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## Makers, hackers, DIY-innovation, and the strive for entrepreneurial opportunities

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**Abstract:** Contemporary maker/hacker communities represent an internet-driven extension of the ‘do it yourself’ subculture. Corresponding projects are typically motivated by fun and self-fulfilment and not primarily by economic stimuli. Nevertheless, many new ventures have emerged as a result of the hacker culture. The purpose of the present multiple case study is to develop insights into the maker culture and its intersections with entrepreneurship and business innovation. The results show that makers typically understand a start-up process as a sequence of creative learning comparable to technical problem solving. Trial and error is seen as precondition for improvement. Makers, hackers, tinkerers, and other creative people who pursue own ideas with the intention to build their own business can unquestionably be qualified as entrepreneurs – even if they occasionally do not like terms such as businessman/businesswoman.

**Keywords:** maker movement; hacker culture; entrepreneurship; entrepreneurial opportunity.

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## **1 Introduction**

Makers, hackers, and tinkerers form a contemporary subculture of people who find their lives enriched by creating something new, learning new skills, and engaging with objects in ways that make them more than just consumers. Dougherty (2012) sees makers as enthusiasts, such as those engaged in the early days of the computer in Silicon Valley. The maker movement emphasises a constructivistic approach of learning-through-doing in a social environment, the so-called hackerspaces or fablabs, which are spaces where people with different interests in technologies, craft, and art can work and collaborate around individual projects (Magaudda, 2012). Hackerspaces are inherently based on people's proactivity. In fact there is a strong focus on learning and using practical skills and applying them creatively. Community interaction and knowledge sharing are mediated through networked technologies, with internet and social media tools forming the basis of knowledge repositories and a central channel for information sharing and exchange of ideas, and focused through social meetings in shared spaces (Gershenfeld, 2005).

Maker projects are typically motivated by fun and self-fulfilment and not primarily by monetary incitements. Nevertheless many new companies based on new products and services have emerged from hackerspaces or in the figurative sense from the so called maker movement (Hatch, 2013). In fact this subculture stresses unique and innovative applications of technologies, and encourages invention and prototyping. Typical interests enjoyed by makers include the exploration of intersections between traditionally separate domains e.g., arts and crafts, metal and woodworking, calligraphy and film making, electronics and robotics, Internet and computer programming, prototyping and 3D-printing.

The maker culture encourages novel applications of technologies, innovations, and entrepreneurship. Since informal, networked, peer-led, and shared learning is highlighted many authors deliberate this phenomenon as maker movement (Kera, 2012). It is finally part of an increasing recognition that the do-it-yourself phenomenon is not just a fun hobby, but it is a wide source of entrepreneurial spirit and economic potential. This goes especially when looking at the economic and financial success of single makers, who were able to offer their self-made products to large markets. Hacking is also not just a temporary appearance, but on the one hand a manifestation of ever-changing environments and on the other hand impacts markets as well as business communities. Waller and Fawcett (2013) even argue that maker movement may change the interaction of producers within the supply chain.

## **2 Characterising maker entrepreneurship**

Welter (2011) elaborated that social contexts are important for understanding when, how, and why entrepreneurship happens and who becomes involved. In fact, the maker movement provides individuals with entrepreneurial opportunities and sets boundaries for their actions. The maker movement forms a temporal, cultural, spatial, and social context for entrepreneurship. In consequence, entrepreneurship and maker movement impact each other reciprocally.

To understand maker movement from an entrepreneurial perspective, different entrepreneurial theories can be considered with regard to maker culture, particularly Schumpeter (German tradition), Knight and Schultz (Chicago tradition), as well as Mises and Kirzner (modern Austrian tradition). According to Hoselitz (1960), who analysed the history of entrepreneurship, the earliest French meaning describes an entrepreneur as ‘a person who does something’, which is similar to both, the English word ‘undertaker’ (Kalms et al., 2013) and the modern expression ‘maker’.

In the following, different aspects of entrepreneurship are being discussed briefly with regard to their intersections with the maker movement:

- 1 Idea generation and business model development, motivation, and risk taking propensity
- 2 sharing culture, networking, and co-creation.

