OPEN INNOVATION ECOSYSTEM: TOWARDS COLLABORATIVE INNOVATION

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Abstract

Innovation is a precondition for the success of companies in today's markets to differentiate from their competitors. Particularly disruptive innovations are addressed in numerous research contributions, product contests and advertisements. They carry a high risk of failure and often require a high investment in research and development. (Watty, 2013)
Corporate groups are often very successful in specialized market segments and with incremental innovations adapted to the needs of their customers. Regarding disruptive innovations, startups and small businesses have better capabilities capturing a new market in a minimum of time (Christensen, 2013).
This paper addresses the research question how an Open Innovation Ecosystem can boost the innovation capability of its community. It describes the context of an (open) innovation system from an engineering perspective and foucses on challenges and opportunities of today's businesses. In conclusion, an exemplary case of an Open Innovation Ecosystem referred to as TechShop@UnternehmerTUM is introduced. Outlining an approach, in order to gather information about companies' way to systematically implement an open innovation space.

Keywords: Innovation, Open Innovation, Entrepreneurship, Collaborative design, Design practice

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Please cite this paper as:
Surnames, Initials: *Title of paper*. In: Proceedings of the 20th International Conference on Engineering Design (ICED15), Vol. nn: Title of Volume, Milan, Italy, 27.-30.07.2015

1 INTRODUCTION

Nowadays technology has a very short life cycle. The challenge of innovation is getting technology to market more quickly. Ranjay Gulati, professor at Harvard Business School, said: "The problem companies' face is, as they get bigger, as they scale, things slow down. They lose speed because they have so many systems and structures and processes, and they lose the ability to take risks." (Clough 2014).

It is commonly accepted that innovation is a major determinant of business competitiveness in today's markets (Weber 2012, Tan and McAloone 2006). To differentiate significantly from their competitors companies develop innovative products (Watty 2013).

An innovation is an idea, device or process and can be viewed as something that "breaks into" the market or society and as a consequence meets new requirements, unexpressed customer desires, or existing market needs (Schipper and Swets 2010).

There are two different types of innovation: incremental and disruptive innovation (Greiner 1998). Incremental innovations continuously improve features or reduce the cost of an existing product (Watty 2013). Disruptive innovations comprise an entirely new set of performance features of existing products, provide completely new products, or significant cost reduction (Leifer 2000).

Disruptive innovations are addressed in numerous research contributions, product contests and advertisements. Nevertheless comprise less than 10% of innovations (Smith 2009), carry a high risk of failure (Cooper and Kleinschmidt 2011) and often require a high investment in research and development (Watty 2013). Corporates are mostly successful in specialized market segments and with incremental innovations adapted to the customer needs. In terms of disruptive innovations, startups and small businesses have better capabilities to capture a new market in a minimum of time (Christensen 2013).

According to (Bakker et al. 2006) ideas never emerges in isolation. The ideation process, meaning the process for generating ideas has at least two aspects: the idea concerns, meaning the content of the idea and somebody who spreads and promotes the idea enthusiastically (Karlsson and Törlind 2013, Hansen and Andreasesn 2006).

To stay ahead in a competitive environment, enterprises develop innovations through exchange and combination of professional experience. Disruptive innovation mostly emerges from in-house R&D, R&D outsourcing, R&D partnerships and alliances, as well as technology-based acquisition (Moitra and Krishnamoorthy 2004). More incremental innovations may emerge from practice.

The challenge of bringing innovative partners together is addressed, among others, by Singularity University (SU). SU labs is an open innovation campus where large enterprises, startups and innovators come to use high-tech to create new business solutions. Small entrepreneurial teams of large organizations and field impact partners are enabled to drive disruptive innovation by moving quickly from ideas to prototypes (Singularity 2014). The Corporate Innovation Exchange (CIX) ignites transformational growth in corporate groups to reimagine and reinvent their future (Singularity 2014).

