edited by
Massimo Menichinelli
Maria Ustarroz Molina

Understanding Collective Awareness Platforms with the Maker Movement

Results, reflections and future strategies from the Horizon 2020 MAKE-IT project

MAKE-IT

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creating social innovations and achieving
How mak
MAKE-IT

Introduction

Massimo Menichinelli, Maria Ustarroz Molina

MAKE-IT is a Horizon 2020 European research project focused on how the role of Collective Awareness Platforms (CAPS) enables the growth and governance of the Maker movement, particularly in relation to Information Technology, using and creating social innovations and achieving sustainability. The idea of online platforms has become increasingly popular with the success of companies like Amazon, Apple, Facebook, and Google, which based their business models less on competition and more on building ecosystems, partnerships and communities where it is easy for providers and users to participate. Online platforms are interesting for their ability to leverage the long-tail of markets and communities, for their dimension, influence and ability of offering a place for multiple individuals or groups to get together. In MAKE-IT we focused on those platforms that support democratic practices that are environmentally aware, participatory and are based on sharing and collaboration: Collective Awareness Platforms for Sustainability and Social Innovation or CAPS (Sestini, 2012). MAKE-IT worked in this context trying to reply to these questions: how can Maker communities achieve sustainability and organize themselves? What do Maker participants do, and how do they behave? What value do they create, and how does this benefit society? How can we help their governance, their impact and sustainability?

This book is an introduction of the work done during 2016 and 2017 within the MAKE-IT project. A lot of content was produced during MAKE-IT, and during the editing of this book we had to reduce it, and most likely more content will be produced or based upon the existing ones. All the activities of the project are well documented in the deliverables and on the website. The scope of this book is to present 1) a small snapshot of the project as of De-

cember 2017, 2) an introduction to the most interesting contents and where to find them online and in the deliverables and 3) contents and guidelines for the life of MAKE-IT even after the official end of the project, both in terms of exploitation by stakeholders and of further innovation and research work done by the members of the consortium.

The book was edited using content published under a Creative Commons Attribution (CC BY) license on the MAKE-IT website, or in MAKE-IT deliverables, or from original content for this book or from contents from other contexts. We edited all this content in order to make it more accessible and more focused on exploiting the results of the projects by improving their acceptance, adoption and dissemination by stakeholders: this book contains an exploitation strategy and it is at the same time part of it. After this short introduction, in section 2 the book introduces the Maker movement and the MAKE-IT project in section 3. In section 4 a short presentation of the ten cases studied is presented, and in section 5 the main results of all the work packages (WP) of the project are introduced. In section 6 we reflect upon the project with specific articles and interviews, and in section 7 we propose scenarios, guidelines and strategies for keeping the results of the project alive and sustainable even after its official end.

We invite you to explore the contents from this book also in their online and richer version on the MAKE-IT website and deliverables at http://make-it.io.

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2.1

De-constructing and re-making the Makers' identity(ies)

Massimo Menichinelli

This chapter was originally published in Spanish as a book chapter under a CC BY-SA license: Menichinelli, M. (2017). Deconstruyendo y rehaciendo las identidades de los Makers. In O. Martinez, A. Mestres, & M. Hinojos (Eds.), Deconstruyendo el Manifiesto Maker (pp. 18–33). Barcelona: Transit Projectes - MakerConvent.

Makers: a movement, a word, a narrative?

The Maker term is very generic and universal, but it has seen a lot of focus in the past ten years. Makers, broadly intended as people who design and manufacture artifacts with both digital and physical dimensions in collaborative places and processes, are considered a new movement with the potential to change the economy and the society. But who are the Makers? And what is a Maker? According to the Merriam-Webster dictionary ("Maker," 2016), a maker is:

1. "A person who makes something";
2. "A company that makes a specified product";
3. "A machine that makes something".

But the noun maker comes from the verb to make, which has 25 meanings as a transitive verb and 7 as an intransitive verb ("Make," 2016). It also comes from the noun make, which itself has 4 meanings ("Make," 2016):

1. "The manner or style in which a thing is constructed" or "brand";
2. "The physical, mental, or moral constitution of a person";
3. "The action of producing or manufacturing";
4. "The act of shuffling cards".

A Maker therefore could be a person, a company or a machine that makes something, and we could ask ourselves if nowadays there is always a clear distinction between the three meanings (and the noun make also refers to brand and to identity, again crucial issues regarding our first questions). But this making is a process that create a design, a brand, an identity, a manufacturing process and the process of mixing cards. All these meanings show two issues: 1) the term is very generic and universal; 2) however generic, the many meanings of the term can be related together, directly or indirectly, in order to form a definition of who are the Makers. This seems an academic, theoretical and abstract exercise, but its importance lays in the fact that there is no clear definition of who are the Makers. Or rather: there are quite few definitions, but they are very broad. The importance of the noun and verb make in the English language and the broadness of the definition of Maker have probably contributed to the success of the term, and maybe to the construction of the Maker movement. It's not a coincidence that the verb to hack has only 3 meanings as a transitive verb, 4 as an intransitive verb ("Hack," 2016) and the noun hacker has only 4 meanings ("Hacker," 2016). The hack/hacker terms, even if famous, are not as universal as the make/maker terms; they are however their parents, at least in the contemporary definition of Maker, or at least in the Make Magazine vision. When the founder, Dale Dougherty, decided the name, he was about to call it Hacks Magazine, but discovered that it wouldn't have been properly understood or understood in a positive way, and opted for Make Magazine (The Blueprint, 2014).

But it's not only a question of popularity of a term: it is also a reaction to more than one historical trend. Before starting with this initiative the Maker movement, Dale Dougherty worked at O'Reilly Media where, toge-

ther with Tim O'Reilly, he contributed to the popularization of the Web 2.0 term with the Web 2.0 Conference in late 2004 (O'Reilly, 2005). Dougherty noted that the dot-com bubble in the fall of 2001 did not crash the web, and that a new wave of applications and websites were emerging with a more participatory attitude. This brought more focus on bottom-up initiatives, but it also brought more interest in the physical dimension of the economy and innovation, since the bubble of the dot-com arrived as a consequence of the huge interest in only the digital dimension of software. The emergence of the Maker movement and of its narrative is also the reaction to another phenomenon: the loss of craft skill and craftsmen during not only the Industrial Revolution but also during the post-WWII boom of many European Countries. During these decades of boom many people moved from their small town and community to the main cities of their countries, losing their sense of community and getting used to consumerism rather than a traditional DIY attitude dictated by a scarcity of resources. From the house with its own workshop to the house with a nearby shopping mall. Each country has passed through a different history, but this is a pattern I've seen in many countries, from Italy to Finland, when asking local makers if they perceive the Maker movement as a new revolution. And in less rich countries, making is yet another rediscovery (for rich countries) of the art of solving problems, building and repairing artifacts, developing a community-based local economy with very little if no resources at all or even garbage (Kamkwamba and Mealer, 2009). An attitude that seems to be useful also for rich countries, not just for managing the huge amount of garbage that they produce, but also for making companies more innovative (Radjou et al., 2012): more innovative products and production, but at least we should know how to use the garbage coming from them in an innovative way now.

