the network of supporting institutions. Membership allows them to get to know the market better and to implement cost-efficient procedures during the R&D projects by sharing knowledge and resources.

A colourful interpretation of the function of a cluster is apparent from the above; however certain common features can be drafted. Among these, the interactions between the member companies, the shared resources and capabilities, geographical proximity, institutional connections and economic specialisation can be mentioned.

3 Cluster development based on the lifecycle model

The organic cluster development process characteristic of the developed Western countries accumulated adequate experience to analyse the lifecycle of a cluster and the exploration of the features of the various phases in order to make cluster management successful. Although a terminological diversity is quite apparent in these analyses, the characteristics of the lifecycle of a cluster can be well outlined along the following phases:

- *Starting phase (pioneering or heroic section)*: The motives of establishment are the local effects found in the environment of the cluster such as raw materials, the possession of some special local knowledge or the knowledge or

the requirements of local groups. This phase often results in the establishment of new companies or spin-offs, which may also help the concentration of enterprises in quasi-identical production phases. Local competition may also be initiated later, which promotes the cluster’s innovation and entrepreneurial activity (Observatory of European SMEs, 2002).

- *Growth phase: The special environmental background is established* in the structure in which further external players may help the functioning of the cluster with their services and access to qualified and experienced labour. New organisations - knowledge centres, special educational organisations and economic associations - are established, providing services to the cluster members. The intra-organisational *local cooperation is further intensified*. As a result of the attractiveness and prestige of the cluster *further enterprises join* it, which may have a benevolent effect on the mobility of qualified labour. *Informal cooperation* is also intensified beside market connections, promoting the flow of information and knowledge and the economic coordination of the cluster (Observatory of European SMEs, 2002).
- *Maturity phase*: After the expansion of the cluster, certain strategies grow stronger and these may help the exploitation of the advantages of economies of scale (Sölvell, 2009).
- *Renewal/Renaissance phase*: After a certain period of time the development of the cluster may experience a phase of renewal, which helps sustainability (Sölvell, 2009).
- *Deterioration phase*: Deterioration of the cluster often takes place because of technological, institutional and/or cultural reasons, to which the existing cluster did not adapt appropriately, and has therefore been confined to a former, less competitive state (Observatory of European SMEs, 2002). The cluster is “put in the museum” (Sölvell, 2009), but may also become part of another cluster (Observatory of European SMEs, 2002).

The management of cluster development - characteristically directed from above - outlines different lifecycle features in the domestic practice, both in terms of establishment or the growth paths of clusters. Our research results have drawn up the following phases:

- *Starting phase*: As the establishment of clusters in Hungary is supported from above, the basis of the establishment of an accredited innovation cluster is the *better access to R&D subsidy sources*. The main attractiveness of membership is a position of better preference as regards the EU’s subsidisation policy. Added to this is the greater lobbying power resulting from the organisational background encompassing the common individual economic interests. These are the aspects that typically motivate the organisation of clusters, amplified by the fact that the small and medium enterprises that enter are characteristically forced

into intensive tendering due to their poor capital power. There are also examples of determination of substantive cooperation right from the beginning, to utilise inner synergies, to supplement one another's activity and portfolio in order to implement the innovation and market targets. From the aspect of further development it is especially favourable if the organisation of clusters is the result of the substantive cooperation of the members dating back earlier, based on a well proven network of connections.

- *Growth phase:* The bottleneck of starting down the growth path is - mostly attributed to cultural reasons - the establishment of an *atmosphere of confidence* and the *sharing of information, knowledge and experience* based on this. This latter is a fundamental condition for the establishment of strategic cooperation based on mutual market interests beyond the aspect of access to tendering opportunities. Creating an atmosphere of confidence proves to be especially difficult for clusters which do not disallow market competitors from being members. Cluster management organisations conduct different practices with regard to the significance they attribute to formal and informal mechanisms among members to strengthen confidence. Among the characteristics of the growth phase strategic cooperations, common projects, the increase of memberships, opening to players of other areas or towards cooperation with other clusters can be found.
- *Maturity phase:* Because of the causes mentioned earlier, clusters in Hungary find their way to this stage with

increased difficulty. In the phase of maturity, the cluster operates in a self-sufficient manner. The market's requirements generate the innovation ideas and the common projects aimed at the implementation of these. The resources required for the operation of the cluster management are generated from the sale of the mutually developed and marketed cluster products and services and the increasing cluster membership is actively seeking cooperation opportunities without the help of the supporting activities. An active intra-cluster cooperation is typical of this stage, whose positive attributes may be the development of the network of connections to external markets and the acquisition of positions in those markets.