This paper addresses the research question of how an Open Innovation Ecosystem can boost the innovation capability of its community. In reviewing the literature, an Open Innovation Ecosystem from an engineering perspective is presented, merging aspects of Open Innovation, Lean Innovation, and Innovation Labs. The innovation challenges and opportunities of today's businesses are described. Lastly, an exemplary Open Innovation Ecosystem referred to as TechSpace (abbr. for "UnternehmerTUM Lab in cooperation with TechShop") is introduced.

2 (OPEN) INNOVATION SYSTEM

Innovation requires that the invention has reached the market or better that a successful realization with enhanced customer or manufacturer benefit (Watty 2013, Binz and Reichle 2005, Ericson and Kastensson 2011).

According to innovation system theory, innovation is a result of a complex set of relationships among actors in a system, which includes enterprises, universities and research institutes (Adner 2006). The exchange of technology and information among people, enterprises, and institutions is a major determinant of whether a process turns out to be innovative (Kirner et al. 2007).

Reviewing the literature, there is no consensus on the exact definition of an innovation system, and the concept is still emerging in particular in Engineering Science. This paper gives a first attempt

describing an open innovation system as a space where large organizations, startups and students come together using technologies to create new sustainable business solutions. The concept is adapted from the Innovation Ecosystem at Singularity University and derived from three research areas: Open Innovation, Lean Innovation, and Innovation Labs, which are briefly described in the following.
Singularity University (SU) brings people who share a common vision together from around the world and every walk of life. SU have been running an experiment in building their own local Innovation Ecosystem, which is pictured below. They have three main approaches for building the future in communities: Startup Programs, Corporate Innovation Exchange (CIX), and Funding. At a higher level, the SU University incorporates the faculties with its students, mentors and advisors. For rapid prototyping, they have a TechShop and further high-tech resources.

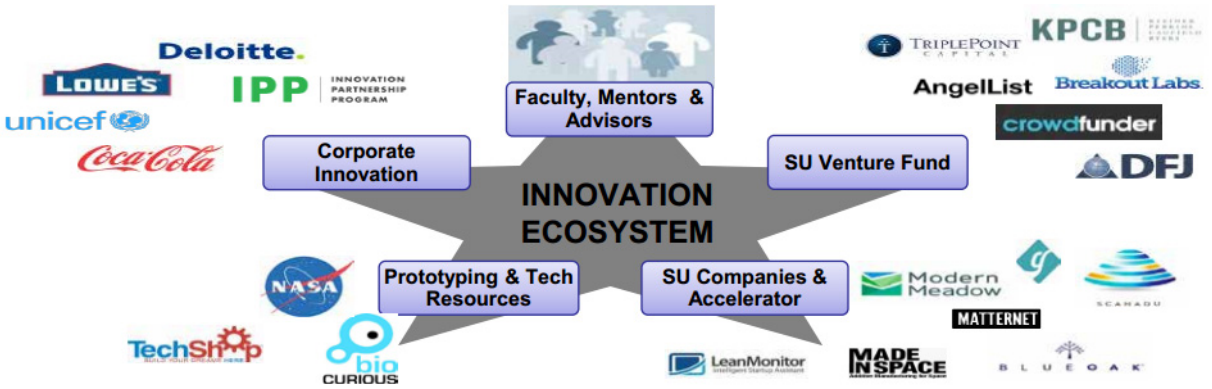

Figure 1. Innovation Ecosystem of Singularity University Labs (Singularity 2014).

"Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology" (Chesbrough 2003).
Lean Innovation is defined by five steps and principles: Identify Value, Map the Value Stream, Create Flow, Establish Pull, and Seek Perfection (Womack and Jones 1996). The act of creating a new product or process includes the work required to bring an idea or concept into final form. The Lean Principles identify and create value and more importantly remove waste during the process.
Innovation Labs provide both application-oriented research and a transfer platform for science and industry. Another variation, Makerspace, is a community-operated high-tech workshop where innovative people meet, socialize, collaborate, and work on new ideas or do-it-yourself projects (DIY). New science and relevant technologies are explored and maker can exchange their experience within a network of creative people. Through the convergence of computer scientists, designers and engineers with specific knowledge and special skills an interdisciplinary knowledge pool arises. Copying and modifying existing designs is a dominant practice to create new products. The maker movement, also known as the silent new industrial revolution, comprises individualizing products locally, just-in-time production and small production volumes (Anderson 2012).

