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COLLECTIVE IDEATION WITHIN THE CONTEXT OF SCIENCE AND TECHNOLOGY PARKS AND REGIONAL ECONOMIC CLUSTERS

Lotte Geertsen (C.H.E)
TMC Manufacturing Support, Flight Forum 107, 5657 DC Eindhoven,
The Netherlands, lotte.geertsen@tmc.nl

Ger Post (G.J.J.)
Fontys University of Applied Science, Rachelsmolen 1, 5612 MA Eindhoven,
The Netherlands, g.post@fontys.nl
corresponding author

Abstract: A central element in the theory of clustering is the idea that physical clustering of businesses within specialized sectors is a source for regional economic growth. The spatial proximity of companies and institutions within related industries create a specific setting in which learning, knowledge sharing and mutual competition are encouraged. Additionally, active participation within the innovation eco-system of a Science & Technology Park provides actors access to knowledge, facilities and complementary contacts and network structures. Collective ideation helps an organization to improve the positioning within the technological field and economic market, especially within an innovation ecosystem because actors are dependent on each other's behaviour to be successful in innovation. This research focuses on the question how to design the collective ideation process in particular to foster interactions within the context of a science & technology parks? This research is based on semi-structured interviews, conducted at all development stages (idea, startup, grow and mature) of Dutch science & technology parks with stakeholders from different perspectives, based on the triple-helix structure (government, industry, research). The study describes how multiple stakeholders benefit from collective ideation, what mechanisms and tools are used in practice and also describes prerequisites and limitations of collective ideation.

Keywords: business innovation funnel; collaborative ideation; innovation ecosystems; open innovation; science parks

JEL codes: D85, O31, O32, O38, R11

1. Introduction

Over the past decades there has been a lot of attention, both from academics as from policy makers, for regional economic systems (Asheim et al. 2011). Scholars and practitioners in this domain describe innovation as a socio-economic process and point at the impact of geographical conditions influencing the development of social and institutional networks and inter-organizational collaboration. The knowledge and network economy brings along the need for collaboration between triple-helix stakeholders, and in some cases involving end-users (consumers) in product development and even R&D. In order to facilitate multi-stakeholder collaboration and joint-research many regions have been developing Science & Technology Parks (STPs) where universities, research organizations, large and international companies and SMEs can meet, share ideas and knowledge and collaborate in technology and business development.

For most SMEs formal R&D is out of reach due to financial and human resources. Yet these companies can play an important role in the translation of market needs in business development and the adoption of novel technologies and business models. Territorially agglomerated clusters organized at and in the proximity of STPs can facilitate connectivity, contact and collaboration between these companies and other triple helix stakeholders.

Science and technology parks (STPs) are physical working locations offering a specialized infrastructure and support services to companies (startups, SMEs and large industries) and R&D organizations and universities which aim to collaborate in the development of knowledge and technology, and the application of these in new business concepts and innovation in the marketplace. Albahari et al. (2017) define STPs as property based initiatives, designed to encourage the formation and growth of on-site technology and knowledge-based firms, and that have a management function actively engaged in achieving these goals. STPs tend to have formal arrangements and operational links with research centres or university labs, in many cases located on-site, which enable technology transfer, and that contribute to the development of regional clusters of innovation. STPs, varying in scope and size, are important policy instruments for innovation policy in many countries. National and regional governments often support the development and exploitation of STPs through various financial and fiscal incentives.

A central issue addressed in the research of regional innovation systems has been the relation between spatial distance, knowledge transfer and knowledge spillovers. Knowledge sharing, collective learning and collaboration are facilitated by proximity. Research indicates that private enterprises benefit from the presence of public sector research and vice versa. Spatial proximity facilitates the transfer of knowledge via education and formal university-industry collaboration.

The physical dimension of proximity is a key element of the policy of an innovation cluster or STP. A central element in the theory of clustering is the idea that physical clustering of businesses within specialized sectors is a source for regional economic growth (Porter 1998). The spatial proximity of companies and institutions within related industries create a specific setting in which learning, knowledge

sharing and mutual competition are encouraged (Raaijmakers 2012). Additionally, active participation within the innovation ecosystem of a STP provides actors access to knowledge, facilities and complementary contacts and network structures (Post 2009).

As physical (or geographical or spatial) proximity has its impact on interaction, learning and innovation, it also has its limitations and cannot be assessed as a stand-alone panacea that offers the solution to all collaborative issues and hurdles in practice. Boschma (2015) claims that geographical proximity per se is neither a necessary nor a sufficient condition for learning to take place. To some extend it facilitates interactive learning, most likely by strengthening the four dimensions of proximity: cognitive, organizational, social, and institutional proximity. Others point at the importance of cultural proximity also. Conducting business with culturally close partners lowers uncertainty, and facilitates acquiring and sharing tacit knowledge (Schmitt & Van Biesebroeck 2013). According to Boschma too little, but also too much proximity may be detrimental to interactive learning and innovation (Boschma 2015).