But then, how do we define Makers? Make Magazine was launched in 2005 with the goal of being the technology, creativity and fun equivalent to DIY magazines for cooking and gardening (The Blueprint, 2014). According to Dale Dougherty, makers are people who make things, and therefore all of us are makers (Dougherty, 2011). This is of course a very broad framework, and the best way for understanding Makers, at least with Make Magazine's perspective, is to watch Dougherty's TED video (Dougherty, 2011), read Make Magazine, read books collecting the portraits of homebrew makers (Parks, 2005) or of successful maker entrepreneurs (Osborn, 2013), visit one of the

many Maker Faires that Make Magazine has been organising or supporting all over the world since 2006. Mark Hatch, CEO of TechShop, insists on the universality of making as well, stating that we are all makers, and that the Judeo-Christian tradition brings this idea, since that the Genesis show that God is a maker, and he made us in his image (and therefore, makers) (Hatch, 2014). Another very important author that helped the emergence of the Maker movement is Chris Anderson (Anderson, 2012), and he defined Makers in a more structured way: Makers are taking the DIY movement to online communities and global networks, with three main important features:

1. Use of digital desktop tools for designing and prototyping projects;
2. The culture of sharing design projects and of collaborating with others in online communities;
3. The use of common design file standards that allow anyone to manufacture the projects.

This bring the definition of Makers close to the idea of people working in online communities or in Maker Laboratories (Fab Labs, Makerspaces, Hackerspaces and so on), working with both analog and digital technologies, with open source and p2p practices but also few times with proprietary and traditional business attitudes. But since the term has been chosen and communicated in a very generic and universal way, it can be defined in a different way in different contexts. From the Make Magazine-style maker, to the hacker-maker, to the indie designer-maker, to the craftsman-maker. This flexibility of the term has obviously contributed to its rapid spread and popularity, but has also led to endless discussions and sometimes to an impoverishment of its meaning: after all, if everyone is a maker, then no one really is one, or we have always been maker since the invention of the wheel or fire. And this universality has been important also on two more reciprocally reinforcing directions: for building a big enough market (i.e. people who would buy Maker-related products and services) and for building a social movement (i.e. people who would identify as part of the same social group and form a collective culture and action). Makers, with needs and willing to act, but still at least partially consumers: brought together by media and businesses, with the promise to revolutionise them (we are not there yet, if we will ever be). Finally, the Maker term is so powerful, that it has not always been translated. In Spanish-speaking countries it is sometimes translated as Hacedores, but in many other coun-

tries like Italy it is never translated. A Maker therefore has many dimensions, shades and local adaptations and interpretations, between global and local contexts: so what is exactly a Maker? The question is important, because it is about the identity of persons that gather to create something together sharing the same identity. The Maker movement is, at the moment, more a movement of people trying to find themselves and each other, building global and local communities, so the issue of identity of a Maker is critical not just for understanding the phenomenon, but also for contributing to its development.

Adding more terms, nuances and data to Makers' identity(ies)

The first step for understanding the Maker movement was to explore the Maker term and the first contributions that defined it. The second step is to go further in its complexity by understanding the many differences that are present in it. For example, a traditional way for establishing a shared identity would be with a manifesto, and we already have manifestos for Makers (Hatch, 2014). But interestingly, we can see that Maker is not the only term used in manifestos for this movement: we also have Fixers (Sugru, 2012), or Repairers (iFixit, 2010; Mok, 2010; Platform21, 2009; Price, 2009) and even, universally, Doers (The Do Lectures, n.d.). And beside manifestos, we should add tenets for Tinkerers (Wilkinson and Petrich, 2014) and many definitions regarding especially open practices: Free Software (Stallman, 2002), Open Source (Perens, 1999), Open Hardware ("Open Source Hardware Definition," 2011), Open Design, which has several but not stable or complex enough definitions (Kiani et al., 1999; Menichinelli, 2013a, 2013b; Villum, 2014). These are different approaches at trying to defining an identity and / or its practice, and are useful for building a more complex view of terms, roles, practices that are or could be part of the Maker movement. If we add traditional terms related to creativity and the act of creation, a list of terms could be this:

- Hack/hacking/hacker
- Make/making/maker
- Tinkering/tinkerer
- Open source software / hardware / design
- DIY (Do-It-Yourself) / DIWO (Do-It-With-Others)

- Design/designing/designer
- Art/artist
- Engineering/engineer
- Fixer, repair…
- Doer
- …

This is, of course, an incomplete list: for example, if we have Fixers, why couldn't we have Reusers or Recyclers? Terms and roles can be neverending, but they show that the identity of Makers is not a monolithic one, but that it is rather made of different narratives. And the same person could adopt more narratives at the same time in order to build an identity. The narrative is here one of the two possible approaches for defining the identity of Makers: in this case we have a general narrative through storytelling by famous actors. This is an important factor: such a storytelling is global, is easy to understand thanks to its simplicity, it uses global media (social and traditional) for distribution. Therefore, this has been a very efficient strategy in spreading the idea of Makers, and the Maker movement would probably not exist without it. The storytelling approach is very powerful, but it has been noted that it can be abused often (Salmon, 2010). See for example two fictional movie characters that can be considered icons for Makers, Hackers and Geek: V from V for Vendetta and Luke Skywalker from Star Wars, both heroes in the fight against an evil and oppressive government. Positive icons that, it has been argued, could be interpreted as not really positive, and this shows one of the dangers of abusing storytelling: Luke Skywalker could be seen as a terrorist (Smug, 2015) and the Jedis as religious extremists (Houghton, 2015); it has also been argued that Guy Fawkes, the inspiration for V's mask, was not a freedom fighter but a religious terrorist as well (Elledge, 2015). Storytelling is always true, but from a certain point of view (as Obi-Wan Kenobi said in Star Wars). Changes are a natural part of society, but how they are told and sold can be a tricky issue, which could tend to their normalization for commercial purposes (Heath and Potter, 2004). Makers still need media, business and resources to spread the revolution, and the revolution always end in media, business and resources. Hackers often discuss if each new year will be the year when Linux will spread to all the desktop computers; many Makers often discuss if each new year will be the year of the end of Capitalism, thanks to making. The point of this article is not to

discuss the eventual revolution brought by Makers, but to point the issues to address when defining, communicating and using a collective identity, which is really a critical issue. The possible pitfall of storytelling is not (just) the extremization or commercialization of an identity, but rather its oversimplification. Storytelling needs a simple narrative, but this tends too often to be too simple, abstract and universal in order to reach as many people as possible. From a certain point of view, Luke Skywalker is a hero and Makers are waging a revolution, but in real life there are much more nuances, differences and issues to consider. There have been few contributions that criticise how Makers are portrait with an oversimplified identity regarding their work, their race or their gender. Debbie Chachra explains that the danger is of a culture that encourages taking on an entire identity, rather than expressing a facet of your own identity: "maker," rather than "someone who makes things". Furthermore, celebrating only making risks ignoring those who repair, study, teach, criticise, and take care of others, communicating that artifacts are important, and people are not, with a vision that is informed by the gendered history of who made thing (Chachra, 2015).