- *Deterioration phase:* As the Hungarian accredited innovation clusters have a relatively brief history to look back on, there are no experiences available for evaluation of deterioration as a consequence of inability of renewal or improper adaptation. The domestic practice rather supports that if the cohesion force remains solely the access to tender sources, then the lifecycle of the cluster will be a short lived and unsuccessful one.

3.1 Cluster development in Hungary

Szanyi (2008) studied the steps of the domestic cluster development process based on the management approach applied. As a first step and as the most difficult task, the *creation of the social capital and confidence* is identified. *Strategic*

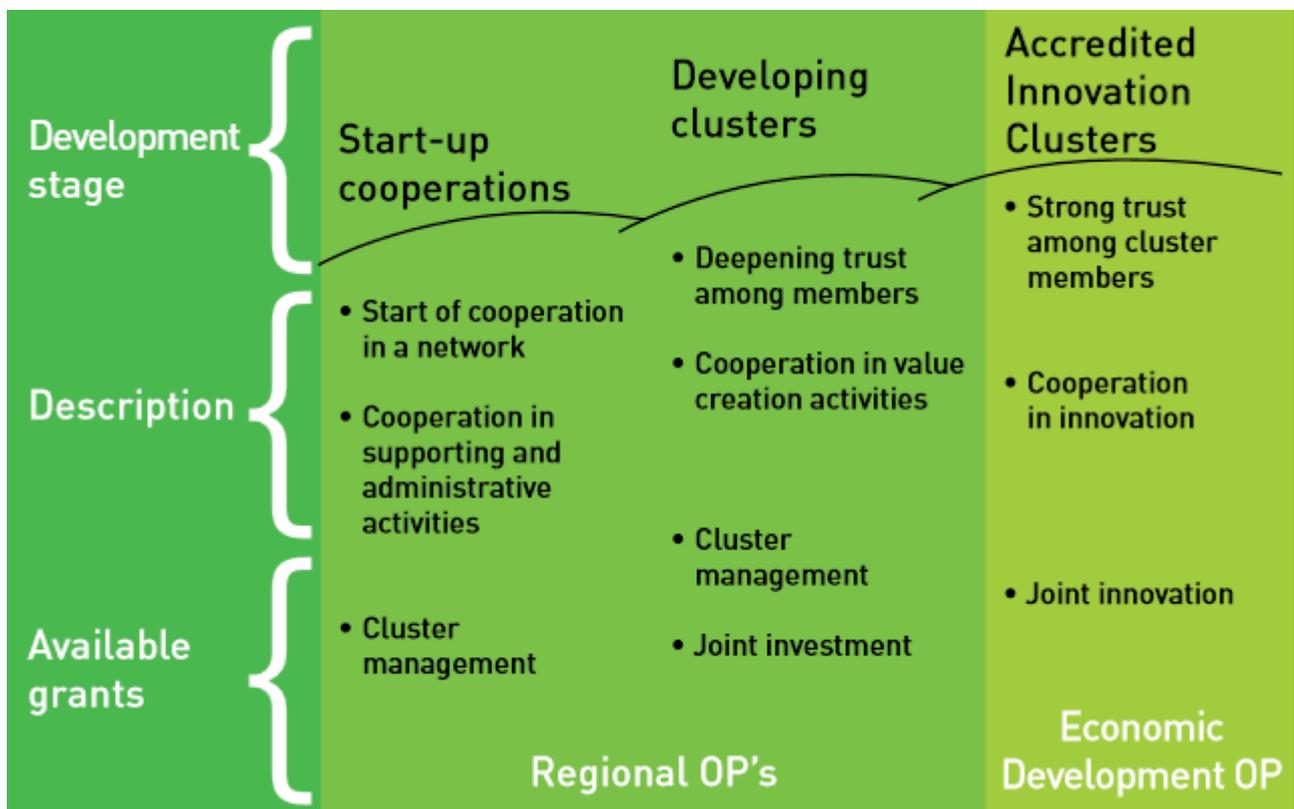


Fig. 1. Multi-stage cluster development model in Hungary (Source: Mag Zrt, 2013)

connections may then be built on these, where Szanyi considers the bridging function of the cluster management and the already existing connection networks of the more active members equally important. The task of building a vision and a strategy is the competency of the cluster management, which is not an easy task with members from versatile backgrounds from various sectors. The *cluster programmes* built on the foregoing support the formation and strengthening of cooperations and last from the research and development phase to the cluster products and services appearing on the market.

Another aspect of examining the domestic process of cluster development is the *directional* approach. In this case, a range of multi-step cluster development systems built on one another seem to have started to evolve from 2007 onwards, as shown in Figure 1.