Building on previous research on organizational learning Lawson and Lorenz (1999) have developed a conception of collective learning among regionally clustered enterprises and illustrate the importance for innovation of a regional capability for combining and integrating diverse knowledge, and of the sources of such capabilities as pre-conditions for successful high technology regions. In this concept of collective learning the capabilities of regionally clustered firms are understood in terms of the existence of shared knowledge, regional level routines and the capabilities of firms to combine and recombine diverse knowledge. Lawson and Lorenz consider diversity of knowledge to be important to an organization and regional clusters as companies tend to look for new knowledge and technology in close proximity to the organizations' existing knowledge and technology base. This is linked to the theories of Nelson and Winter (1982) who claim that new knowledge needs to be incorporated into existing firm's routines and knowledge base. In many cases this process follows an incremental path and radical renewal of firms' knowledge is hindered by 'organisational inertia' (Lawson & Lorenz 1999).

One way of overcoming this organizational inertia of knowledge renewal is to broaden the diversity of knowledge and creating a collaborative setting where this knowledge can be shared and reproduced by multiple parties. At STPs knowledge workers from different companies, universities and other organizations can meet and exchange knowledge and ideas in order to accelerate and improve the development of innovative success (Post 2013). However, scholars do not agree on whether to structurally manage the fuzzy front end of innovation or rather let it be the result of accidental encounters (Birkinshaw et al. 2011). Overall, in essence innovation is about bringing together 'neue Kombinationen' (Schumpeter 1934). How do these new things come together? Is it only by informal contacts and by accident or can this sharing of ideas be structurally well organized?

Companies looking for innovative success and regions focusing on solutions for social and societal problems, both need to work on incremental innovation and breakthrough ideas, which can be achieved through collaboration. This starts at

the idea generation phase of the innovation value chain (Hansen & Birkinshaw 2007). Here collaboration can also defined as 'collective ideation' (Harvey 2014) and is characterized as extraordinary group creativity (Cotton et al. 2011; Ericscson et al. 1993; Robers et al. 2005). This group creativity output improves when there is a greater variety of resources that give input and by that raises the chance of a breakthrough idea (Harvey 2014). If this is only a random process a breakthrough idea is treated as an exception, which is not preferable (Harvey 2014). Moreover, stakeholders should get into conversations and integrate their opinions and perspectives to achieve cross-fertilization (Harvey 2014). And so collective ideation helps an organization to improve the positioning within the technological field and economic market (Alexy et al. 2013), especially within an innovation ecosystem because actors are dependent on each other's behaviour (Adner 2012; Pisano & Teece 2007) to be successful in innovation (Stam 2009; West 2003).

Regional competitiveness and sustainable economic growth are very much dependent on social networks, trust and environmental conditions. The yield of these resources can be increased through network structures and collaboration. Therefore there should be a centre of attention on how to design a well organised system of valuable interactions between actors at STPs. In other words, these interactions are important to succeed in innovation ecosystems, because you need to build connections, set limitations of the current capabilities, set standards and also establish leadership (Zahra & Nambisan 2011). This research will focus on the relationships of actors since it is acknowledged that generation of new ideas increasingly result from accidental or unexpected encounters and collisions of knowledge domains that seem to have nothing in common at first sight.

Collective ideation makes it possible to develop these complex connections that were previously unrelated (Bartunek et al. 1983; Bledow et al. 2009; Koestler 1964). Unfortunately, this process has been receiving too little attention in practice and the sharing of knowledge in processes of collaborative ideation is underutilized due to a number of reasons, including the lack of collaborative atmosphere, cultural differences and formal arrangements (Smulders 2013; Post 2013). We may hypothesize that, in addition to the focus on spatial proximity, STPs and its stakeholders could benefit from investments in the other dimensions of proximity, like cultural proximity.

Therefore it is important to examine collective ideation since it increases the chance on breakthrough ideas as it shapes the collaborative behaviour of different external actors. This is done by involving knowledge and competences outside the organization (Alexy et al. 2013). And so it is important when knowledge is to be revealed, to examine the essential issue of how to design the process so that it maximizes innovative success (Alexy et al. 2012).

This research focuses on the question how to design and organize the collective ideation process in particular to foster interactions among the actors of STPs. We aim to describe the potential benefits of collective ideation considered by STP stakeholders and also want to identify the limitations of the concept. In addition to this we also aim to describe strategies and mechanisms used in practice and/or described in literature.

This research contributes to consisting literature in three different ways. First, this research builds on theory on how to produce ideas as it offers an structural overview of the process and of the underexplored process-based facilitators (benefits, boundaries, strategies, mechanisms, deliverables) in the process of collective ideation (Harvey 2014). So far there is not much attention paid to how multi-stakeholder networks use the resources that facilitate group creativity (Harvey 2014). Second, this research provides a new template of collective ideation and a new design of the creative process at the group-level (Harvey 2014) and how this can be embedded in innovation strategy (Alexy et al. 2013). It adds new insights on how these networks can be governed successfully (Alexy et al. 2013) both from the perspective of an individual firm as from the regional policy level. Third, the concept of collective ideation is empirically tested at STPs which provides a new framework that will help platforms to become more successful (Gawer & Cusumano 2014). In other words, this research contributes on how to organize innovative activity and open innovation in practice (Alexy et al. 2013; Chesbrough 2003; Dahlander & Gann 2010; Laursen & Salter 2006).