Leah Buchley has showed that women and minorities have been much less narrated in the Maker movement (Buechley, 2014), but we cannot ignore the body of Makers: as Sennet pointed out, the hands and bodies of craftsmen have an important role in their activity (Sennett, 2009), and therefore their identity. A further element is that people still tend to identify themselves with their education title, but education is still too contained in silos, it also takes place outside of school and universities and it is increasingly intradisciplinary, interdisciplinary or multidisciplinary: one cannot be defined only by the degree or by titles achieved. In the Fab Academy, the distributed digital fabrication course of Fab Labs, the focus is on mastering a little bit of all the technologies and processes, not on becoming a highly specialised professional that works only on one technology or process. Traditionally, many educational institutions make you a professional by making you a cog with limited reach; Fab Labs and other maker laboratories make you understand how to work together with other people and how to build your professional identity by mixing more disciplines together. And work and professions have a pivotal role in the construction of identity: in the current neo-liberal economy, your identity is not defined by your passion, but by your work (which ends up being, mostly, your passion), which is increasingly a 24/7 ac-

tivity (Crary, 2014). Beside manifestos, definitions and books, another way of working with identity is on visual terms. One of the many meanings of the make noun is brand, another term strictly related to identity, since it is also referred or inserted into a broader visual identity for an organization, product or service (not just a logo, but all the visual aspects emanating from the logo and the identity it expresses). Brands are central in the Maker movement, even if the approach to their design, management and adoption may vary: one needs to sign a contract in order to being able to use the Maker Faire brand for organising a Mini Maker Faire; the Fab Lab brand is informally open and anybody can use it, even if there are criterias for being called a Fab Lab (Fab Foundation, 2013); Arduino itself has been developing a complex brand, but the division among the founders also brought a legal battle around the ownership of the brand (Hackaday, n.d.): the case is interesting because it brings more questions: is the identity in the digital and global project, or is the identity in manufacturing, or is the identity in contracts or court discussions? The whole Maker movement could also be seen as an experiment in new practices in the development of brands, especially with distributed dynamics. Each Fab Lab could be seen as a local attempt to adopt (and adapt, to a certain extent) a global brand. But the main question regarding distributed systems is: how do we handle differences among all the actors in such distributed systems? And as we have seen before: how do we handle the different identities any person could have?

When we move from the abstract concepts and terms to real people, we understand the limits of the storytelling approach, which should be complemented with research and data from real people: both are important and need to be balanced for a sustainable identity for Makers. If storytelling could be considered as a top-down approach (identity built from the visions of famous authors), then a research-driven approach could be considered bottom-up (identity reconstructed from data gathered from people, communities and places). Data can be gathered from interviewing people or from many sensors and databases: qualitative and quantitative approaches are possible, and new possibilities are increasingly emerging. For example, researchers have been working on the issue of understanding or reconstructing identity by analysing data from human motion patterns (Neverova et al., 2015), the victory sign of terrorist videos (Hassanat et al., 2016), geographic location of work and life places like in the case of Banksy (Hauge et al., 2016),

networks of transactions and discussion in the Bitcoin community (Reid and Harrigan, 2011). With machine learning and big data it is now increasingly possible to identify people regarding their body, geography, work, economic activity, political communication and so on. These cases show that we can discover more about identities now, but that there are also many more critical issues regarding privacy as a consequence and about ethical approaches to research. Beside big data analysis, many researches based on surveys and interviews have shed light on the identity of Makers. For example, one research found that the formation of the Maker identity is informed by 1) the development of a tool and material sensibility; 2) the cultivation of an adhocist attitude as an approach to making in general; and 3) engagement with the maker community, both in the space and on a larger scale (Toombs et al., 2014). A series of surveys by Eric von Hippel and his team (von Hippel et al., 2011) investigated the size and features of lead-users (people who hack existing product or develop their own products) in UK, USA e Japan, with interesting results in terms of dynamics of such phenomenon and in terms of how many Makers exist. Another example is the Makers' Inquiry research project [1](Bianchini et al., 2015), that tries to investigate the social, economic and technical nature of Makers; the project started in Italy, but it is expanding to more countries in order to understand also the differences among the national Maker communities. Other researches investigated the structure of the Maker communities, identifying different sub-communities and different architectures for the social networks of Maker communities, pointing out more nuances in the distribution of trust and of collaboration among Makers and Maker laboratories (Menichinelli, 2013c, 2016).

Making the Makers' identity(ies), in order to make the Maker movement

The identity of Makers is a recent phenomenon, shaped by storytelling on media and by practice in communities and laboratories, and both strategies are useful for building such identity, or rather the many identities that constitute what Makers are. This is one of the main challenges but also one of the important experimentations of the Make movement: a distributed experimentation on building a collective and global identity that includes and res-

1 http://makersinquiry.org/

pects many different identities. Makers are not only making physical objects, but also communities and identities and both are useful in keeping the movement together and strengthening it. The challenges is moving from identity as a source of conflicts, to conflicts solved through a more open identity that appreciates diversity, which many studies have shown to be an important element for society and single humans (Phillips, 2014). Each Fab Lab is different, each Maker is different, since they operate in a different local context with different history, culture, economy, body, mind, … . Even Autodesk have realised that there are many kind of Makers, and have published an online quiz for enabling Makers to find their own kind (Autodesk Inc., 2015).

We have seen that a huge discussion is going on regarding whether automatization, robots and machine learning will replace all or most of the jobs in the future. If work is a key element in a person's identity, it is important to understand, explore and show that the identity of a person and of a community are richer than the identity of a robot or algorithm. If we want Makers to be colleagues of robots and algorithms in the future (and not being replaced by them), we need to discover how to develop an identity for building global and local identities, communities and economies. If we look at the meanings of the maker word, it could represent a person, a company or a machine that makes something, and we could ask ourselves if nowadays there is always a clear distinction between the three. This is increasingly relevant, since there are already patents regarding how a robot could determine the identity of a user in order to develop its own identity, which can be shared online or with other robots (Anthony G. and Thor, 2015).

But algorithms, robots, machines and processes could also be useful in the development of such identity, and while the struggles of society and economy of the future are still to be fought, Makers could have a role in this, and there are two interesting examples in this direction by two women, who are not only makers but also designers, bio-hackers, information artists (and of course, even more). Heather Dewey-Hagborg[2], within the Stranger Visions [3](2012–2014) project, reconstructed and 3D printed faces of anonymous people by analysing traces of DNA found in the street, as an example of the potential misuse of DNA profiling, privacy, and genetic surveillance. Iona