The first two phases are supported by the regional operative programmes, but while the first step focuses on the start of cooperations and the establishment of the fundamentals, the second one – developing clusters – concentrates on cooperation between enterprises, non R&D asset procurement and common investments. The third step, i.e. the Accredited Innovation Clusters may earn this title at the tender managed by MAG Zrt. (Hungarian Economic Development Centre) and the clusters and the member enterprises may submit tender applications for mutual R&D projects or infrastructural investments within the Economic Development Operational Programme.

4 Research results

In our research we studied the *Accredited Innovation Clusters*. We sought the answer to questions as to what incentives or hindrances in the business environment influence the formation and operation of clusters, what do cluster managers and cluster coordinators identify as advantages of being a cluster member, what are their solutions to support information flow and cooperation, what are the membership criteria and what are the characteristic information, cost and risk distribution practices they tend to follow. To analyse the recorded depth interviews, we used the NVivo qualitative data analysis software.

The *target population* of our research was made up of the innovation clusters which earned or renewed their titles of accredited cluster. The duration of data registration took place between *July 2011* and *May 2013*, during which period a total of 21 innovation clusters earned the title accredited cluster. In our assessment we managed to contact 18 accredited innovation clusters, which is 85.71% of the entire target population (access rate).

As the majority of the Hungarian innovation clusters is concentrated in a few geographical regions, we judged it interesting to examine the regional profile our sample reflected. This is shown on Figure 2.

It can be seen that the majority of the accredited innovation clusters in our sample are from the regions of Budapest, Szeged

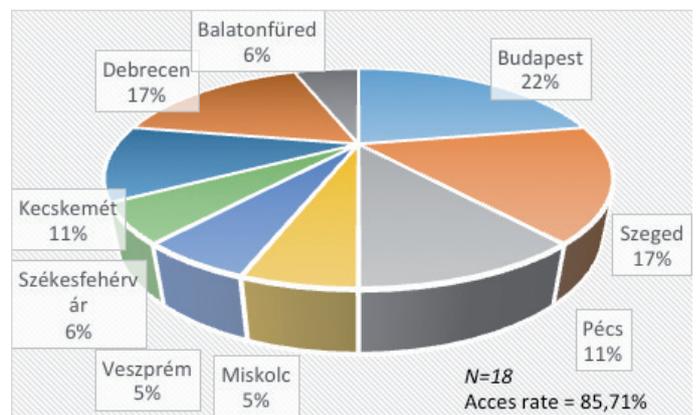


Fig. 2. Regional profile

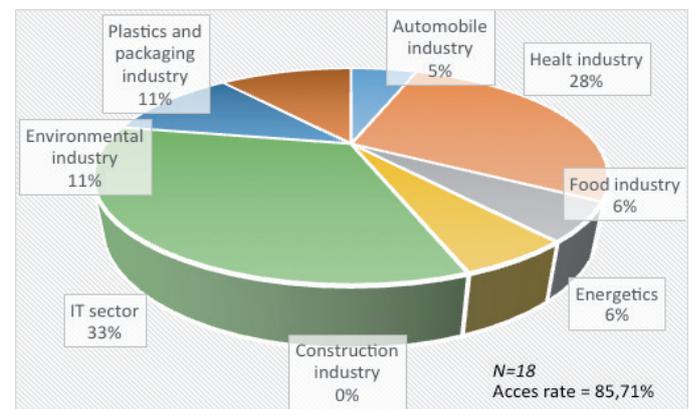


Fig. 3. Industrial breakdown

and Debrecen. This is not at all surprising, since the fundamental conditions we mentioned earlier at the description of the cluster lifecycle phases (raw materials, number of SMEs, infrastructure, etc.) are more accessible in these more developed regions.

The industrial breakdown of our sample was the following (Figure 3): 33% of the clusters contacted operated in the IT sector (ICT²), 28% in health industry and 11% in the plastics and packaging industries respectively.

The data reflect the dominance of *the IT and the health sectors*. Most popular are clusters oriented towards ICT. This can be attributed to the “trendy” nature of the sector at present, the rapid diffusion of innovations as well as the diversity and the fluctuating nature of the market. In addition, domestic companies also show a strong presence in these two areas, this is an especially common field among the start-ups³ and SMEs,

² This acronym is the abbreviation of Information and Communication Technology and is also used as infocommunication technology.

³ A start-up is understood as a newly started knowledge intensive company which generates rapid growth at relatively low capital and labour investment levels. Beside this, it is able to provide a service or is able to introduce a progressive new product to the market with the help of which it achieves quick and significant growth.

while the health industry possesses a significant history of innovation, resulting in a strong motivation and cohesion force among the companies of this area to regain their previously lost market positions.