### *2.1 Idea generation, business model development, motivation, and risk taking propensity*

Similar to Schumpeterian entrepreneurs, makers try new factor combinations and attempt to change their own realities of life and those of their fellows. As inspiration for innovation and potential business ideas makers consider social and economic developments, as well as their everyday life. This goes along with an important shift in entrepreneurship debate, especially around how entrepreneurs set goals, come to conclusions, create and identify opportunities, and secure resources to exploit opportunities (Stinchfield et al., 2013). Relevant research has been conducted for example by Alvarez and Barney (2007), Wiklund et al. (2003), and Sarasvathy (2004).

In entrepreneurship research, success is traditionally defined in terms of growth and maximising economic returns (Kirzner, 2005). In accordance to that, ‘traditional’ entrepreneurs take opportunities of market developments or temporary market disequilibrium with the ambition to realise profits (Kirzner, 1997; Shane, 2003), and grow their companies to enhance their competitive position (Porter, 1980). However, researchers have demonstrated that there are numerous entrepreneurs whose behaviours do not fit these likelihoods (Wiklund et al., 2003). Makers behave in a similar way since they do not define success in terms of economic benefit and are therefore not primarily focused on the achievement of financial profits. Makers try to design their own living environment, to satisfy particular needs, to solve individual problems, and not least to just enjoy. Due to the focus on available assets, the maker movement can be captured rather with the creation theory of entrepreneurship than with the discovery theory (Alvarez and Barney, 2007). Levi-Strauss (1962) and subsequently Baker and Nelson (2005) describe this type of entrepreneurial behaviour as bricolage and as making do ‘with whatever is at hand’. This term has also been discussed in relation to technological systems (Orlikowski, 2000). The central concepts in bricolage include ‘improvisation’ and a rebuttal to be ‘constrained by limitations’ (Di Domenico et al., 2010). Bricolage is a process of trial and error and often repeated incremental adjustments to find the right fit for a problem (Simon, 1997). Baker and Nelson (2005) identified the importance bricolage has for the entrepreneur’s process of organisational growth. In fact, many makers pursue particular commercial objectives, even if they claim to remain part of the hacker culture. These individuals can be classified as ‘maker entrepreneurs’ – regardless of the fact that an actual formation of a company has taken place or the

commercialisation has been carried out alternatively. The deciding argument is working on innovation with the aim to share it with others and finally to bring it on the market.

Both traditional entrepreneurs and non-economic driven maker entrepreneurs are exposed to considerable financial and social risks. This applies exceedingly as both groups are often highly educated with the perspective of a well-respected employment. In this regard makers in some degree are comparable to start-up founders, which prefer a self-determined activity instead of a dependent employment even on the condition to take future risks. Those risks are countervailed by the expectation of independent action and profits, whereat the former seems to be the vital aspect. As motivation is crucial in entrepreneurship theory, it seems to be necessary to get a far better understanding of what motivates hackers to get involved with own projects, invest time and financial resources, and take personal, economic and social risks. It seems to be an interesting point to understand how personal motivation is changing when a fun-based hacker project turns into a success-oriented entrepreneurial project.

## *2.2 Sharing culture, networking, and co-creation*

One of the basic principles of maker movement is to share ideas, knowledge, and technologies with like-minded people in order to obtain the best possible results. Chesbrough (2003) used the term ‘open innovation’ to describe ways in which different actors combine different technologies and know-how to build new businesses. Open innovation is the usage of ideas from inside or outside a company in order to increase technological knowledge (Chesbrough, 2003). Besides being effective in the implementation of performance, it can be valuable in integrating inflows and outflows of knowledge, expanding the market, and bringing new products to a company (Saebi and Foss, 2015). Studies with regard to the sources of innovation found out that external sources such as business partners, customer collaboration, suppliers, and competitors are at least as important as internal sources (De Ridder, 2010; Ukrainski and Varblane, 2005).