2 *http://deweyhagborg.com/*

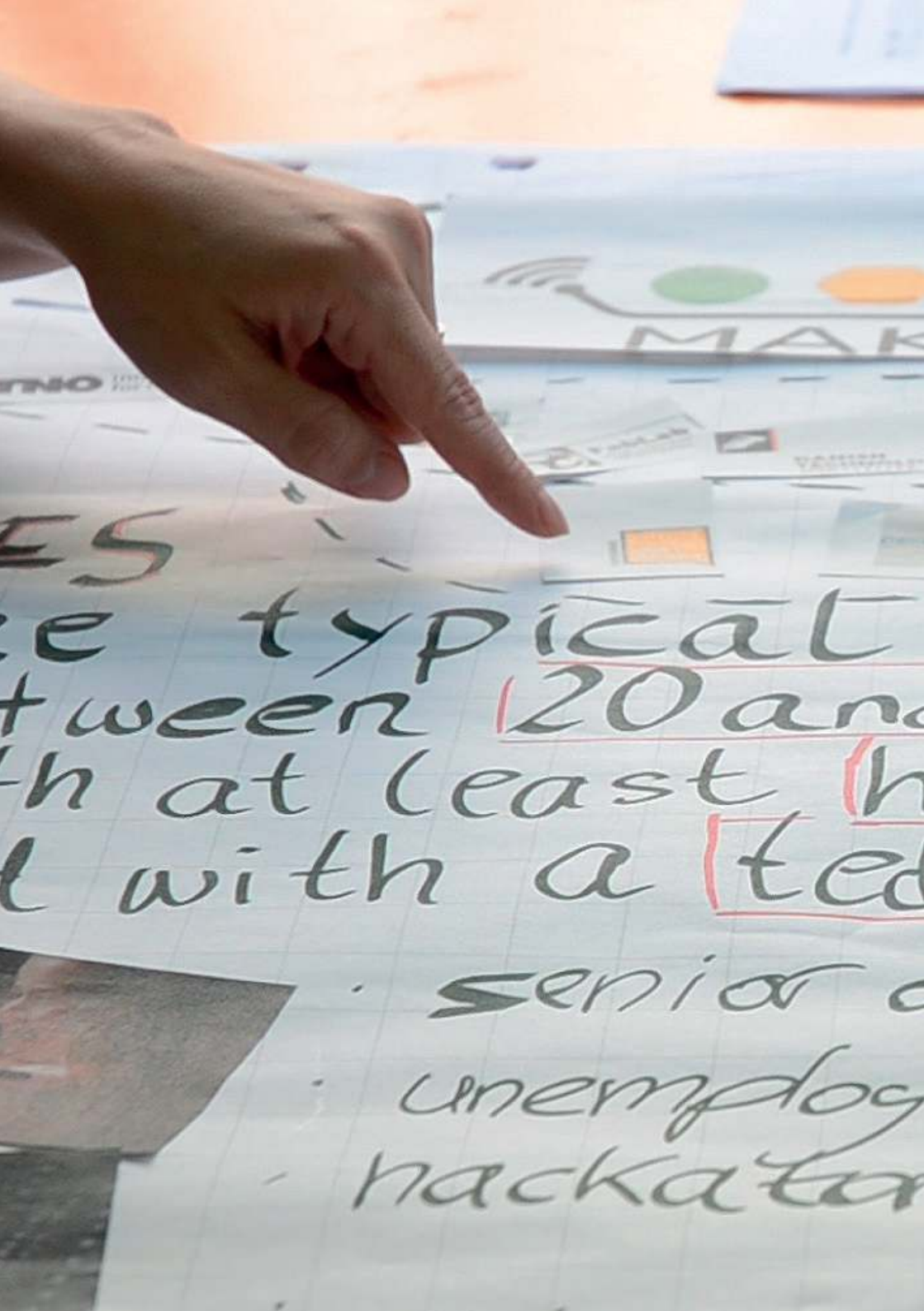
3 *http://strangervisions.com/portraits.html*

Inglesby [4] launched a company called Dot One[5], that designs scarves, posters, family trees as visualizations of users' DNA (the name of the company is a reference to the fact that only 0.1% of DNA is differentiates each person). Furthermore, the scarves are hand manufactured by another maker, Helen Foot.

Consumerism might be less important in defining identities in the future, but if we want Making to take that role, we need to understand that we can design this definition of identities as a social, open and distributed process and that identities are just another project we can work on together.

4 *http://www.ionainglesby.com/*

5 *http://www.dotone.io/*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2.2

The MAKE-IT project's perspective on makers and the Maker movement

Jeremy Millard

For further information see Deliverable 2.1 version 2 here: http://make-it.io/deliverables/

As demonstrated in section 2.1, the Maker movement is a rapidly expanding field with innumerable perspectives, interpretations and definitions. It is part of a major transformation in manufacturing towards distributed digital manufacturing, and marks a decisive shift away from a society driven by mass production and consumption towards a society characterised by 'mass customisation'. In principle, every organisation and every individual can customise the products and services they consume. This new business model cuts waste and promotes greater personal satisfaction. It also enables manufacturers to restructure supply chains and completely reorganise their businesses and operations. It enables localised individualised production, attuned to specific local and user requirements, and reduces environmental impacts because products are produced close to where they are needed. Unusually for a manufacturing innovation, momentum started at the bottom, pioneered by non-profit makers who hack products and designs in addition to software. This has had significant social impacts such as spawning new skills and jobs, for example through the Fab Lab network (Anderson, 2012).

This blurs the relationships between producer, supplier and consumer, and also has profound implications for supply chains as well as for the organisation and content of work, which will in turn have impacts on governance, regulation, education and social security. Given the specific context of the MAKE-IT project as a CAPS funded research and innovation action supported by the European Commission, its approach to and definition of the Maker movement focuses on the overlap between four main strands and fields of activity, as illustrated in the figure:

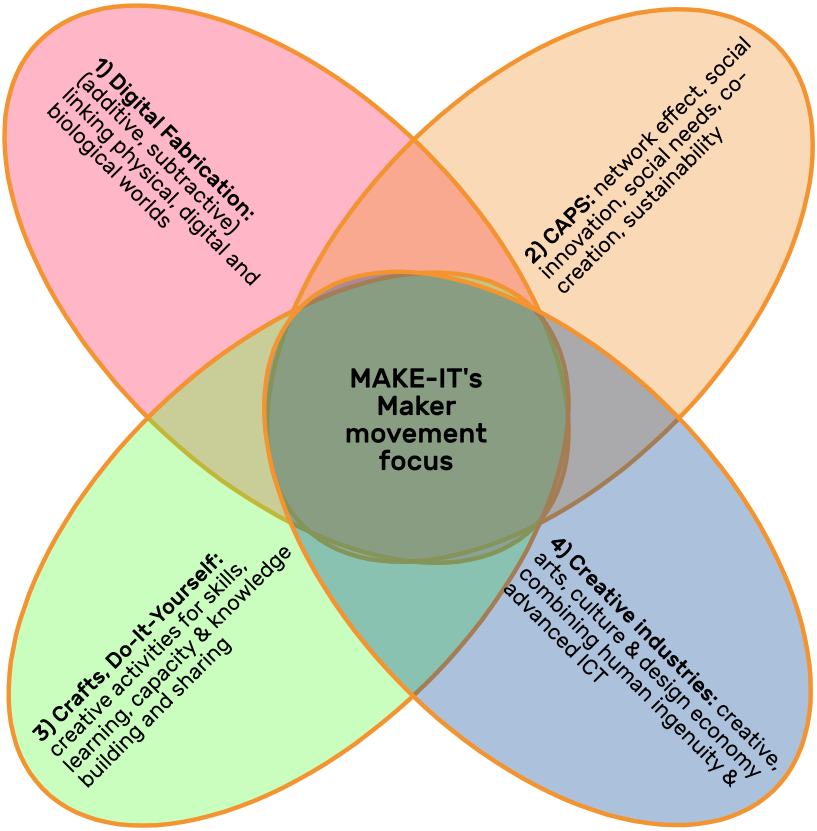

Figure 1. Venn diagram illustrating the Maker movement focus of the MAKE-IT project at the conjunction of four overlapping fields