As the fundamental cornerstone of clusters is the system of connections and cooperation among the members. We highlight in the following the research results which introduce the broader as well as the more focused business environmental effects influencing cooperation and the directions of information flow with regard to the internal and external connection networks of the clusters. And last but not least the lifecycle characteristics of the innovation activities resulting from the system of connections and the cooperation.

4.1 Macro-environmental factors determining the operation of clusters

Based on the answers recorded during the depth interviews the macro-environmental effects influencing the operation of the domestic clusters are the following:

- *Political and legal environment:* The cyclical nature of politics is experienced by clusters as a negative influence (*Gábor Lemák*, interviewee: “*A change of government has a very strong impact on cluster formation*”), but the accreditation and its continued development are regarded as positive factors. The existence of the tenders where only clusters having previously earned the title of being accredited may submit applications is regarded positively, while some of the darker aspects of this have also been brought to the surface. While tenders do remedy the lack of financial resources, they also limit the room for movement of the clusters as they do not motivate the cluster members to organise themselves on a market oriented basis. The leading time of tenders also has a negative effect as the longer period makes it uncertain that the tenders announced three to five years back – especially in the ICT sector characterised by rapid changes – remain marketable. As a further external danger, the uncertainty of the accessibility of the financial resources, the ambiguous tender announcements, the bureaucracy in the tendering system and the increase in the taxes and duties of the SMEs were mentioned.
- *Economic environment:* The clusters experience as a negative effect the uncertainty caused by the economic crisis, which greatly limited the innovation possibilities of a very large number of Hungarian SMEs. The lack of appropriately qualified experts was also expressed as a problem in a number of cases. At the same time, for the domestic clusters in continuous battle with lack of funding, a credit facility, mostly accessible for SMEs may be helpful as well as the infrastructural development of certain regions (construction of industrial parks, roads, etc.).
- *Social environment:* Another jeopardising factor influencing the operation of the clusters is that the majority

of domestic enterprises do not yet possess the appropriate organisational and cooperation culture. This may be expressed by managing directors not delegating certain decision competencies to their subordinates, having a decelerating effect on the development of connections. The cooperation among the universities and the industrial sectors is still not intensive enough and the lack of mobility of the workforce is also a potential danger the operation of a cluster is exposed to.

- *Technological environment:* The continuously changing market requirements generate development trends that hold significant opportunities for clusters and the governmental development policy is also supportive in this regard. A characteristic of Hungarian clusters and enterprises is that they have a large number of licenses coupled with a high level of development of technological infrastructure.

4.2 Factors supporting and hindering cooperation

The significance of clusters lies in the realised cooperations and the market connections that evolve from them; because of this, our study thoroughly investigated the factors supporting and hindering cooperation. Our results are shown in Figure 4.

It can be seen well on the summarising diagram that the operation of clusters is implemented under the influence of a number of factors that support the formation of cooperation between members and organisations. These factors are the following:

- The events organised by the Cluster development office of MAG Zrt. (Hungarian Economic Development Centre) offering opportunities for cluster management organisations as well as cluster members to get to know other, similar organisations are listed among the *macro-environmental* effects. This is a good incentive for contact building and promotes information flow among the participants. Accreditation also has a supporting effect on cooperation as a cluster that submits a tender for the title must satisfy certain criteria, such as the share of common projects that have been implemented.
- The supplier programmes that enable cluster members become suppliers of multinational companies are classified among *cluster management* impacts. This may help them earn certification systems (such as ISO) which ensure the quality operation of management level activities, having a benevolent effect on cooperation. Informal meetings organised by the cluster management (ruin pub meetings, Hi-tech Pub⁴), such as prototype competitions and scope workshops are also solutions aimed at promoting cooperation.

4 “The “Hi-tech Pub” is the first groundbreaking event of the Mobility and Multimedia Cluster where the members of the MMCluster – and its invited guests – can have discussions in an informal way – with a beer in hand – getting to know new members or each other’s projects. “No neckties” network, enhanced further by “refreshments” and good atmosphere.” (MM cluster website, 2010)