Open innovation practices are changing the rules of value creation in companies: from peer-to-peer design to co-creation with customers, suppliers, and even competitors. Tabscott and Williams (2006) state that successful firms have “open and porous boundaries and compete by reaching outside their walls to harness external knowledge” (p.290). The ability to absorb different kinds of knowledge is one of the big challenges in open innovation and co-creative scenarios (Muscio, 2007). This approach is very similar in certain aspects to the hacker culture. Therefore, many hackers without purpose apply modern approaches of innovation management. Finally hackers are part of the open source culture, where sharing information, resources and knowledge is common sense. Open source principles somehow contradict principles of business and corporate management such as intellectual property rights or the aim of establishing a unique selling proposition. It seems to be interesting, how open source ethics and business modelling logic will work together.

As mentioned before makers share their ideas with others in order to solve individual problems, to design an eligible living environment, and to just have fun. Maker teams are often based on acquaintance and friendship rather than on professional aspects such as fitting spheres of competence. Maker teams therefore are characterised by personal relationships, individual trust, and even affection. From this it becomes apparent that

maker teams differ from venture-capital-oriented start-up-teams where complementary team constellation is reckoned among most important success-factors. Nonetheless team constellation is essential for start-up development. Therefore it is of special interest to analyse differences and commonalities when observing maker teams and other start-up teams.

Idea and business development seems to be related to networking and community exploitation. Recently Nikolopoulos and Dana (2016) investigated the relationship between cosmopolitanism and the entrepreneurial process; the authors suggested to look at entrepreneurs as a set of connective entities, always evolving through networks. The spots of interchange and the communication junctions can be both physical and virtual places. Regarding this, hackers and entrepreneurs show the same desire of social contact as other people do. According to Boltanski and Chiapello (1999/2005) people in both circumstances, in a private environment and in a professional environment search to get in contact with other people, to network with others, to establish relationships, and therefore not to remain isolated. Dana and Dana (2005) advise the vital importance of networking in entrepreneurship. Therefore, stand-alone actors experience more and more difficulties in obtaining competitive and sustainable positions. In this regard, the internet can be seen as a facilitator and enabler, allowing people and firms to communicate more effectively. The Internet is a driver of innovative opportunities that involve co-creativity and collaboration (Bell and Loane, 2010). Many studies indicate that firms using internet technologies and information technologies efficiently in their workflow show a better economic performance (e.g., Gërguri-Rashiti et al., 2015; Ratten, 2008; Devaraj and Kohli, 2000). Nevertheless ‘space matters’, which means that hackers – similar with many nascent entrepreneurs – have the desire to experience both, the creative act and the materiality of things and spaces. Significant advances in Internet technologies and open-source architectures have led to open-innovation strategies. But at the same time physical hackerspaces are becoming popular in cities and rural areas as well. Therefore it seems to be interesting to carve out the role of physical and virtual spaces on hack-based innovations and new venture formation. It can be shown that there is a lack of enquiry into the meaning of Internet, Web 2.0 as well as hackerspaces on maker movement and co-creation. It is particularly interesting to analyse their impact in different stages of the innovation process – idea generation and idea implementation.

### *2.3 Research questions*

Taken together the existing research and the previous examinations there seems to be a lack of knowledge on the relationship between maker movement, entrepreneurship, and business innovation. The purpose of the current study is to address this gap and to develop insights into the hacker culture and maker movement and its intersections with entrepreneurship and business innovation. The aim is to elaborate what makes makers/hackers special. Therefore the study focuses on idea, motivation, driving forces, and setting of maker project by investigating maker projects on behalf of the following list of criteria:

- Sources of entrepreneurial ideas – Do makers/hackers pursue a systematic ideation approach and proactively look for market opportunities? What is the role of personal issues in contrast to social, ecological, and political challenges?

- Business model logic – How important is strategic planning in contrast to emergent business modelling?
- Motivation – What are the drivers for entrepreneurial behaviour of makers/hackers? What is the role of financial motivation?
- Risk taking propensity – How do makers/hackers deal with personal, economic and social risks?
- Networking – What is the role of networking in a virtual and analogue manner?
- Sharing ideas – How do makers/hackers deal with their roots in the open source culture? How important is co-creation and open innovation?