Digital fabrication (1) provides the technological underpinning of the Maker movement. Digital modelling and fabrication is a process that unifies design with production through the use of 3D modelling software or computer-aided design (CAD) and additive and subtractive manufacturing processes: 3D printing is a type of additive fabrication, whilst machining is a type of subtractive fabrication. The initial focus on simple 3D printers has now progressed to an awareness that the real Maker revolution comes when these are combined with laser cutters, precision mills, large and small format mills, as well as digital assemblers and re-assemblers. These use various combinations of feed-stocks, including biological materials as well as pulverised, sintered or melted plastic, rubber, metal, glass, wood, ceramics, paper, etc., much of which is very inexpensive and sourced locally. Tools and materials like these used together give Makers at any scale and size a whole suite of capabilities for additive and subtractive manufacturing, 2D and 3D printing, form, function, actuators, sensors, etc. They are being installed and used, not just in industry and research labs, but in many communities by SMEs, start-ups, civil organisations and even individuals. As in the ICT revolution over the last twenty years, their costs are tumbling fast and their quality and ease of use are dramatically improving (Rifkin, 2014), and just like its digital predecessor that saw the disruption driven by personal computers and co-creation online, much of the energy and innovation of the digital fabrication revolution is being driven from the bottom. Thus with suitable feed-stocks, digital fabrication tools allow designers to produce both inert and bio-material objects from a digital source, as well as convert a material object back to a digital source in a two-way process which can be shared both online and in situ.

Community Awareness Platforms (CAPS) (2): Communities such as the makers may build and exploit communication infrastructures for collaboration, sharing and learning purposes. CAPS is the European Commission's initiative for designing and piloting online platforms that create awareness of sustainability problems and offer collaborative solutions. These are based on networks (for example of people, ideas and sensors), thereby enabling new forms of social innovation that aim to support behavioural change, reputational processes and self-regulation to the maximum degree so that these are trustable and effective. These can express themselves, for example, in new lifestyles and in consumption and production patterns, and give

power not only to for-profit platforms but also to those which have, at least in part, non-commercial objectives. CAPS use ICT tools and networks for supporting and propelling new forms of sustainability and social innovation. This is done through a people-centric approach that aims to actively involve citizens in creating multi-dimensional communities at the grassroots, whilst at the same time linking into wider social, economic, environmental and democratic systems. Sestini (2012) describes CAPS as mobilising the network effect of collective intelligence for the public good, where collective intelligence is seen as expressing itself through such phenomena as crowdsourcing and connective communities, and is often the result of forms of bottom-up and self-organisation. In this context, the concept of CAPS has arisen from three trends each of which can harness and deploy different forms of collective intelligence, and lead to better policies and actions in tackling the many societal challenges we are facing. All three can lead to what Sestini calls 'hyper-connected humanity', the ultimate goal being to foster a more sustainable future based on a low-carbon, beyond-GDP economy, and a resilient, cooperative democratic community: first, social networking; second, direct contact with the environment through the Internet of Things; and third, the collaborative production of knowledge, like Wikipedia. A fourth major trend can now be added to this repertoire, i.e. not only the collaborative production of knowledge and other forms of intangible content, but also the collaborative production and consumption of tangible forms of physical objects, as currently being realised by the burgeoning Maker movement.

Crafts, do-it-yourself, creative and learning cultures (3): The tradition of craft production is the process of manufacturing by hand with or without the aid of advanced or power tools. In parallel with this, do-it-yourself presents gateway opportunities for the un-skilled or novice to build, modify or repair something without the direct aid of experts or professionals. Both can also express themselves through developing an ethos of self-help, learning and competence building, often in shared and collaborative spaces like libraries, repair cafés, schools, universities and other common, shared or public spaces. Such spaces are often aimed at specific target groups, such as those who are marginalised or vulnerable in some way, and support hands-on experiences and creative ideas development and production. Many become 'constructionist learning environments' for building 'social-emotional competences' with strong social-political potential, social capital and so-

cial inclusion (Fourie & Meyer, 2015). According to a From Now On report (2016), the idea of 'making' is more important than seeing people primarily as 'makers', given that making is taking place as just one activity intimately mixed/bundled with other activities. This emphasises the notion that the Maker movement is not a discrete, separate phenomenon but instead points to a broader 'making culture' reflecting the burgeoning desire amongst many people to move on from a purely consumerist society to start again 'getting their hands dirty'. This means there is a need to think less about promoting and supporting a discrete separate 'maker culture', and more about a broad and integrative 'making culture'. Thus, it is important to move away from only seeing making as an instrumental activity for people to make their own products with the focus largely on the technology, towards also supporting a more widespread change of 'reconnecting brain and hand'. In practice this also means, for example, not establishing making only as a separate activity in separate maker spaces, such as in libraries, educational institutes, etc., but ensuring making is an integral part of the wider range of activities in many institutions. Thus, makerspaces in this context focus on encouraging 'trying', 'doing', 'creating spontaneously', 'enjoying' and 'having fun'. The very essence of maker spaces lies in creativity, informality, doing things without pressure and a 'try-and-fail-and-try-again' approach. In this way there is often an ethical and inclusive imperative in making things, nurtured through capacity building and empowerment, exploration, experimentation, fun and the absence of pressure to excel, coupled with sharing and gaining new knowledge (Fourie & Meyer, 2015).

Creative industries (4): Arising from the craft and do-it-yourself cultures but distinct from these, many makers are today overlapping and working with the so-called creative industries as creative, arts and culture-based economic activities. These constitute a range of economic activities which are concerned with the generation and exploitation of knowledge derived from, for example, architecture, art, cultural heritage, crafts, design, fashion, film, music, the performing arts, publishing, R&D, software, toys and games, TV and radio and video games. ICT tools are playing a significant role in boosting these industries as they enable, often for the first time, any actor to collect, preserve, organise and distribute creative and cultural content, ranging from languages to historical artefacts. Makers are providing much of the new physical and digital inputs to these industries, many of which are

still small scale, often recently established as start-ups, social entrepreneurs or SMEs, but also increasingly working with and becoming larger enterprises often internationally as well as locally. The creative industries employ 11.4 million people in the EU, accounting for 5%, and rising fast, of the workforce. They are characterised by higher than average levels of life satisfaction and wellbeing, with the largest number of jobs being ICT-related: 'computer consultancy and programming activities' (Pratt et al., 2015). Creativity is also inversely related to computerisability: 87% of highly creative workers are at low or no risk of full automation, compared to 40% of jobs in the UK workforce as a whole. Such findings reflect the fact that machines can most successfully emulate humans when a problem is well specified in advance -- that is, when performance can be straightforwardly quantified and evaluated -- and when the work task environment is sufficiently simple to enable autonomous control. Machines struggle when tasks are highly interpretive, geared at products whose final form is not fully specified in advance and when work task environments are complex -- a good description of most creative as well as Maker occupations (Fujiwara et al., 2015).

2.3

ICT and Maker technology

Troels Bovbjerg

You can read more in the Deliverables D5.1, D5.2 and D5.3 here: http://make-it.io/deliverables/

Most makers uses information and communication technology (ICT) without reflecting on how it affects the way that, e.g. the project is making progress, how the maker is teaming up formally or informally with contributors around the world or just finding valuable open source input online. When working in this environment for a while, maybe makers start to take all this free information for granted, but the current situation is very different from product development in the corporate and industrial world. This does not mean that the two worlds – Maker movement and corporate – are completely separate, but instead they often seem to benefit from each other. For example, both ICT and manufacturing technologies have mainly not been developed in the past for the Maker movement specifically, but are nevertheless highly used within it. And, now we are seeing clear indications that corporate industry is inspired by the way makers collaborate, share and socialise around product development.