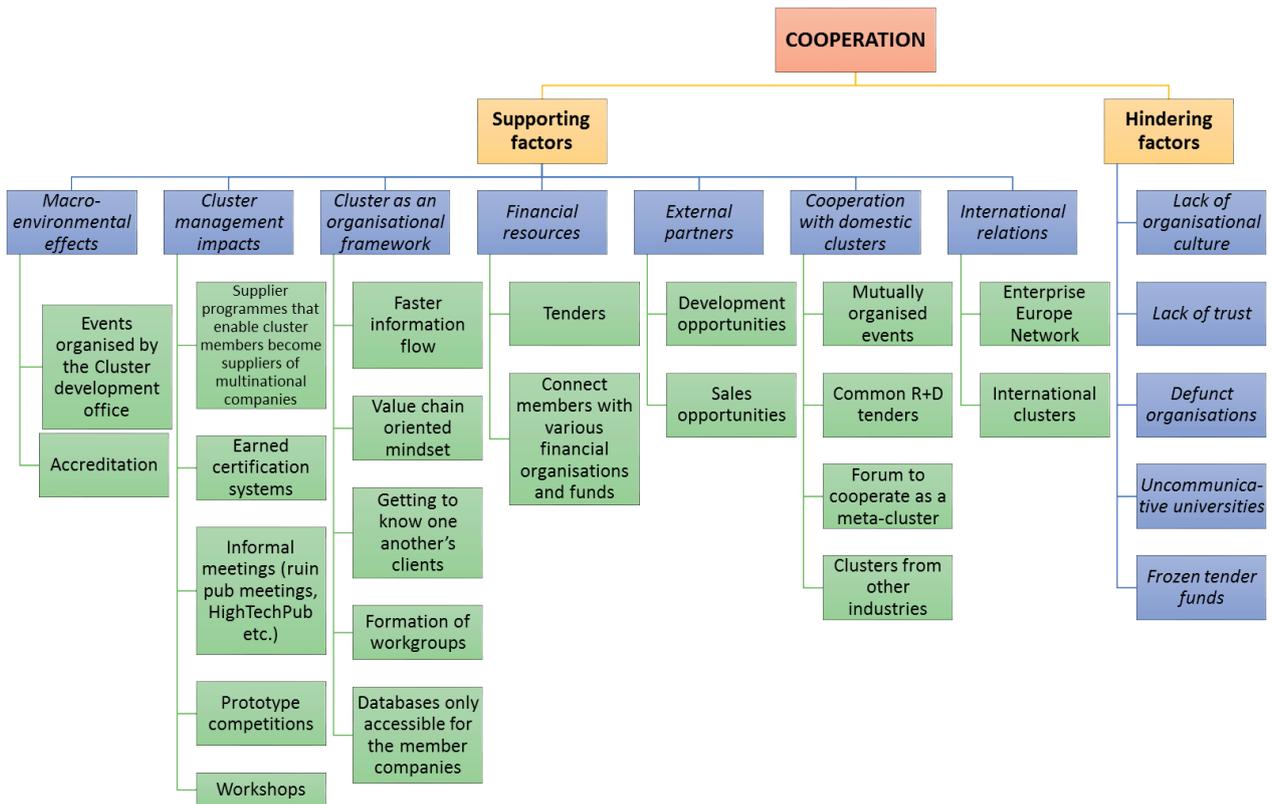


Fig. 4. Factors supporting and hindering cooperation

- The *cluster as an organisational framework* helps intensify information flow among the members as well as promoting a value chain oriented mindset *resulting from its nature*, as a fundamental condition of its operation is that innovation ideas are transformed into marketable products and services. This is supported by the formation of workgroups within the cluster and the databases which are only accessible for the member companies and contain their main data. Many times cooperation is not realised because the companies have no insight into each other's competencies. Getting to know one another's clients is also an incentive, which may also open up the way into new market segments as well.
- *Financial resources*: The various tender opportunities may not only represent financial advantage for the member companies, but may also support cooperation by setting conditions which are only accessible through the implementation of common projects. Furthermore, the cluster management is able to connect members with various financial organisations and funds (e.g. venture capital investors, jeremie funds, etc.) which may be able to provide indispensable funding to implement common projects.
- *External partners*: Not rarely, the factor withholding an R&D project from successful implementation is the lack of certain competencies, knowledge or even routines (e.g. linguistic skills, tender application preparation know-how, etc.), which may hinder successful cooperation.

These problems may be overcome by the cluster using external market players – typically educational institutions, R&D organisations but even consultancy companies, whose role may not only be significant in innovation projects, but in the sale of the developed cluster products and services.

- As a result of *cooperation with domestic clusters*, intra-cluster projects and cooperations often evolve, creating further opportunities for the member companies. These are supported by the mutually organised events (conferences, workshops, etc.) that serve as meeting and information exchange points for the members of the specific clusters. Furthermore, the clusters operating in identical areas – this is typical of the IT industry – may create a forum to cooperate as a meta-cluster of the industry, increasing their competitiveness and lobbying power. Beside this, examples of intra-cluster cooperation can also be found, which are not implemented within an industry sector, but are closely linked to one another's profile, for example from the user side (e.g. cooperation of the IT cluster and the automobile industry cluster).
- *International relations* may also have a supporting effect on cooperation within the cluster, as they may introduce international aspects, factors and in favourable cases, even funding into the life of the cluster, which may be of definitive significance from the perspective of expansion as well as innovation.