By this way, the study wants to explore what connects the maker movement with entrepreneurship, and especially what unites makers and entrepreneurs, and what separates them. Moreover the study demands to give insights on what entrepreneurship theory and practice could learn from maker movement and its raw creativity.

### **3 Methodology**

#### *3.1 Choice of material and method of analysis*

To explore the research questions, a multiple case study approach is used, which is especially useful in exploring the complexities of the entrepreneurial process (Dana and Dana, 2005; Gartner and Birley, 2002). In fact, as this research field is still in its infancy to gain a richer understanding of this rather new phenomenon calls for case study research that can be used for theory development (Yin, 2003; Linna, 2013). Therefore maker teams which follow the open source ethics and at the same time develop sustainable business models are interviewed (unit of analysis) with structured in-depth interviews (Dana and Dumez, 2015).

Qualitative research systematically investigates a selection of cases; the spectrum should represent the object in as many variants and peculiarities as possible (Baxter and Jack, 2008). In this case data from five maker projects from Germany was collected through a combination of structured in-depth interviews with maker entrepreneurs and secondary data made available by the firm. The selected projects show both, interactions with a local makerspace and an academic start-up-hub. This makes sure that the cases deliver relevant information with regard to the research questions. The choice of material consequently can be characterised as theory-driven (Glaser and Strauss, 2005). The following maker ventures are examined within the study:

- Case A: ‘VonPappe’ – individual, ecological, local-based cardboard furniture
- Case B: ‘COMAKE shoes’ – DIY shoes with sustainable materials
- Case C: ‘Purapur’ – sustainable hybrid diapers for babies
- Case D: ‘Plants and Machines’ – aquaponic systems for interior fitting
- Case E: ‘HANT’ – magazine for regional photographers and artists.

The aim of the study is to draw conclusions from individual observations, applying them to general contexts, and to generalise from results, following the principle of qualitative research. Any characteristics discovered will be transferred to existing rules and existing knowledge repositories (Yin, 2003). In-depth interviews are a useful qualitative data collection technique that can be used for a variety of purposes, including theory development. In-depth interviews are appropriate for situations in which open-ended questions are used to elicit depth of information from relatively few people. For the study a qualitative content analysis seems to be appropriate as a method for analysing the in-depth interviews with the maker entrepreneurs.

### *3.2 Data analysis*

The maker movement has emerged only recently as a research topic and therefore no standard procedures exist to investigate this field. Especially in the fields of entrepreneurship and innovation quantitative ways of enquiry are dominant over qualitative and interpretative forms. However, in the past years the interest in qualitative research methods is rising because of the limitations of quantitative methods. Mendenhall et al. (1993) argued that qualitative enquiry is appropriate for emerging fields of research and an important source for theory development. To the author's knowledge, no other study has previously investigated makers from an entrepreneurial perspective.

Aim of qualitative approaches is to address the peculiarities and to derive general insights from that inductive procedure. Crux of the matter is to use appropriate methods in order to obtain generally admitted findings from a few observations (Yin, 2003). Especially when exploring a novel field of inquiry (pilot studies) qualitative approaches seem to be appropriate to generate variables and instruments for further studies (Mayring, 2010). Barton and Lazarsfeld (1979) name this as construction of descriptive systems. Considering the topic at hand, case study and qualitative content analysis are fairly an appropriate method complementing existing literature in a number of ways.

Qualitative content analysis offers many advantages, but also limitations have to be taken into account when evaluating the generalisability of the findings and their informational value. However, qualitative content analyses contribute to more precise findings than free text interpretations especially due to the fact that the process is systematic, rule-based, and step-by-step with three main techniques for analysing data such as structuring, summarising, and explication. Therefore classification and structuring are typical use cases of a qualitative approach such as bringing regularities into text and dataset. Following Mayring (2010) content-based structuring is an appropriate method when searching for marked characteristics in text passages of different cases. The data collection and analysis process followed the general analysis process and was adapted to the objectives of the study and to the material available.