3 CHALLENGES OF TODAY'S BUSINESSES

Peter Diamandis, founder and chairman of the X PRIZE Foundation and co-founder and chairman of the Singularity University says: "The rate of innovation is a function of the number of people connected and exchanging ideas." (Singularity 2014). As a result, conditions are changing rapidly. With lower barriers to entry, the metabolism of the economy is increasing.
Figure 2 illustrates a generic innovation process. The innovation seeking is initiated by a customer need, a customer problem or a problem's solution. In addition, trends and technology scouting start the process. The innovation seeking runs both internally and externally. The step is either initiated by the executive department itself (pushed) or by another department (pulled). Using methods like Open Innovation, ideas are generated and saved using a template. Based on the internal review, the business strategy, and other criteria, the submissions are rated and filtered. Once innovation management agrees that an idea is worth pursuing, the idea essentially becomes a project. Few ideas reach this stage. Subsequently, a team is given responsibility to fully develop and implement the idea. Most often, the idea realization requires a large amount of resources and time.

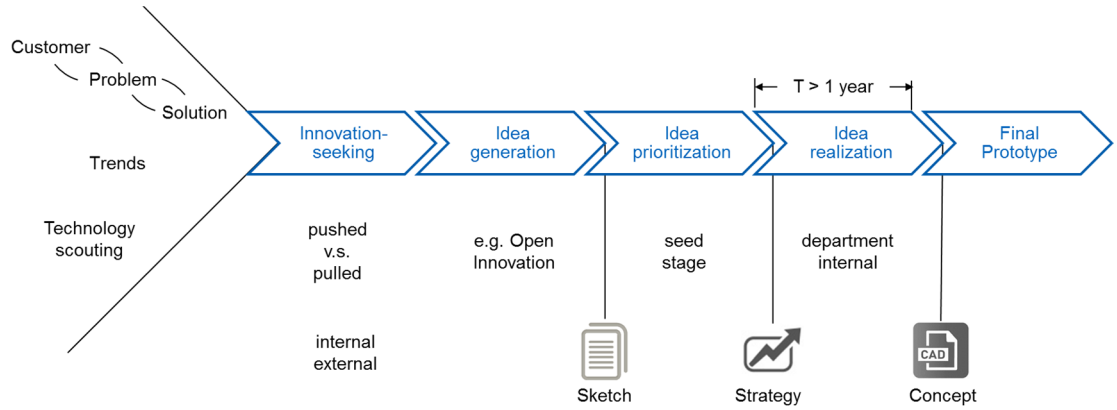

Figure 2. Generic Innovation Process.

As companies get bigger they scale, things slow down and lose speed because there are many systems, structures and processes. Moreover they lose the ability to take risks and are currently experiencing volatile markets with very short product life cycles due to rapid technological innovation (Clough 2014, Rulison 2014, Aytac and Wu 2013). In this context, a company usually operates in a culture driven towards efficiency rather than creativity (Cross 2013).

According to (Bakker et al. 2006) ideas can be rejected for reasons relating either to the content (i.e. an idea is impracticable for technical reasons) or the organisational context (e.g. budget problems, priority of other ideas, organisational policy, competition). In an ongoing development project there is a risk that promising ideas are rejected due to time constraints. Ideas are the carriers of innovation; novel and radical ideas are often exposed to rejections and resistance. Those ideas could become a potential goldmine of innovations and need to be pursued. (Karlsson and Törlind 2013)

Intrapreneurship programs tend to operate on a waterfall model: come up with an idea, draw up a business plan, pitch it to an existing business unit, build the prototype, and see the prototype be absorbed by that unit. Thus, the standard of success is governed by existing business units, who push the results towards incremental rather than disruptive innovation. Creating radically new product and business ideas is accompanied by cultural and structural challenges. As a result disruptive projects need to be insulated from corporate politics, to incentivize entrepreneurial employees, and to implement “VC-like” decision criteria. (Owens and Fernandez 2014)

Clayton Christensen, Harvard professor and businessman, says that successful companies fail to adopt new technology or business models that will meet their customers' unstated or future needs. The main idea is that businesses or organizations will reject innovations based on the fact that customers cannot currently use them (Christensen 2013). As a consequence, companies allow ideas with great potential to go to waste (Christensen 2013).