2. Theory

Innovation is a development process that is triggered by market opportunities, societal needs and inputs from basic and applied research which leads to the creation and introduction of new products or services on the market. The innovation value chain of Hansen and Birkinshaw (2007) is built up in three different phases: Idea Generation, Conversion (concept, prototype, engineering) and Diffusion (market).

It all starts with the idea generation phase where ideas are generated in three possible ways: (1) In-house: ideas are generated within a unit, (2) Cross-pollination: ideas are generated through collaboration across units and (3) External: ideas are generated in collaboration with parties outside the firm. One of the fundamental reasons why two firms combine their resources is to create value by pursuing the potential synergy between them. This external idea generation, hereafter referred to as collective ideation, depends on so-called inter-organizational relationships, which are important for the flow of new knowledge (Zahra & Nambisan 2011). In this phase companies try to generate high-quality ideas from outside the firm. This external approach asks for interfaces to be sufficiently 'open' in order to allow other outside firms to 'plug in' complements and at the same time improve and innovate these complements and make money from own investments (Gawer & Cusumano 2014). This belief is in line with prior research about open innovation such as Chesbrough (2003) and von Hippel (2005). However, it also pinpoints important tradeoffs between the complexity of 'open', or collective ideation, and 'close' innovation. Several researchers suggest that opening up these interfaces results in increasing the complementors' incentives to innovate (Gawer & Cusumano 2014).

The fuzzy front-end of innovation consists of scouting and ideation. The concept of collective ideation in this fuzzy front-end is a dialectical model that understands collective processes and recognizes a constant struggle between conflicting

forces which act as drivers of change and novelty (Hegel 1977; Marx 1967). In this model people engage in social interactions from diverse views with different perspectives and different understandings (Berger & Luckmann 1966), which needs to be integrated (Harvey 2014). In this model, actors engage with one another which changes their understanding and allows them to develop new ideas. This is visualized in Figure 1.

It is very important that collective ideation is consistently organized as random variation treats a breakthrough idea as an exception, which leads to more incremental innovations instead of radical innovations (Harvey 2014). Next to that, reorganizing knowledge and identifying categories before collectively generating ideas structures creative thinking and results in more original and high-quality ideas (Mobley et al. 1992; Mumford et al. 2003).

Based on the definition above and on literature reviews of Alexy et al. (2013) and Harvey (2014), the following conceptual model of the collective ideation process could be established (see Figure 2). It also includes the different process steps and underlying elements of collective ideation. In the text below the different steps and elements will be explained.

The ideation process starts with a need to collaborate in order to get radical innovations which is more difficult without partners or without using the ecosystem (Alexy et al. 2013; Harvey 2014). Next, 'why' an actor considers collective ideation will be based on weighing both direct and indirect benefits it can deliver (Alexy et al. 2013). Direct benefits can be described as intentionally and active (Alexy et al. 2013). These benefits of collective ideation are expected to be preferred over traditional collaboration models (Ahuja 2000) if there is a high level score on the different elements. Indirect benefits on the other hand can be described as unknowingly and passive (Alexy et al. 2013). These benefits play a subtle but also important role that can lead to unintentional collaborative behaviour (Alexy et al. 2013). Then in the next step, the boundaries or internal and external resources give an answer to 'when' collective ideation is decided to be applied. Internal resources reflect on all aspects and capabilities of the existing organization while external resources reflect on all social and environmental aspects and forces (Alexy et al. 2013; Harvey 2014). Subsequently, the strategy is determined and gives an answer to 'how' collective ideation will be used. A determined strategy depends on a choice between problem or solution revealing (Alexy et al. 2013) and on a choice between path extension or creation (Alexy et al. 2013). This step is then followed by the action oriented step of collective idea-

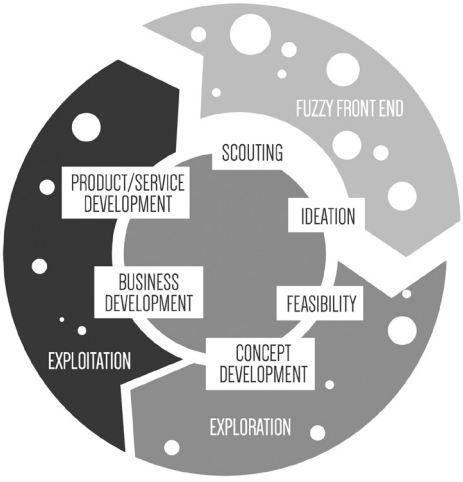

Fig. 1. Open innovation process
Source: Post (2009), Geertsen (2015)