In the MAKE-IT project, an extensive overview of maker relevant technologies has been conducted. This overview includes online platforms for communication, collaboration, organisation, sharing, as well as Information Technology and technologies for the manufacture of tangible objects.

All these different types of technologies are categorised in MAKE-IT's TechRadar[6] application into several levels for research purposes and for mapping, thereby also creating a user-friendly overview.

An example of categorization into Domains, Categories, Sub-categories and Technologies is seen in Figure 2. The whole data set can be found on the TechRadar website. The screenshot in Figure 3 shows content filtered for (online) collaboration platforms.

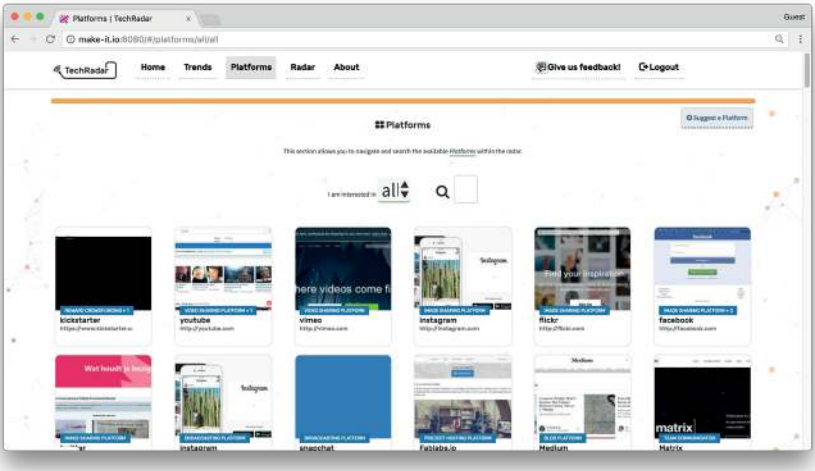

Figure 2: An illustration of levels of technology in the manufacturing domain used in the TechRadar

Figure 4 shows the disposition of technology types (both Information Technology and Manufacturing) as well as of technology uses (termed here "Maker Community"), as covered by the TechRadar as of 7 June 2017. It can be seen that manufacturing technologies are dominated by examples of 3D printing, as would be expected in the maker context, whereas modelling and robotics examples are much less numerous, though becoming increasingly more so. Information Technology currently provides fewer examples

6 *http://techradar.make-it.io*

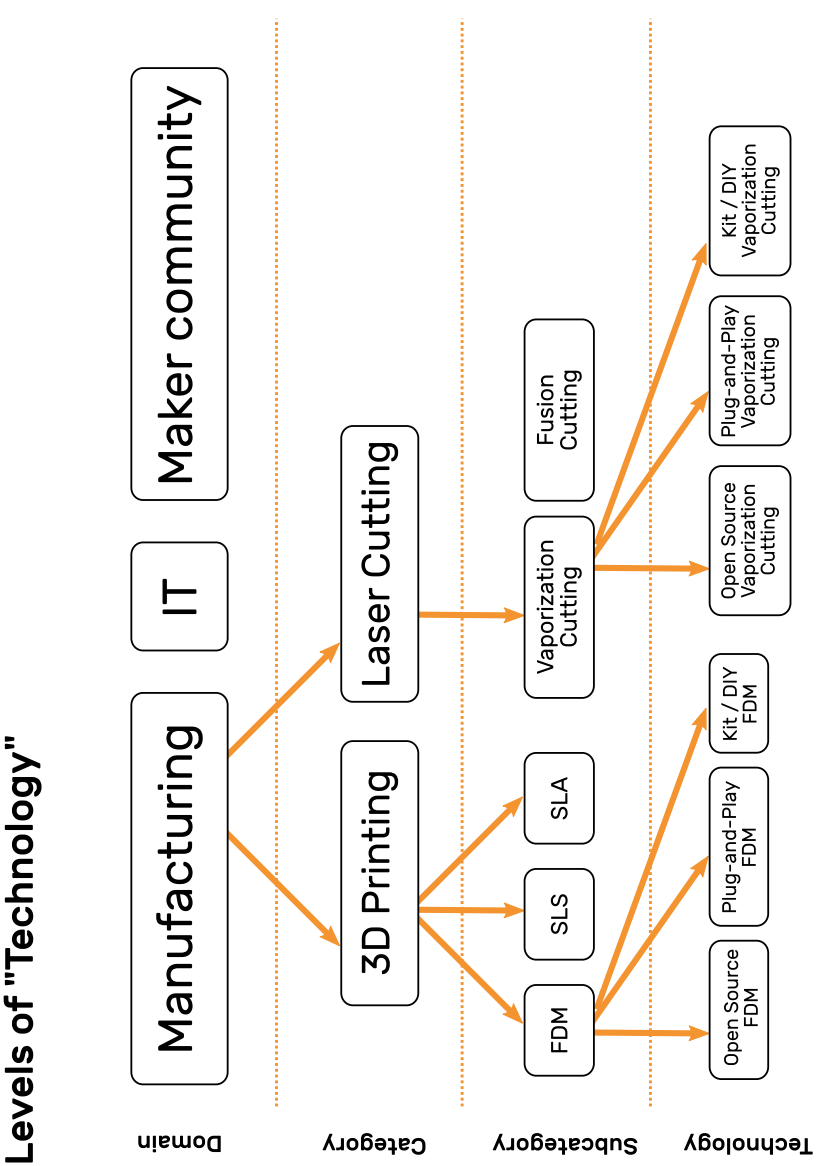

Figure 3: Screenshot of the TechRadar content filtered for (online) collaboration platforms

overall than manufacturing technologies, but where the Internet of Things and software development are the most common IT for makers. This shows that, at this early stage of maker development, the basic technology is still dominated by 3D manufacturing products and services and much less so by specific IT technologies. It might be expected that this balance will change in future as making becomes more professionalised, commercialised and more integrated into the supply chains, for example, of large scale manufacturing, as well as integrated into larger scale ecosystems and networks. Technology uses (in the Maker Community domain) are dominated by technologies used for collaboration, indicating the prime importance of this to makers. Technology use also strongly supports commercialisation, interaction, sharing and learning, similarly indicating their importance to makers. Communication and organisation are also important activities but considerably less so than the other five. It is clear, that at this early stage of maker development, it seems that technology suppliers are already developing many more products and services tailored to engaging makers with each other through collaboration, interaction, sharing and learning. These activities can be undertaken in a relatively informal and unstructured manner at the outset, although can later benefit from a more structured approach.

Maker development at this stage seems much less characterised by activities like communication and organisation that require relatively more planning and structure from the outset. However, commercialisation is the second most important activity after collaboration, and this does requires considerable planning and structure, indicating the high importance of this particular activity for the survival of many Maker initiatives.

In MAKE-IT's deliverable D5.1, all the platforms and technologies covered by the TechRadar are given a score across four dimensions which provide a cumulative sequential logic for how maker technologies are identified, developed, adopted, deployed and then used by different maker types, as depicted in Figure 8:

1. Technology Readiness Level (TRL)
2. Technology adoption
3. Technology deployment
4. Scale and Interaction of use

Starting in the bottom right corner of Figure 8, ideas, prompts and proposals for new technology development are progressed through the 9 levels of the Technology Readiness Levels[7], resulting in technology which is system operational, although there are no specific adopters at this point.