The difficulty with most ideas is that they are not sufficient in their initial state. Sometimes, the ultimate cause is that some ideas are not properly understood or presented. Based on the internal rating process, the innovation management invests in idea concepts, which are often simple sketches. Those ideas need to be refined to a form that is more applicable (Cross 2013). Driving ideas means also executing the project that launches the ideas and setting up a team to pursue those ideas (Kirner et al. 2007).

Another challenge of today’s businesses is that most employees have no downtime during daily business to take a step back and think or reflect (Cross 2013). Certainly, most people hit on an idea outside the workplace, for example while having a shower. Unstructured time can positively affect the creativity and encouragement of employees. For example, 3M pursues a 15%-strategy to encourage employees to innovate on company time. Google has a similar rule, where engineers devote 20% of their time to project of their own initiative (Cross 2013). Giving employees downtime enables a continually innovative organization, which is never satisfied with the status quo.

4 OPEN INNOVATIVE ECOSYSTEM – A BOOSTER FOR INNOVATION CAPABILITIES

Until recently developing new products was a haphazard affair, based on a combination of past performance and good instinct (Owens and Fernandez 2014). The line of action was specifying the

offering, assembling a team, and going into stealth mode to design, build, and manufacture (Owens and Fernandez 2014). In today's rapidly changing environment, managing innovation effectively has become essential.
A business's long term sustainability is determined by its ability to address a constantly changing market and economic environment. The competition is not the other enterprise, but startups that are geared for rapid execution. On this account it is important to work in cross-functional teams rather than isolated silos (Owens and Fernandez 2014). In addition, the knowledge to innovate is globally distributed (Singularity 2014). Open innovation makes use of external ideas as well as internal ideas, and internal and external paths to market (Chesbrough 2003).
Established companies know their market very well. Startups barely know who their customers are, what they want, or how to get them to pay for it (Owens and Fernandez 2014). On this account startups need to shorten their cost-intensive and assumption-based product development. The lean startup method by Eric Ries mentions an iterative model to isolate uncertainty. Startups can launch products successfully and more quickly by adopting a combination of business-hypothesis-driven experimentation, iterative product releases, and validated learning (Ries 2011b).
Based on the above mentioned challenges of today's businesses, it becomes clear that in today's rapidly changing business environment, startups and large enterprises need to combine their competences with others. An Open Innovative System seems like an appropriate method for this, boosting the innovation capabilities of its members. From my point of view, it is based on three main approaches: Open Innovation, Lean Innovation, and Innovation Labs. It comprises an innovative framework, principles of the Lean Enterprise and aspects of the Lean Startup method (see Figure 3).

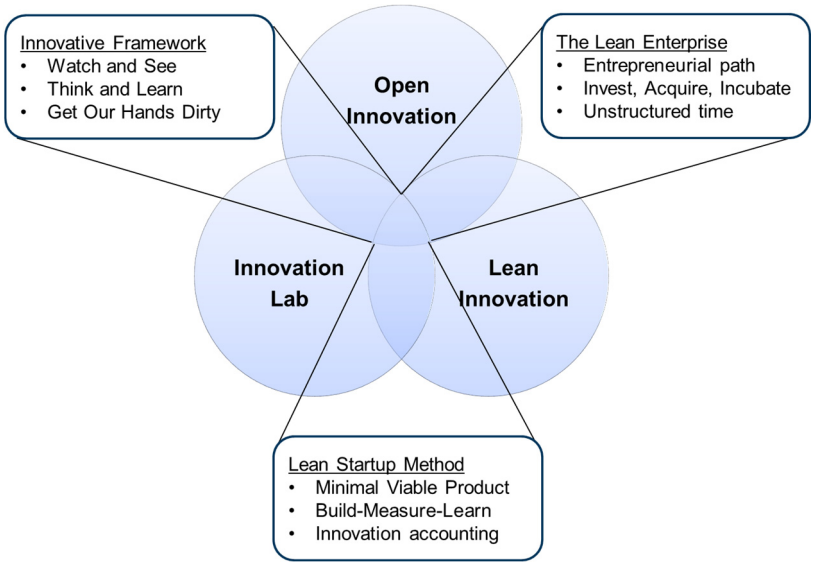

Figure 3. Open Innovative System.