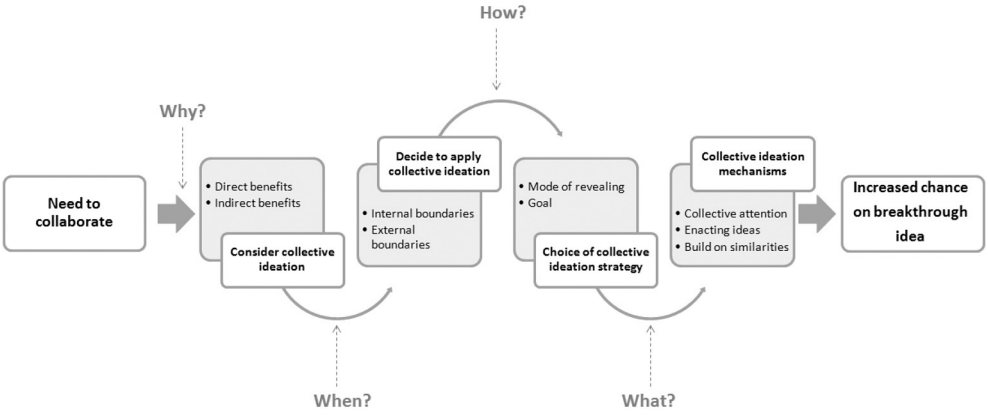

Fig. 2. Conceptual model of the collective ideation process
Source: Geertsen (2015)

tion and 'what' mechanisms are used in this step (Harvey 2014). In the end this process will deliver an increased chance on breakthrough ideas, which lead to radical innovations (Harvey 2014). Furthermore, it is important to consistently follow this process, therefore it can also be seen as a cycle which is constantly restarted.

Having described the concept of (collaborative) ideation we also need to elaborate the concept of STPs and geographically concentrated ecosystems in literature. The ecosystem concept is borrowed from biology where it refers to a complex set of relationships among the living resources, habitats, and residents of an area, whose functional goal is to maintain an equilibrium sustaining state. In nature clustering around a natural drinking place is a result of the scarcity of water in the near environment. Humans and businesses gather in ecosystems for this same reason. 'The presence of (scarce) resources, (natural) sources, (skilled) labor and financial resources explain the emergence of concentrations of economic activity' (Post 2009). In such an ecosystem accidental encounters happen and there is thinking along issues.

Moore (1993) defines an ecosystem as 'an economic community supported by a foundation of interacting organizations and individuals, the organisms of the business world'. Nowadays the following definition is developed with a particular set of elements: (1) dynamic, purposive communities with (2) complex, interlocking relationships built on collaboration, trust and co-creation of value and (3) specializing in exploitation of a shared set of complementary technologies or competencies. Such business or innovation ecosystems are important because you can benefit as a player from relationships around you. And also, helping another player in your ecosystem can help you. This makes ecosystems fertile ground for creating new ventures of different types, both birthing and supporting (Zahra & Nambisan 2011). Moreover, growth has been taking place of innovation ecosystems because of an increase in digital content of products and services and in the number of digital innovations comprising physical and digital components. Within these ecosystems there should be more openness in order to lower the barrier to

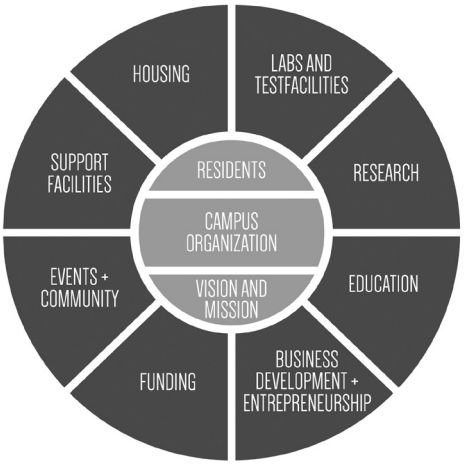

Fig. 3. STP elements
Source: Post (2009), Geertsen (2015)

participate in the ecosystem with limited resources and capabilities (Zahra & Nambisan 2011).

This research will focus on micro innovation ecosystems, hereafter called STPs, which are active on an industry level and include all three elements of the 'triple helix'. The concept of triple helix emerged in the nineties as a novel approach to bridge the boundaries and cultural differences between institutional actors in the emerging and networked knowledge economy and to facilitate collaboration between these actors (Leydesdorff & Meyer 2006). Etzkowitz and Leydesdorff (2000) describe this triple helix as a dynamic and multi-level arrangement that is continuously transforming under influence of change at the individual actors, in the relationships between these actors and in the environment of these helix-partners.

The development and exploitation of a STP often requires close collaboration between industry, university and governmental partners. This collaboration is embedded in a broader regional economic cluster policy and is build on a shared vision and mission of the STP. In accordance with this vision the working area is open for novel residents that link to the STP ambitions and profile. In order to match the shared ambitions the community consists of residents and (frequent and active) participants with a background in industry, research and education, and government agents. In many cases the triple helix partners participate in a collaborative STP site management team that is responsible for the development of the site, its constituting facilities and the shared operations and services offered to residents and visitors. A visualization of the elements of a STP is presented in Figure 3.

There is hardly any scientific documentation on the use of collective ideation at STPs. A case study of how collective ideation is organized within the scope of a STP has been described by Smulders (2013). He describes how collective ideation is organized by bringing people physically together and inviting them to participate in a well-prepared, structured process. He describes this process as a powerful means of generating new ideas and offering solutions that had not been imagined beforehand.