## **4 Results of the case study**

### *4.1 The role of idea generation and business model development*

The ideas of the examined maker projects evolve from a combination of personal issues with aspects of overriding importance such as social, ecological, and political challenges. Makers often feel personal dissatisfaction with the state of a system, a service, or simply

a thing. This is when existing solutions, that are available on the market do not meet the personal expectations in terms of quality, costs, and especially functionality. From this dissatisfaction evolves the desire for improvement and the carving to build a better solution that fits the individual requirements properly. Part of the dissatisfaction is that the products or services available on the market often deal inadequately with social challenges (resources, energy, waste, ethical concerns and so on). Therefore ‘maker ideas’ prevalently combine two aspects: first, solutions with improved functionality und better need-/value-orientation and second, sustainable solutions that consider social and ecological challenges. Some examples of initial points for maker project ideas are shown in the following:

- Case A I moved into an unfurnished apartment in Barcelona for an exchange semester. I needed furniture but didn’t have money or possibilities for transport. So the idea of cardboard furniture was born – recyclable, convenient, DIY, which you could receive by mail.
- Case C After the birth of my first child I was shocked about the huge amount of waste diapers produce, and I was unsatisfied with the washable diapers on the market.
- Case D My chilli plants didn’t survive as I couldn’t get the room temperature stable. So the idea was to create a system which takes better care of plants than I could do.

Business models may follow two different and somehow polarising logics. On the one hand business models emerge from the experience makers gain when dealing with peers, interested persons, potential customers and other stakeholders. A certain business model may be the result of special demand, situated supply, and accidental team constellations. This approach is more an effectuation-oriented approach of management than result of strategic business modelling. Accordingly makers act like bricoleurs and experimenters not only in terms of product design but also in terms of business model development (Stinchfield et al., 2013). On the other hand some maker teams show aspects of strategic planning and approaches which are strongly oriented on business plans in order to obtain economic success. Nevertheless in both, emergent and deliberated business models lean management attitude predominate the maker teams. By this means the maker teams keep cost structures minor and complexity manageable. Analysing the business models in depth, some common aspects can be assorted:

- Makers focus on different target groups, where often at the very first moment they appeal to members of the maker subculture by themselves. This goes in line with the attitude of sharing knowledge and co-creation in order to create appropriate solutions as constituent part of the maker ethics.
- Makers typically focus on premium segments and do not compete with low-price offers.
- Makers prefer cooperation with local actors in order to have better knowledge about the suppliers and to strengthen the local and regional economy.
- Furthermore makers appreciate production-on-demand-models in order to reduce their costs and risks but also to consider specific customer requirements.



Table 1 describes the ideas, the observed deficit of existing solutions, and the addressed social, ecological, and political as well as business challenges of the considered maker ideas.

**Table 1** Ideas and business models of the maker ventures in the study

<i>Case</i>	<i>Description of idea</i>	<i>Observed deficit of existing solutions</i>	<i>Addressed social, ecological, and political challenges</i>	<i>Business model (customer value)</i>
A	Cardboard design furniture	Existing products show insufficient functionality (daily use capability)	Saving energy and resources (transport)	Design, quality, price, lifestyle, co-creation (paintable)
B	Do-it-yourself kits for shoes	Similar products are not available on the market (DIY); insufficient design, price, and quality characteristics	Using fair produced and organic materials	Price, lifestyle, community
C	Hybrid diapers for babies	Baby diapers produce a huge amount of waste; reusable diapers are inconvenient	Reducing waste, save resources, reuse biodegradable waste	Design, sustainability
D	Aquaponic systems	Existing systems are not suitable for end-users	Providing urban food production, may be part of solution for nutrition problem	Design, lifestyle, co-creation, open source
E	Photography magazine with regional focus	Similar products are not available on the market	Creating a platform for local and regional artists	Ambitious quality, artistic value

## 4.2 *The role of motivation and risk taking propensity*

Personality aspects such as the motivation and the willingness to take risks are very individual-related aspect and differ from person to person. Nonetheless some common ground can be discovered and arranged according to the following categories.