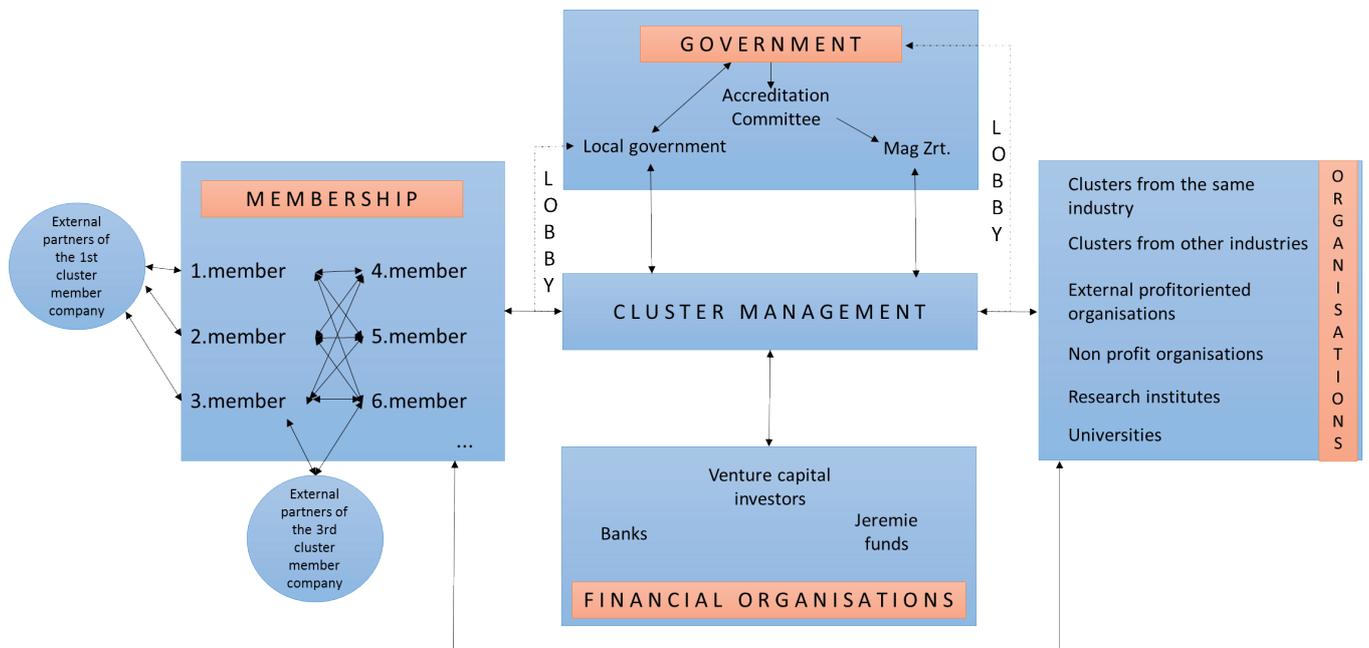


Fig. 5. The directions of information flow

The following factors hinder cooperation activities within the clusters:

- The *lack of organisational culture* and the lack of confidence are significant obstructing factors of cooperation, especially when member companies are competitors of one another.
- *Defunct organisations*. In a number of cases, cooperation failed because of the termination of a partner organisation, such as an enterprise, but examples of terminating clusters can also be quoted.
- *Uncommunicative universities*. Cooperation with the world of science is often hindered due to the “ivory tower” mindset and behaviour characteristic of some Hungarian tertiary educational and research institutions.
- *Frozen tender funds*. The majority of the clusters and the cooperations are implemented from the tenders they have won. If, however these resources – as described in chapter 4.1 – are depleted or arrive with a delay, they often result in the failure of the common projects.

4.3 Information flow

An important aspect of the examination of clusters is the mapping of information flow. Because sharing information could be the key issue in implementing common projects, and it is essential for cluster management in measuring effectiveness as well. The management has to know the path and channels of information flow between members and has to explore the hindering and critical factors of it, in aim to offer services (e.g. develop communication software for members) which can support information and knowledge share. At least as important in the examination of information flow are the external relations

of clusters, including the government, financial investors or other innovation clusters.