3. Research Design

The aim of this exploratory research is to develop more in-depth knowledge and understanding about the phenomenon of collective ideation, in the specific context of STPs. There is no prior research that investigated this in-depth. The concept of col-

lective ideation at STPs still has many unanswered questions on how it works in the real world and how it can be improved. Through case study research comprehension of the meaning of the concept can be determined (Easterby-Smith et al. 2012). A research design that perfectly fits this kind of research topic is qualitative research as it leads to new integrations and tries to revise the conceptual framework.

The conceptual model of collective ideation is tested at Dutch STPs in the south of The Netherlands with Eindhoven region as technological R&D hotspot and driver of the national economy. Eindhoven region has become one of Europe's prominent high-tech regions in recent years. The region is characterized by very strong high-tech engineering and manufacturing, an outstanding design sector and a unique model of collaboration, open innovation and knowledge sharing. Other regional clusters of national and international importance are focused on agrofood, human health, maintenance, logistics and biobased economy as illustrated in Figure 4. In comparison to Eindhoven region, the western part of Brabant province is far less competitive in the international economic landscape. The levels of R&D, innovation and economic growth in the western part are less prestigious and give rise to worries of policy makers and triple helix partners.

In both parts of the Brabant province the regional triple helix stakeholders join forces to create a successful future by finding solutions to societal challenges in

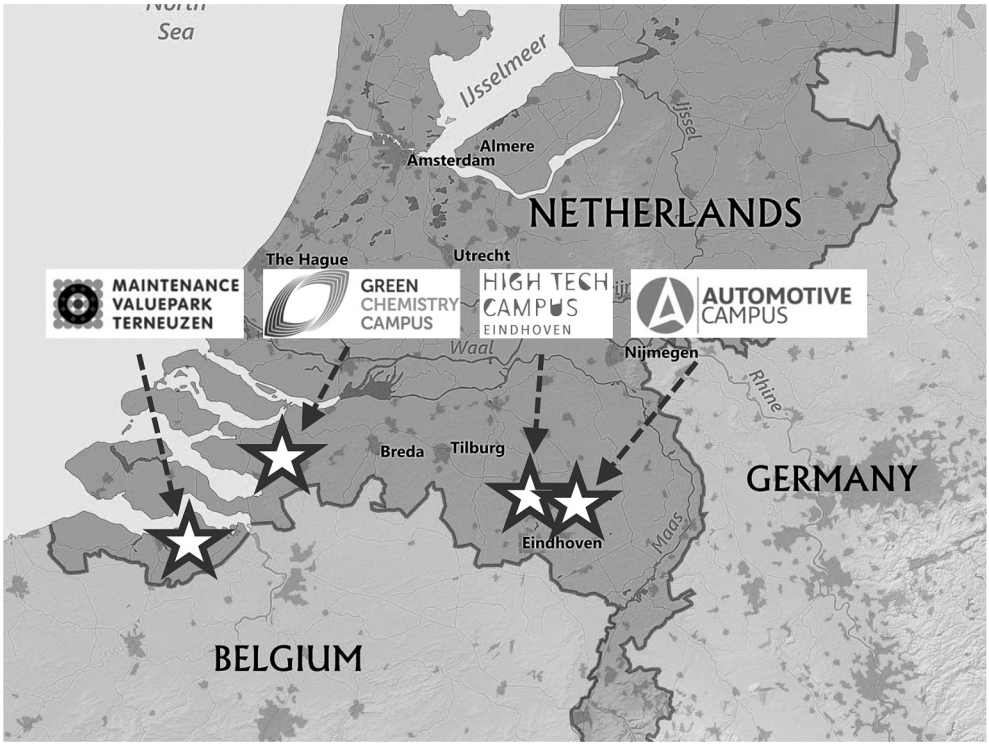

Fig. 4. Science and Technology Parks in the south of the Netherlands
Source: own research

Table 1. Cases selection of Dutch STPs

Name	Location	Development stage	Focus on R&D and/ or technology driven activities	High-quality business environment (incl. research facilities)	Manifest knowledge carrier
Maintenance Value Park	Terneuzen	Idea	Yes	No	DOW Chemical
Green Chemistry Campus	Bergen op Zoom	Startup	Yes, partially	Yes, limited	Sabic
Automotive Campus	Helmond	Growth	Yes	Yes, extensive	PDE, TUV, TNO
High Tech Campus	Eindhoven	Mature	Yes	Yes, extensive	Philips, Holst

Source: Geertsen (2015)

the areas of health, mobility, energy, food and safety. These challenges are tackled with a combination of technology, design and open innovation. Companies with outstanding high-tech competencies and world class research institutes are able to make connections with international OEMs, SMEs and companies from other industries and are thus tapping into global markets that they couldn't previously reach. Collaboration among these key players is facilitated via a range of specialised STPs that attract companies and research institutes on the basis of a shared vision and state-of-the-art research labs and incubator facilities and that promote collaboration between residents and other cluster-actors in the areas of research, innovation and business development

For this research we have focused on four STPs embedded in the regional clusters described above. These STPs are the High Tech Campus in Eindhoven, the Automotive Campus in Helmond, both located in the eastern and high-performing part of the province, and the Green Chemistry Campus in Bergen op Zoom and the Maintenance Value Park in Terneuzen, both located in the western and less competitive regions. The combination of these parks is considered to be representative of the mix of economic climates in the province. The locations of these parks is illustrated in Figure 4.