The purpose of a framework is to tie together the concepts of a theory in a pattern. According to (Cross 2013) there are five sections that stand-alone but also support the rest of the innovation framework structure: Innovation Culture, Generate Ideas, Refine Ideas, Spread Ideas, and Adoption.
When implementing an innovation framework, cultural change is often needed. An innovation culture changes routines of employees, promotes talking to new people, and makes them try something they have never tried before (Cross 2013). The Whitestrips of Proctor and Gamble (P&G) were invented by taking concepts, products, functions, and services from different parts of the business (Cross 2013). There are three steps to a lean culture shift (Cross 2013): watch and see, think and learn, and get your hands dirty.
The Lean Startup Method is an ethos of driving to market quickly, testing and validating a concept (Ries 2011b). Silicon Valley entrepreneur and author, Eric Ries, who specializes in teaching lean startup principles, worked with GE on FastWorks. Historically, GE revises products every five years, and keep new products under wraps (Clough 2014). With the FastWorks program across its business units, GE become more nimble and remains competitive in the rapidly shifting global market (Clough 2014). The company became much more open and collaborative with the customer base and is transforming its culture to be leaner and faster (Rulison 2014). Innovation fills the gap between here

and there; measuring to learn is the only way to know if you are accomplishing this. The learning cycle to contribute to innovation consists of five steps (Schipper and Swets 2010):

1. Plan: Define what you will work on and what resources will be employed
2. Design: Propose solutions for the problems to be solved
3. Build: Rapidly prototype, in whatever format necessary, to solicit feedback
4. Test: Evaluate the prototype
5. Review results: Summarize what has been learned and update stakeholders

Traditional corporate restructuring, like Lean Six Sigma, clearly stimulates creativity; however, it is not the best method for identifying ideas for breakthrough innovation. Organizations must combine those approaches with other methods that are better suited to breakthrough innovation (Hoerl and Gardner 2010). The Lean Startup method gives creative employees autonomy to work on their ideas and freedom to try things that may not prove successful. Comstock, the chief marketing officer of GE, says: “Fail fast, fail small.” (Clough 2014).

An innovation lab is a freewheeling creative environment that can take chances developing something fresh and unexpected, by breaking organizational paradigms. They are not equipped to scale their successes. It is a risk-free playground for innovative thinkers. The prototypical innovation lab is Xerox PARC (for Palo Alto Research Center), founded in 1970. (Owens and Fernandez 2014)

Establishing an entrepreneurial path within the enterprise attracts internal candidates who have ambitions beyond their current job. This path requires downtime, which allows employees to innovate on company time.

Established innovation labs and intrapreneurship programmes often fail to overcome legacy corporate structures, politics, and culture (Owens and Fernandez 2014). Therefore, entrepreneurs need to be in a special environment which is isolated from the company that enables the autonomy, incentives, and focus required to innovate (Kirner et al. 2007). Employees only can live their dreams in a comfortable and stable environment, far away from typical corporate organizational system (Owens and Fernandez 2014). Access to other innovative communities enables employees to develop direct contacts with startups. Moreover, seed-stage investors can give the company early warning of emerging trends and business models. In addition the company has the opportunity to invest, acquire, or even incubate a promising startup (Owens and Fernandez 2014).

Nordstrom Innovation Lab’s first attempt at an Open Innovation System was a physical retail store. The innovation team can test new features, and get feedback by talking face-to-face with customers, salespeople, and managers (Owens and Fernandez 2014).