As mentioned earlier, a condition of efficient cooperation is an atmosphere of confidence and the information and knowledge sharing based on it. In our research, we therefore thoroughly focused on the mapping of the directions and channels of information flow. Considering the densely knit internal and external connection network of the clusters, the introduction of this is not a simple task; on Figure 5 below we nonetheless try to show the directions of information flow identified during our research and its points of connection among the players.

According to Figure 5, the most intense information flow takes place among the cluster members. At the same time, thanks to this, the external players also appear in the information flow, who become participants of certain development or sales processes due to the connection network of a member company outside the cluster (as shown on the left side of the diagram). The diagram also demonstrated the *bridging function of the cluster management* as well, as it appears as a link between the members and the financial organisations and the members and the external, non-member organisations. It can also be seen that the cluster management attempts to influence the government through a lobbying activity, determining the accreditation processes and the directions of cluster development. Beside this, the cluster management also plays a significant role in the information flow towards the region’s local governments and it can also be seen that due to the cooperations already implemented, the members may also exchange information with external organisations independently (research institutes, universities, etc.).

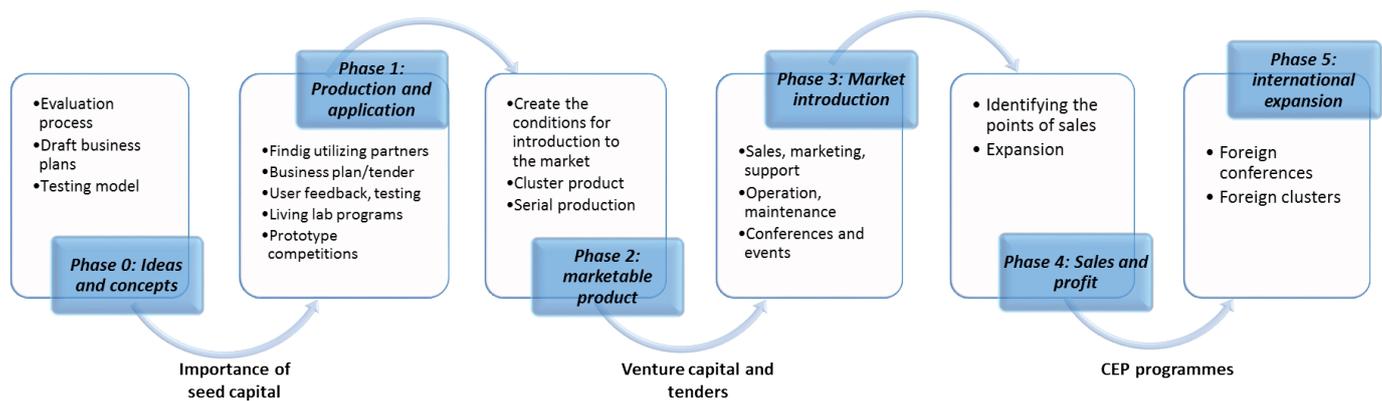


Fig. 6. Innovation lifecycle in clusters

4.4 Innovation lifecycle

The end goal of the innovation clusters is that cooperations, thanks to the well managed connections, the partners are able on the one hand to integrate competencies and resources and on the other hand they can also help one another in the successful market utilisation of innovative solutions. Therefore, as a main direction of our research we have outlined the innovation lifecycle in which the clusters are able to utilise their contact bases. This is shown in Figure 6.

The innovation activities appearing in the clusters can be broken down to 5+1 phases. *Brainstorming and working out ideas is treated as a Phase 0* in which the ideas and concepts coming to the cluster are assessed by an evaluation process. The affected member companies, the cluster management and even an external evaluation body may participate in the appraisal. The draft business plans corresponding to the specific ideas are prepared in this phase; including the “testing model”⁵ that demonstrates the functionality of the plan.

The first phase of the cycle is *prototype manufacturing*, during which not only the preparation of the production of the prototype takes place, but the entire business plan is elaborated. This is the phase where tender opportunities are already being sought and the prototype is also tested. The living lab⁶ programmes during which the user feedback gets back to the designer team further help testing. Prototype competitions also appear as cluster management solutions (mainly in ICT clusters), where the prototype owner small businesses are given

a chance to introduce their new solutions to the managers of multinational companies, which, given a successful positioning may result in mutual utility. This solution again underlines that cooperations of broad platforms can significantly contribute to the market utilisation of R&D ideas. *Seed capital*⁷ also plays a significant role in the zeroth and first phase.

The *second phase targets the production of the marketable product* and to create the conditions for introduction to the market. In this phase the “cluster product” appears for the first time, which is generated as a result of the accumulated common knowledge and the implemented cooperation. In this phase, the process of seeking financial resources starts (venture capital and tenders) which enable serial production and preparation of sales.