These STPs are distributed over four different stages of development ranging from idea, startup, and growth to mature. Within the context of STPs in the Netherlands the unit of analysis is both the system of collective ideation within this environment and also the interactions between different actors during this process.

This research holds a multiple case study of 16 semi-structured interviews, conducted at all development stages (idea, startup, grow and mature) of Dutch STPs with stakeholders from different perspectives, based on the triple-helix structure (government, industry, research). An overview of the cases is given in Table 1. An overview of the respondent categories is given in Table 2.

Before the actual interviews were held, two pilot interviews were conducted to test the accuracy of the conceptual model and the interview questions. The situation and context were clearly framed at the beginning of each interview so that all respondents gave answer regarding external idea generation with external parties within the environment of the STP. Moreover, all 18 interviews were recorded and

Table 2. Respondent categories at Dutch STPs

Category	Respondent
Government	Campus management
Industry – 1	Campus resident – start up or SME company (up to 50 FTE)
Industry – 2	Campus resident – large company (>250 FTE)
Research	Education or Research Institution

Source: Geertsen (2015)

every respondent received an interview report and was asked to check if the content from the interview is correctly interpreted. In addition, different sources of data such as informative documents are gathered to appropriately answer the question (Baxter & Jack 2008) and triangulate the data. All interview transcripts are coded with use of the qualitative analysis software tool Atlas.ti (Microsoft version).

4. Results

In this results section a clear summary is given of the most important collected data on how to design the collective ideation process. The results are presented based on the four elements of the conceptual model.

WHY: reasons to consider collective ideation

As there are different reasons to consider collective ideation, the first question is: 'Why do you use collective ideation?' In Table 3, the most important answers from all respondents are given.

Table 3. Motivation for collective ideation (highest scores)

	Benefits
New knowledge	To achieve complementary knowledge & technology developments
Synergy	To jointly produce a combined effect greater than the sum of its parts
Purposeful learning	To learn as an individual and as a company from the experiences

Source: Geertsen (2015)

It becomes clear that new knowledge is the most desirable benefit to gain from collective ideation since is gives participants new complementary knowledge and insights about technology developments from other participants. The following quote confirm this:

> *'That is the drive for innovation, the knowledge or solution you do not have and which someone else could have, but he or she does not know you are looking for it.'* (Respondent #01)

Next to that, the synergy level is also considered an important benefit as you need your partners within the Science & Technology ecosystem to be able to jointly

produce a combined effect that is greater than the sum of their separate effects. If you do this with the community in a short time-to-market process you can stay ahead of competition. This is illustrated with two quotes:

> *'I think it is still and an advantage that you get people together and try to achieve new steps together and support each other. Then you also have the opportunity to build a larger business case'* (Respondent #08)

And:

> *'And then you see that it really is a must to work together to achieve integrated solutions and that is what we all go from. On your own you cannot get more solutions. So there is a necessity.'* (Respondent #03)

Also the element and awareness of purposeful learning is an important benefit within collective ideation as you can learn as an individual or as a company from the experiences you gain through the process has a lot of impact on how you. This is illustrated with the following quote:

> *'What I see is a lot of activity from people coming in and out and who are doing meaningful things together, which makes them happy. I see an inspiring environment where people can be working on technology that matters.'* (Respondent #11)

As becomes clear from these three most important elements, the benefit of gaining new knowledge is closely related to the benefit of synergy. By people sharing and interacting, or a so-called collusion of hunches, new knowledge can be established from which the effect is greater than the sum of the separate elements. All this provides an individual or a company the benefit of purposeful learning.

WHEN: indicators and limitations of collective ideation

A decision to apply and or participate in collective ideation is influenced by several contextual factors, indicators and limitations. The most important factors are given in Table 4.

Table 4. Boundaries, indicators and limitations of collective ideation (highest scores)

Boundaries (indicators and limitations)	
Shared value	If there is a shared value and interest
Enthusiasm	If participants are enthusiastic and passionate about it
Funding & ROI	When there is sufficient funding & Return on Investment possible
IP protection	When IPs are protected and NDAs are made

Source: Geertsen (2015)

The analysed data shows that a shared value and shared interest is the most important factor or precondition to decide to apply collective ideation. This is supported by the quotes:

> *'It may be that we say yes, that looks good, they do things that we find relevant, we have common interests and we do not know each other so well already so we join.'* (Respondent #16)

And:

> *'Well, you need to look very closely at the value of the relationship'* (Respondent #13)

A second important factor explained by the respondents is the level of enthusiasm of the participants. According to the respondents it is essential that the participants are enthusiastic, motivated, and passionate to join and enjoy the process. This can be made clear with the following quote:

> *'You also need people excited to participate in such a project. Not every engineer is enthusiastic about it. And engineers are not directly the people who will enthusiastically share knowledge.'* (Respondent #09)