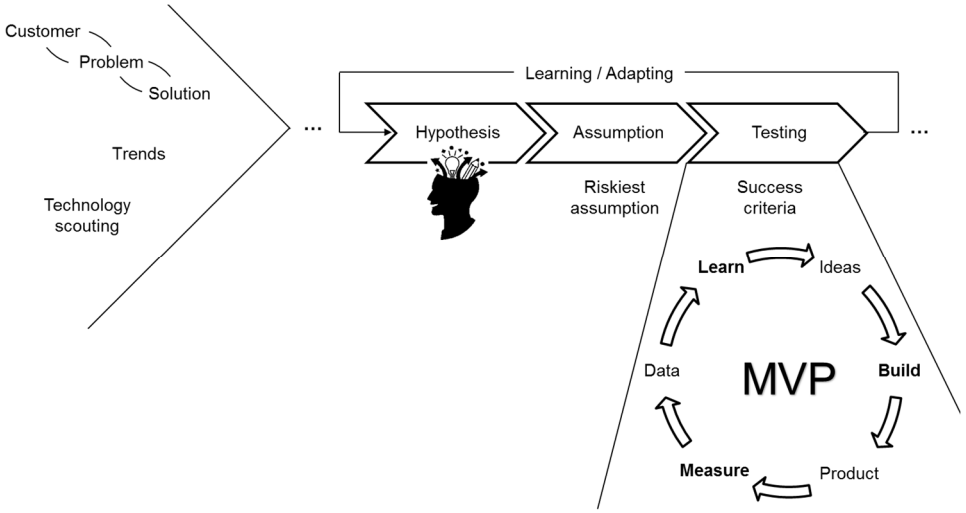

Figure 4. Experimental Process adapted from (Owens and Fernandez 2014).

Releasing a minimum viable product (MVP) is a market testing strategy to check whether the market wants the product before time and monetary investment are made. An MVP is an expression of a clear idea of the product’s benefit. The method is facilitated by makerspaces and rapid application development tools (Doll 2009).

Hackathons focus on building new and usable products in the course of the event itself. It is good for developing technical skills and strengthening team cohesion. The events brings together employees from other departments, which generates interest in the innovation colony. Inviting independent

entrepreneurs, engineers, marketers, designers, and other interest groups to your community will build an innovative network (Owens and Fernandez 2014).
Figure 4 illustrates an overall experimental process, including the above mentioned aspects. Creative and innovative people from various branches and companies run the process, which is represented by the head symbol.
The main stumbling block for many companies are concerns about brand equity (Owens and Fernandez 2014). On this account, MVPs should be used with a small and specific group, like early adopters, who like to try new thinks and are glad to have the opportunity to contribute. Furthermore, enterprises can launch products under a brand called "Labs" and tell the customer explicitly that these things are experimental technologies.

5 OPEN INNOVATIVE ECOSYSTEM @ TUM: CASE PRESENTATION

"It's one thing to talk about 'rapid experimentation' and 'validated learning' as abstract concepts. It's quite another to see them in action, in a real-world setting." (Ries 2011a). On October 29, 2013, TechShop, a membership-based, do-it-yourself (DIY) workshop and fabrication studio, announced it was partnering with BMW Group and UnternehmerTUM. The new high-tech workshop will be open to the public, and targets creative types, business founders, start-ups and employees of the BMW Group and other companies (Wienstroth 2013). TechShop provides space and facilities to the innovators, where they can realize their ideas. Located on the research campus of Technische Universität München (TUM), the workshop is strongly influenced by a university and an entrepreneurial environment. UnternehmerTUM assists startups and established companies with business creation, successful business development and market entry (Zheng 2013). The cooperation with the BMW Group will provide startups and innovators with access to first-rate know-how. The expectations of the BMW Group is to promote innovations initiated by BMW Group employees with the workshop available to employees for prototype construction (Wienstroth 2013). In addition the company will be closer to ground-breaking innovations, located at TechSpace and Open Innovation Ecosystem @ TUM.
The OIE @ TUM is characterized by a creative network with both technical and business know-how. The innovation center facilitates exchange and communication of innovations in which all partners can contribute their expertise. The aim of the resulting open innovative ecosystem is to strengthen the local network between the city, universities, startups, companies and the local creative scene (Zheng 2013).
This paper addresses the research question how an Open Innovation Ecosystem can boost the innovation capability of its community. The previous section discussed the concept of an Open Innovation Ecosystem, whereby this section introduces the Open Innovation Ecosystem @ TUM. To verify the hypothesis, that an OIE increases the innovation capabilities of its community, the Ecosystem is described and key performance indicators are identified. A first approach to gather information about the stakeholder's method to systematically implement an open innovation space is outlined.
First, the stakeholder of the ecosystem will be defined. At an operational level, the focus is on the public, startups, students, and employees. Regarding the organizational level, the focus is public access, UnternehmerTUM, TUM, and the BMW Group. Interest groups of each organization will be explored by means of inquiries and through direct observations of projects at TechSpace.
Second, the various objectives of each stakeholder and their correlations will be gathered. The motives of the stakeholders will be detected by interviewing various people of different interest groups. Personal and strategic intentions, which are related to daily business, must be distinguished.
The assumed focus areas of TechSpace are:

- Hands-on class projects
- Empowerment of makers and innovators in a community
- Building physical prototypes
- Possibility to work on personal projects and hobbies
- Automotive-focused innovation

Third, key performance indicators related to the achievement of the stakeholders' objectives will be defined (Schipper and Swets, 2010). The executing team must be involved in creating the measurable indicators. Their ownership of the measurement is required, as this will drive commitment. The project

will start with given goals, and the team develops the measures that will demonstrate how well the solution reached these goals (Schipper and Swets, 2010).
Fourth, the projects, will be observed. The project expectations of all interest groups will be gathered at the outset. Subsequently the interactions of the stakeholder and their networks will be observed. The upcoming projects will be analyzed by identifying the interacting people, their knowledge, the way they interact, and the project itself. Project will be defined by reference to their complexity (e.g. product complexity) as well as their category (e.g. automotive focused). Value Stream Mapping is one possible method to map a project and not the process (Schipper and Swets 2010). The process can be acquired, for example, by the cooperation process by (Harland 2002). The information will be collected through direct observation, expert interviews and project reports. Based on the point of origin, the intentions, the achieved goals, and the added value of the OIE will be examined.
The last step is the integration of the OIE process into the existing innovation process of the respective stakeholder with its boundary conditions (Adner 2006). In this context, the successful key performance indicators will be operationalized (Kirner et al. 2007).
To boost the innovative capability the success criteria must be matched to the innovation process of the OIE (Kirner et al. 2007). The main success criteria for large companies are:

- a “free playground” for visionary employees during their downtime
- combination of technical and entrepreneurial know-how with speed and flexibility of startups
- cross-linking to external stakeholders
- improved exchange of knowledge
- rapid realization of ideas
- physical closeness to ground-breaking and pioneering innovations

A vision of the Open Innovative Ecosystem @ TUM is illustrated in Figure 5, which gives a first insight into how the interactions within the OIE will look. There are four main stakeholders: the public, UnternehmerTUM, TUM, and the BMW Group. TechShop is an open system and the central aspect of the OIE. Based on this, various people define the community of the OIE @ TUM. There are public people, creative innovators (entrepreneurs, innovators, etc.), students, and employees. The differentiation of the community depends on their motives. A segmentation could be done by their main task, since the community, particular creative innovators, cannot easily be segmented.