The *third phase is the market introduction phase*, during which the appraisal points are evaluated and the marketing activity is also commenced. The cluster management has to undertake significant supporting functions in this phase; they appear at several conferences and events, introducing the product. In this phase, the participants do not make any profit yet; the role of tenders in sustaining the project is significant here.

The *stage of the sales phase is the fourth phase of the innovation cycle*, during which the circulation of the product or service starts at the identified points of sale. In this phase as well as the last phase, the so-called CEP programmes appear⁸ which provide support in introducing the innovation to the market and sustaining the programme.

⁷ Provided for the purpose of enabling the owners of the idea to elaborate their business concepts, evaluate the potential markets and the required actions for the launching of the business activity and to prepare the business plan.

⁸ CEP = The Central Europe Program is a programme of the EU, promoting cooperation among Central-European countries. It is targeted at promoting innovation, improving the business environment and the intensification of the competitiveness of the cities and regions in the programme territory. The programme extends to the following countries: Austria, the Czech Republic, Germany, Hungary, Italy, Poland, the Slovak Republic, Slovenia and Ukraine.

The innovation lifecycle's *last phase is the phase of international expansion*. This is the phase where the introduction of the product/service to foreign markets takes place. In this phase, beyond the CEP programmes support is also provided by the services of the cluster management and the already established foreign connections (e.g. attendance of foreign conferences, involvement of foreign clusters in the sales).

The innovation lifecycle of clusters is accompanied all the way through another factor, i.e. time. Nowadays time-based competition determines the operation of enterprises (Kalló and Koltai, 2008), and it has a decisive role in the area of innovation as well (de Toni–Meneghetti, 2000). It is very important that the phases start and end with appropriate timing as the implementation of a newly introduced, marketable idea may not take more than – depending on the industrial sector – a few years.

5 Conclusion

Innovation clusters provide a broader cooperation platform than networks. They offer possibilities to profit oriented enterprises and non-profit organisations to engage in activities aimed at utilising innovation potential, to share their information and experience and to integrate knowledge. This is especially significant from the perspective of developing connections between universities and the industry sectors. Smaller enterprises are able to concentrate their resources and make use of the market connections of multinational companies while preserving their independence and also supplying the multinationals with new innovation ideas and supplier opportunities.

The cooperation of clusters in identical areas may greatly contribute to increasing the competitiveness of the industry while the trans-sector intra-cluster connections promote opening innovations and strengthening the connection between manufacturers and users. Cooperation with local governments and regional development organisations is also significant from the aspect of implementing regional goals.

The governments and regional organisations of developed market economies – having recognised these advantages – have welcomed and shown a preference for the organisation of clusters; they look at them as a certain asset with which to respond to challenges of globalisation. Albeit with a delay of some years, the process of cluster development has begun in Hungary too, and although it is organised from above, the term “cluster” is drawing increasingly greater attention in the corporate sector as well as at supporting institutions.

With our research, we have pointed out the external environmental and the internal organisational factors which may help or hinder the process of organisation of clusters in Hungary. We have also highlighted that the effect of accreditation is positive with regard to better access to financial resources and the implementation of common projects as a condition of the former. On the other hand, the characteristically non-market based organisation has a decelerating effect on cooperation, amplified

by the lack of cooperation culture, the lack of confidence and the negative attitude towards knowledge sharing. All these effects are apparent in the domestic characteristics of the lifecycle of a cluster.

The intertwined internal and external network of connections and the multi directional information flow make the bridging function of cluster management especially significant. Cluster management organisations may help the evolution of the atmosphere of confidence and support cooperation with formal as well as informal mechanisms – informal meetings, workgroups, workshops, etc. - and such initiatives can even be observed from directional bodies.

With the introduction of the lifecycle phases of the innovation activities appearing in clusters we also intended to demonstrate that the cooperating partners can help one another in the market utilisation of the innovation ideas as well as in finding solutions to market opportunities, user requirements and R&D ideas.

There is a need for further research to explore the motivation of cluster members and to map their experience according to their different characteristics (SMEs, multinational companies, start-ups, non-profit institutions etc.). Based on the Triple Helix model⁹ we would pay special attention on how innovation clusters can create closer cooperation between areas like R&D institutions, businesses and governments. On the basis of the results of qualitative research we plan to examine the innovation impact and the market orientation of the innovation clusters by a quantitative (survey) research.

⁹ This model refers to a spiral (versus traditional linear) model of innovation that captures multiple reciprocal relationships among institutional settings (public, private and academic) at different stages in the capitalization of knowledge.

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