Financial resources and funding are also found very important by the respondents. Funding can come from different sources but is an important precondition to start collective ideation. The following quotes explain this matter:

> *'You see that funding is a very important precondition. Participants do have concrete project ideas, the only dilemma is who will pay and how to get it financed.'* (Respondent #03)

And:

> *'I try to stay away from money very often, because if money is you ask for money it often works more difficult.'* (Respondent #04)

Finally, whether IPs are protected and whether NDAs are established is also considered important by the respondents. This is made clear with use of the following quotes:

> *'Good ideas are worth money and you should therefore think very carefully whom you engage at any stage.'* (Respondent #12)

And:

> *'If we are going to share knowledge with other parties, then we of course use a non-disclosure agreement. Open innovation sounds nice, but you have to realize that there are no or only a few companies willing to put their ideas and technology on the street, you must also protect yourself.'* (Respondent #10)

These four most important factors show an interesting and also difficult conflict here. The conflict that is going on is the matter of 'connecting' versus 'protecting'. The boundaries 'shared value' and 'enthusiasm', people's inner incentives to share ideas, are opposed to the boundaries 'funding & ROI' and 'IP protection', a company's fear to not share ideas, since the Intellectual Property can be stolen and profit can be lost. Just as in the real world, the most dominant half is likely to win the conflict. In order for 'connecting' to win this of course the resources 'shared value' and 'enthusiasm' must weigh more, but also it is important to have a certain level of a 'complementary value chain commitment', 'creative thinking', 'company culture', 'group diversity' and 'time available'.

HOW: Strategies

Table 5 offers an overview of the most relevant strategy factors relevant for collective ideation.

Table 5. Strategy factors relevant for collective ideation

	Strategies
Themes	Based on themes from the R&D agenda
Technology Readiness Level	Determine problem statement in pre-competitive stage
Path Extension	To extend existing paths close to the core business

Source: Geertsen (2015)

As it becomes clear from the above table, 'themes' is answered by the most by the respondents since it is important to develop a collective ideation strategy based on themes connecting the future development trajectory or R&D agenda. This can be explained with the following quotes:

> *'To get the R&D calendar, so what are the main issues that you will focus on the next eighteen months or the next three years. Then we will try to determine a common denominator to see where we should do or where we should try to get it organized.'* (Respondent #02)

The second most answered element of the collective ideation strategy is the Technology Readiness Level. This element contains the determination of the problem statement in a pre-competitive stage in order to stay away from competition and also valorization. Respondents explain that you need to stay in between:

> *'Technology Readiness Level: when you are at a too high level and you come close to the market… If you come too close to the market, the competition sensitivity is too high. Then intensive cooperation is difficult… You should also not*

> *be too far away from the market, for example on fundamental research, it also will not work because you have no idea of the business case and because companies do not want to invest in it. So you miss the commitment of the businesses and so you have to fit it in between.'* (Respondent #16)

And:

> *'Yes, you have to be early to increase the willingness to collaborate. The closer you are to a product, the more competition will play a role and confidentiality comes into play… So you have to look for generic issues that hold for everyone. There you can easily find willingness to collaborate.'* (Respondent #03)

The third most important strategic element is path extension or the way to extend existing paths not too far away from the core business. This is clarified with the next quote:

> *'It should fit our core business… we experience the importance of certain technological developments which we think we require in the future.'* (Respondent #12)

WHAT: Mechanisms

During the process of collective ideation, several mechanisms are used. The most important mechanisms (in use or considered) are presented in Table 6.

Table 6. Mechanisms for collective ideation (highest scores)

	Mechanisms
Organize soft facilities	A party responsible for organization and direction of all soft facilities
Provide hard facilities	Provide distinctive hard facilities
Participation	Active participation from the community, achieve movement

Source: Geertsen (2015)

From this table it becomes clear that collective ideation requires proper organization and support facilities. Respondents find it important that a certain party is responsible for the organization and direction of all soft facilities. Respondents do not believe in accidental encounters which will be explained in the next quotes:

> *'It sounds a bit bland, but the accidental encounter does not exist. At least it is always a very carefully organized accidental encounter. Or it is a carefully organized way to let the encounter occur accidentally.'* (Respondent #02)

And:

> *'You have to organize the sharing otherwise it will not occur. You do not initiate such things yourself.'* (Respondent #06)

Next to that, providing distinctive hard facilities at a STP is also important according to the respondents. This mechanism is explained with use of the next quotes:

> *'Good facilities are very important because you need to be able to conduct experiments on a very high level.'* (Respondent #12)

And:

> *'You need distinctive facilities because when you have the same facilities as the rest you will never reach the world class level… these are expensive so it is best to share these facilities with each other.'* (Respondent #14)

Furthermore, the level of active participation from the community at the STP is also important. You need to build an active network community not based on single moments but as a way of living, a movement, within the ecosystem of the park. This is supported with the following quotes:

> *'You must have a certain critical mass, that there is indeed a possibility to interact and so that things happen.'* (Respondent #10)

And:

> *'At the moment, the number of companies is relatively low, so the number of participants seems to be important.'* (Respondent #15)

There are several mechanisms that distinguish one STP from another, but the one thing that really makes a difference is the 'soft facilities', or intangible aspects. These aspects such as organizing different ways meeting each other, building connections, creating the sense of a community, a liquid network of sharing are essential to enhance the chance of sharing ideas from where a breakthrough idea can be further developed. Together with the distinctive hard facilities, such as the best lab facilities but even important the welcoming coffee houses, lunch spots of other meeting places, and the active participation of the community and getting the STP in motion will help increase the change on breakthrough ideas.