### 4.2.1 *Expressing creativity*

The need for creativity and learning motivation unifies makers that have been investigated. They predominantly enjoy dealing with problems. This can also be classified as passion to create something new, which has not existed before and – in a second step – bring this new solution on the market. Makers feel satisfied when accepting a challenge and take it as a sort of play. The curiosity to learn new things therefore is a strong driving force behind most maker projects. Even starting-up the business is conceived as a learning process, just like dealing with a technical issue. Examples are shown in the following:

Case C There is a passion to create something which hasn't existed before.

Case C We all enjoy to deal with problems and to create solution strategies.

Case D We wanted to do something new and to learn about something which exceeds our personal knowledge fields.

#### *4.2.2 Creating a better world*

Creating social impact is a strong motive for maker projects. They pursue the objective of doing something with a greater meaning and social effect such as saving resources, reducing pollution and waste, supporting local structures, and working against mass consumption. Getting appreciation from like-minded people is thereby a most-welcome implication. Creating products that are socially and economically worthwhile is a condition precedent to the fact that the individuals strongly believe in their own products. The interviewees stated:

Case A I want to make products I really can stand for.

Case B We try in reducing the waste of resources, working for the environment, and working against mass consumption.

#### *4.2.3 Creating their own workplace*

With regard to work aspects both issues are important drivers for maker projects, the subject as described above and the work structure. Makers aim to express their creativity not only when creating products or services but also when designing their own conditions and environment of work. Most interviewees articulate a clear desire to frame the place and structure they work in. This includes an occupation with responsibility for success and failure as well as vast creative leeway. The motivation of being part of a pleasant and cooperative work atmosphere seems to be important. This includes the working together with people that are like-minded and even friends. In some cases makers are driven by the demand of building their own employment just in order to live at the place they want to live, such as the place of study. This goes along with the attitude of not accepting a status quo – no work available at a certain place – and looking for possibilities to create better solutions – creating its own workplace.

Case C I feel more comfortable in humane businesses than in larger business structures. The goal is to create a job opportunity in my city, which is a great place to live but has not many job opportunities.

Case D I want to design my own work environment, which means variety, collaboration, self-determination, responsibility, no fix working hours, no hierarchy, no avoiding of conflicts to receive better solutions.

#### *4.2.3 Earning funds*

Realise profits and earning money seem not to be the predominant motives for maker projects least of all at the first phases of maker projects. Compared to other motives financial profits play a minor role. On the other hand makers realise the fact that a perpetual source income may be necessary to stay tuned to the maker project itself. Therefore profits are not seen as necessary evil but instead as enablers for a fulfilling job. Typical statements of the interviewees are shown in the following:

Case A Of course we would like to make profit in the long term. But for the moment our team is fine with working almost for free in the short term.

Case B I like the perspective that the project could feed us in the future.

Case D The goal is to get money for doing what I love to do.

#### *4.2.4 Perceived risks and risk taking propensity*

Makers especially in early stages do not feel that the financial risks apply much pressure. Usually the maker teams try to keep investments and cost at a low level by working unpaid in short/middle term and by involving volunteers and friends. In later stages the makers frequently open up for external investors. This is connected with the conclusion that external support may be indispensable to prosecute an idea. On the other hand the interviewees are well aware of technical and market-related risks such as uncertainties with regard to scalability, implementation, and acceptance. However technical and market-related uncertainties are typically conceived as provoking tasks.

Case C To reduce the technical risks we carried out a test, the diapers get pretested with a small number and then a nation-wide test will be following.

Case E We do not worry about risks. If we fail, we are keen on doing it better the next time.

#### *4.3 The role of sharing culture, networking, and co-creation*

Maker ventures evolve from the sharing culture. Therefore sharing knowledge with other people is somehow a self-evident fact. Indeed hackers often share knowledge e.g. with friends, and even with other start-ups in their circumstances. Thereby the expectation is to help other members of their communities, to get in contact with others and finally to learn from each other in many different ways. Nonetheless the sharing culture varies among different actors. Some interviewees remain integrated members of a hacker scene – even after starting a venture.