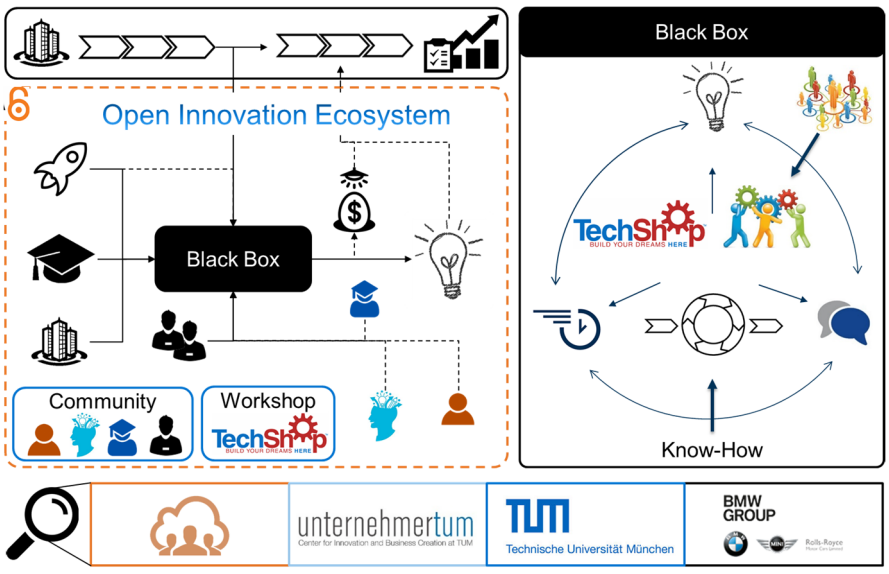

Figure 5. Vision of the Open Innovation Ecosystem @ TUM – Focusing on Open Access, UnternehmerTUM, Technical University Munich, and the BMW Group.

The interactions of the OIE stakeholders is shown as a black box, since the TechSpace has not opened, yet. A generic model will be generated by analyzing similar innovation processes and ecosystems. As illustrated in figure 5 on the right, the model will comprise the workshop, the innovation process and the innovation cooperation. The overall goal is to promote exchange, shorten the innovation process and boost the innovation capability of the community by using its network and know-how.

It is assumed, that the innovation process is an iterative model with dynamic interaction of various stakeholders and may be influenced by above-mentioned Experimental Process and MVP.
The first TechShop facility in Europe will expand UnternehmerTUM's Entrepreneurship Centre at the research campus at Munich-Garching (Zheng 2013). In this context, the rule of TechShop within the OIE @ TUM will be analyzed separately by reference to projects that use the workshop and its facilities. Large enterprises will probably use TechShop for rapid prototyping. For startups a TechShop enables small series production. The use primarily depends on the product complexity. An early communication process with a validated learning feedback loop based on an MVP will be enabled for both large enterprises and startups.

6 CONCLUSION AND OUTLOOK

The OIE @ TUM tries to educate, inspire and empower leaders to apply technologies to address grand challenges. The first TechShop in Europe will be a high-tech workshop infrastructure and include a variety of machines, tools and software for prototype construction and small-series production. The TechShop infrastructure and services will complement the existing entrepreneurship training, incubation and consulting activities of UnternehmerTUM within one building. On-site training and consulting services will be a foundation of the TechShop model.
Students will get the opportunity to realize their ideas in cooperation with sympathizers at TechShop. In addition startups can build their products with low investment and have the opportunity to interchange ideas within an entrepreneurial and innovative environment. Open Innovation aspects will support the innovation process with new standards, applicable for each stakeholder.
Main reason for continuous rise in collaborative initiatives are increasing innovation and technology dynamics, massively shortened development and product life cycles as well as the aftermaths of the information and knowledge society. On this account, the OIE is a huge opportunity for large enterprises to break deadlocked and rigid processes and structures to follow up on new ideas and implement them more quickly and flexibly. Successful innovation seeking and rapid realization of ideas comprises one of the main focus areas for large enterprises. Moreover, the OIE allows employees a facilitated networking and communicating across spatial, organizational and hierarchical borders. The OIE connects strategic decision-makers and creative thinkers. In this context, the OIE, represents a "free playground" for creative employees and supports the formation of subject specific alliances.
This paper introduced and described three basic research areas in the context of an (Open) Innovation Ecosystem from an engineering perspective. Today's business challenges were described and in this context an Open Innovation Ecosystem as a booster for innovation capability was introduced. Finally, a rough visualization of the OIE @ TUM was presented. A first attempt to gather information about the stakeholder's method to systematically implement an open innovation space was outlined.
A complete and detailed view of the ecosystem is the key to effectively assessing options and prioritizing opportunities (Adner 2006). Based on that, future steps involve a deeper understanding of the specific goals, approaches, and interconnections of each stakeholder. Furthermore the relevance of TechShop will be explored considering MVP methods and rapid prototyping. Besides this, the impact of IP rights and the accruing innovation culture will be examined.

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