5. Conclusion and discussion

The aim of this study was to create a more in-depth understanding of the collective ideation process at STPs. This research has led to an overview of benefits, boundaries and limitations, strategies and mechanisms considered by stakeholders and used in practice. All together we may conclude that the synergy awareness within the ecosystem of the STP leads to people interacting and sharing ideas. This is

supposed to facilitate a 'collision of hunches' which can be beneficially provide new knowledge, purposeful learning or both.

This research debunks the myth of accidental encounters. The overall claim of this research is that the fuzzy front end of innovation or the collective ideation process should be properly and carefully organized.

This research suggests that soft facilities, such as events where invited people can meet and connect as participants based on a carefully prepared guestlist, need to be organized by a party responsible for this matter. One of the mechanisms to design and adopt the concept of collective ideation at STPs is the availability of a strong and professional facilitator. This is supported by the right distinctive hard facilities, for example an attractive conference centre with auditorium or an excellent innovation lab, to help setting interactions in motion and building relationships and trust. This is also supported by the level of active participation of the community. As chances are not organized by itself, you need to help and organize the soft facilities of a STP and hold a party responsible for it. These facilities are stimulated by places at the park that invite interaction of people. This way you can create an active community that is participating within a sharing network.

Three interrelated partial conclusions can be drawn on how to design the collective ideation process at STPs.

First, the collective ideation process needs communal forces or a sharing culture to be able to achieve interactions among actor and create the possibility of a collision of hunches. This can only be achieved is 'connecting' wins the battle of 'protecting'. And also the active participation of the community of actors is required.

Second, in order to have impact the collective ideation process requires organized creativity so that the ideas from the interactions have a higher chance to be executed and become a breakthrough idea as they are combined. Therefore it is important to have a party responsible for the organization of these soft facilities of the STP.

Third, though you cannot fully control interests and skills of the actors at the park you do have the possibility to stimulate people's opportunities. By explicitly adding the element of people in the model there is more focus on motivating the possibilities of actors. This third conclusion is depending on the company's culture, its leadership capabilities and from that for example the time available to join collection ideation. Overall these three conclusions will provide a better organized collective ideation process which is an important means to enhance and facilitate innovation and collaboration at the STP.

Based on the findings of this research we propose a modified conceptual model for collective ideation at STPs. This model is presented in Figure 5.

This research can be extended in several directions. First of all, the results are applicable to the Dutch STPs. Additional research in other regions and countries will help to adopt the model to other contexts and economic conditions. All STPs included in this research are parks specialized in new product development in a certain area. It is expected to be different for STPs that contain service development in certain areas. This investigation of services parks is an interesting field for future research. Next to that, the STPs of this research do not only develop products, the

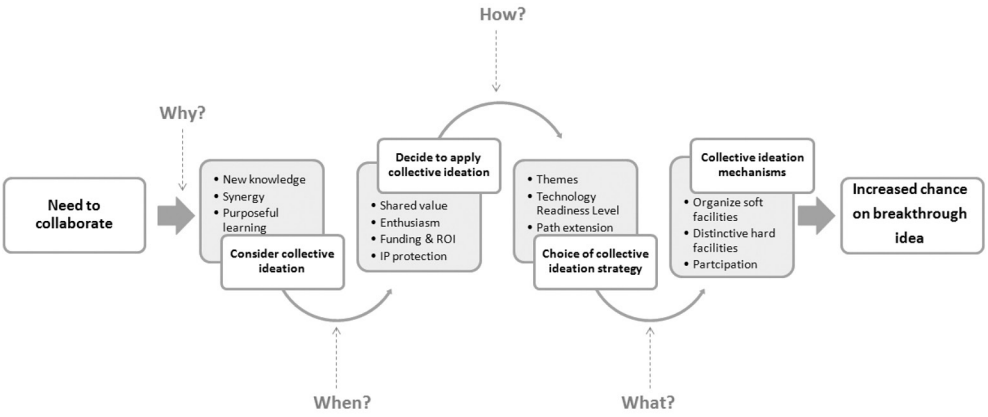

Fig. 5. Modified conceptual model of collective ideation at STPs based on the findings in this research
Source: Geertsen (2015)

products that are developed are dominated by 'hardware' developments that can be distinguished by an extreme high level of funding that is required for development of new ideas. Since funding is shown a hard condition for collective ideation it is interesting to conduct more in-depth understanding of this principle in future research. Finally, these hardware product developments at STPs are carried out by specialists, mostly highly educated technical engineers, and so the human factor or so-called DNA of these specialists would be interesting to investigate in more depth in future research.

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