Case D We all learn from each other. To give and to share goes hand in hand.

Case D We use of open source software, free software. This makes it easy for users to participate and to give us feedback on which we develop our stuff further.

Makers typically like to create and to share the things they created. Moreover they inspire other people to create something as well and to share their experiences. Accordingly maker entrepreneurs typically refuse passive consumer behaviour and encourage customers to become part of ‘their journey’. The products often are available as construction kits or beta-versions and address customers who like to assemble things by themselves. Makers stimulate people to join the development process either as co-developers or as beta-tester or simply as intellectual backers. They often share parts of their products/know-how with customers and value-chain-partners. According to this, maker entrepreneurs usually cooperate strongly with their suppliers, in order to improve products and processes. Therefore business partners need to be able to relate on co-creation. This also implicates that every partner on the value chain focuses on what he can do best. Some of the maker teams use open source software and hardware; others

even classify their own products as open source software and hardware. In these cases they provide manuals, source code as well as CAD-data. Complement to this, open source in other cases is also seen critically due to competition and the fear of idea drain.

The makers' attitudes towards spaces and incubators are quite ambiguous. On one hand digitisation and Internet technologies have made spaces somehow negligible factors for project development. Teams can effectively work together even if located in remote places. On the other hand the rehabilitated focus on community and local resources contribute to the perception that space still matters. The results show that some maker teams after some time complaisantly barter the creative-chaotic culture of sharing for a well-structured, professional, and reputable environment. The step out of the hacker milieu into the ecosphere of business incubator seems to be like a verbalism for a further step in entrepreneurial development.

Case C Physical space doesn't play an important role for our company.

Case B The space at the university start-up hub is good to get in contact with other start-ups, to get inspired, and to learn from others perspectives; on the other hand there is less privacy and a lot of distraction.

Case D The best room for us would be a factory building with lots of space and many tools, and a Café and hack space next door.

Case E We re-use an old building where there is almost no rent and just small fees to cover utilities. We brought it back into use. This environment offers the opportunity to meet and work together with other makers, with artists and creative people. It makes it possible to implement projects very quickly and to exchange knowledge.

## **5 Discussion and conclusions**

Makers, hackers, engineers, artists, and creative people who pursue own ideas with the intention to build their own business can unquestionably be categorised as entrepreneurs – even if they occasionally do not like terms such as businessman/businesswoman and rather prefer denominations such as bricoleur or tinkerer. This clear demarcation between so-called makers and entrepreneurs indeed has an element of truth. Therefore it seems to be of special interest to focus on both, the special characteristics and the commonalities when looking at the results of the study.

Compared to entrepreneurs in general makers show very particular motivation. Driving forces behind maker projects seem to be the wish to create something new, which has not existed before, to provide better solutions or at least to outperform existing products. Starting points of maker projects therefore predominantly are insight views and the emergent insisting on transformation. Market research and the well-directed search for market opportunities are of little importance at the first stage.

On the other hand financial motives are essential, but not dominant when projects are transformed into businesses. Achieving profits does not become an end in itself. Profits are seen as enablers for projects and the groundwork for the realisation of own ideas.

Furthermore makers typically understand a start-up process as a sequence of creative learning, just like technical problem solving. Trial and error is seen as precondition for learning and improvement and therefore error tolerance seems to be fundamental.

The so-called maker movement may be a social phenomenon, when people try to solve problems by themselves, they try to 'hack' commercial solutions, they try to share knowledge and help others, they feel strongly related to a community and to the open source ethics. But the maker movement is also an entrepreneurial phenomenon. Special characteristic is the fact that makers approach technologies playfully. They have a preference for experimentation, prototyping, adaption, and twist of technologies (e.g. use of open source microcontrollers and 3D-printed parts).

The study shows some examples of 'maker entrepreneurs', which means persons or teams which feel related to the hacker community in terms of sharing ideas and sharing knowledge, but they also feel the passion to generate new ideas, to solve problems in a new and better way, and to bring their ideas to the market. This certainly is related to the entrepreneurial spirit.

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