The technology may then be taken up through the 5 adoption stages, noting the 'chasm' (critical transition) between stages 2 and 3, which if successfully overcome, is likely to lead into stages 3 and 4.

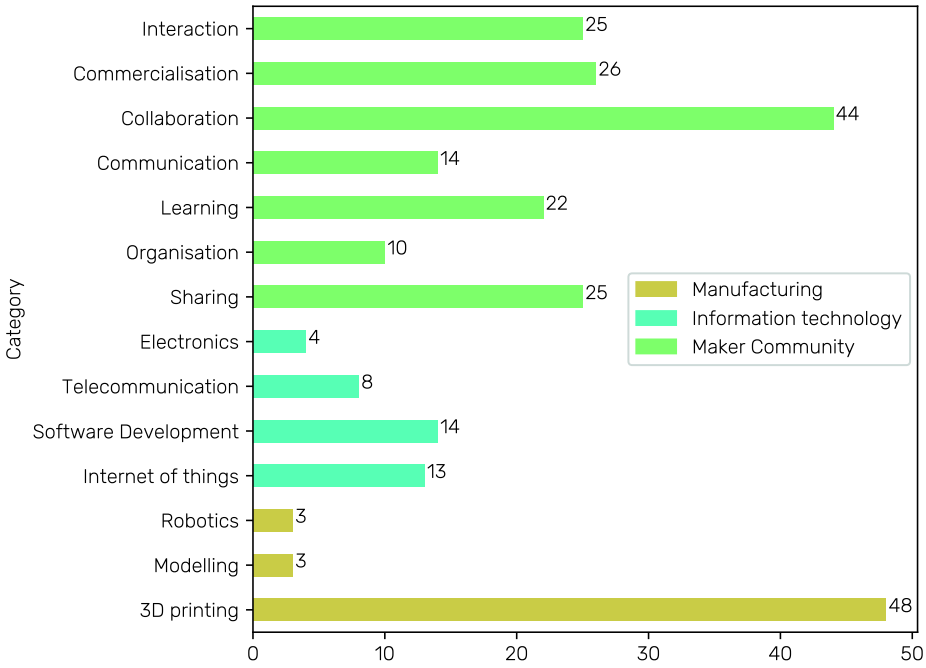

Figure 4: Distribution of domains and categories in the TechRadar

7 *https://en.wikipedia.org/wiki/Technology_readiness_level*

Adoption might, in turn, lead to real market or other real-life deployment, which also has five phases with a critical point between phases 2 and 3, when early enthusiasm and hype may not translate into a phase of reassessment and re-evaluation. However if it does, then creative construction and market pull are possible for widespread rollout and use that creates real value and impacts across society. Finally, at the top of the figure, the different phases of deployment can also support different constellations of Maker initiative.

This is likely to commence with a single maker, but several of these may then scale and interact with other initiatives and actors through collaboration, community, ecosystem and fully networked examples. Each of the three top dimensions in the figure feeds back into the bottom dimension, perhaps prompting ideas and innovations for further technology development through the cycle, as well as iterating with each other. An analysis is currently being undertaken of each of these four technology dimensions using the TechRadar data.

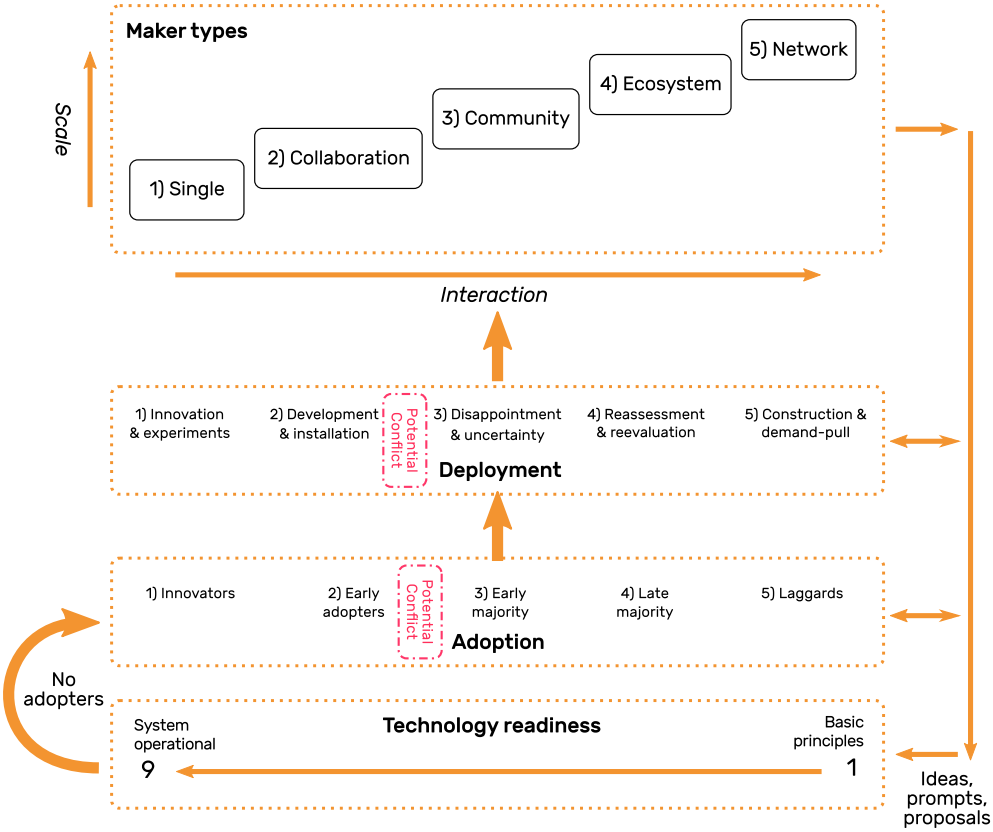

Figure 5: Technology systems

2.4

Thousands of independent inventors, with one blind spot

David Langley

Originally published on the MAKE-IT blog here: http://make-it.io/2016/11/02/thousands-of-independent-inventors-with-one-blind-spot/

Recently, I was lucky enough to visit the **Maker Faire Rome**. With over 110,000 participants, Europe's largest meeting for citizens who want to make innovative new things. Thousands of independent inventors showed their ideas to thousands more wannabe inventors. On one of the days access was exclusively for children, to inspire the next generation of inventors. Altogether, very fascinating!

It occurred to me that there was a lot of undiscovered talent there in the huge hangars, just outside the Italian capital city. There was no shortage of scintillating ideas. Many of them made use of the newest technologies for making prototypes, to which large organisations no long have sole access: 3D printers, lasers that melt powder in highly accurate forms, or that cut out shapes from all sorts of materials. And mini-computers, such as **Arduino**, that control many inventions and instil them with smart characteristics. Whilst walking around, I chatted to a couple who had developed a smart city solution for car sharing. The system registers who uses which car and the costs are automatically settled. A pilot in Cagliari is well on its way. I ate "food of the future", where algae and insects were incorporated into a range of surprisingly edi-

ble foods. There was a design for a computer with unlimited computational power, a hyper-efficient electromotor, drones to measure air quality, an enormous printer to squeeze mud and straw into the shape of houses, all sorts of robots and much, much more.

Professor Neil Gershenfeld, director of MIT's Center for Bits and Atoms and one of the creators of the **Fab Lab concept**, awarded the main prize to a couple of students. Francesco Pezzuoli and Dario Corona had invented a smart glove that registers sign language movements and translates them, via a smartphone, into speech. This can reduce the gap between those with hearing impairments and the rest of the population.

So why did I have the feeling that all this talent was, as yet, undiscovered? To begin with: it seems that the makers themselves do not fully realise that – besides having a brilliant idea – a lot more is needed to bring a desirable and successful product to market. They seem to be preoccupied with their own technical solution. But I found many of their answers to my questions regarding their business plans to be weak. Because of this, I fear that many encouraging projects will fail unnecessarily.

Most makers subscribe to the ideas behind **the open source movement** and most ideas are directly related to creating a better world, for disadvantaged people, for the environment or in other ways. They have an allergy to being "commercial". Commendable perhaps? But, at the same time it is somewhat strange: Because makers also crave financial stability and a healthy future perspective for their brainchildren.

The thing that occurred to me above all, was that the visitors to the stands were hardly encouraged to contribute at all. Those guests walked around full of interest, with their own opinions, judgments and additional ideas. I saw them being quite impressed with the various projects and they enjoyed discussing things with the makers. But, the other way around, the technically oriented makers seemed to have a blind spot for the potential contribution of the visitors. After seeing what a project was all about, the visitors generally just walked away without there being any lasting connection. Unless they remember to go online once they get home and search out the maker projects they liked the best. I believe that the interested public can do much

more than just listen: they can sign up to take part as guinea pigs for prototypes and pilot tests. They can share their ideas for application areas and user situations. They can offer their experience and knowledge of, for example, marketing and commercialization.

Apart from some notable exceptions, most maker projects do not achieve large scale penetration in practice. For some, that is not the intention. Other ideas may just not be good enough. But I believe that too often this is because the makers try and do everything themselves. Whilst their strength often lies in the technology and not in other equally important areas. Why do they not endeavour to build a community around their project from the well-intentioned visitors to their stands? Why do they not see the benefit of increasing the reservoir of available knowledge and talent which they could make use of in making their project sustainably successful?

All in all, the vibrant **Maker Faire Rome** showed me something highly encouraging: Through access to advanced production technologies an enormous potential for innovation is being awakened within the citizen population. Should large-scale production firms, such as those making consumer electronics, consumables and chemical products, fear a new wave of competition? Well, I actually see the makers as representing a new opportunity for these firms. New forms of collaboration between incumbents and these hobbyists and free spirits have not been well explored. By understanding the makers' motivations and by offering them resources, new win-win situations could regularly be achieved.

THE MAKE-IT PROJECT 3

3.1

Overview

David Langley

How do new digital technologies enable ordinary citizens to organise their mutual interactions so that they can develop their own social innovations? In what ways do people learn from each other and work together in so that they can form an ecosystem in which knowledge, ideas and talent are shared and built upon? Which development paths do socially-minded entrepreneurs follow as they attempt to balance their sharing ideals with the commercial focus needed in order to scale-up their impact?These and other questions with wide-ranging implications for European society are addressed in the MAKE-IT project, described in this book.

MAKE-IT studies "makers"

As digitalization within society continues to become ever more pervasive, increasingly powerful tools are becoming available to ordinary people and this is completely changing the way we make intangible (digital) products, as well as intangible (physical) objects. Over the past two decades, the Internet has revolutionised, and many would claim democratised, publishing, broadcasting and communications. Today, virtually everybody on the planet with access to the Internet can make digital content composed of virtual 'bits' and make it available to everyone else instantly, no matter who they are or where they live. Now, the same thing is happening to manufacturing

as makerspaces and Fab Labs are providing low-cost access to digital fabrication tools like 3D printers and laser cutters. Now everyone can design tangible objects using state-of-the art design programs and share their ideas as virtual 'bits' in global networks. Additionally, they can fabricate these objects as physical things ('atoms') which manifest themselves locally. In this way, the interface between the virtual and the physical worlds is blurring, if not disappearing altogether. As a shorthand term, this move from bits to atoms is being called the Maker movement.

Only in the last few decades has citizens' self-image become that of "consumers", buying, using and disposing of things made by corporations. Now there is a growing trend towards "making" as an intrinsically human activity, as old as humankind itself. As Daniel Charny explains in his book, Power of Making (Charny, 2011) , "Making is the most powerful way that we solve problems, express ideas and shape our world. What and how we make defines who we are, and communicates who we want to be." Be it clothes, clay pots, smart health sensors or digital home automation systems, making activities are increasingly being embraced by ordinary people. And their making activities are increasingly enabled by new internet technologies. We choose to focus our project on the Maker movement because of makers' strong focus on collaboration and social innovation, and because of their use of global networks as well as their local embeddedness. As such, we believe that they ways that makers use collective awareness platforms for sustainability and social innovation (CAPS) now could point the way forward for their use in other societal areas in the future.

MAKE-IT analyses CAPS

The essence of the idea of CAPS is that communities of users form a new and transparent understanding of their activities and of their environmental and societal impact, often supported by new information and communication technologies. They become collectively aware and, together, more intelligent, capable and mindful than they could be as individuals. In 2012, Fabrizio Sestini from the European Commission collated ideas surrounding new internet technologies into this vision that highlights (1) new approaches for the self-organization of human relations, such as social media, (2) the development of collective intelligence and the cooperative production of knowledge, such as github and Wiki-

pedia, and (3) the enhancement of transparency through collating information from the surrounding environment, such as through the implementation of sensors in the internet of things (Sestini, 2012). Together, these developments allow for increased collective awareness and the increased participation of a wide range of individuals and groups in collective decision making. According to Thomas Malone from the MIT Center for Collective Intelligence, any group's collective intelligence is only partially determined by the individual intelligence of the group's members. Three other factors turn out to be more important: high social perceptiveness within the group, a balance between participation of all members, and a healthy gender balance. Malone (McCarthy, 2016): "Women on average score higher on social perceptiveness than men. But what you need for a group to be collectively intelligent may be just having enough people in the group who are relatively high on the measure of social perceptiveness."

MAKE-IT Objective

The overall objective of MAKE-IT is to understand the role of collective awareness platforms for sustainability and social innovation in how ordinary people become empowered and enabled to make things, as opposed to only buy things; how the community of makers has grown and operates, particularly in relation to using and creating social innovations and achieving sustainability. We then translate these findings into a wider understanding of the uses and impacts both of CAPS in different contexts as well as of the Maker movement itself. In order to achieve this, we have made use of an excellent network of related European projects, maker organizations, including some of Europe's leading maker minds, and other global relations, such as the MIT Center for Bits and Atoms and the worldwide Fab Labs network.

The key topics covered in MAKE-IT relate to the ways that makers are using CAPS. We have tackled these challenges by applying different approaches:

- A conceptual framework to inform other tasks and to form the basis of an approach to analyse the impact of Maker initiatives. This work builds on other EU projects that measure the impact of social innovations, including IA4SI[1]. For more information on this see sections 2.2, 3.2 and 7.2.

1 *http://ia4si.eu/*

- Primary research through in-depth cases analyses of ten Maker initiatives and an analysis across the cases, whereby we form a picture of the European Maker movement in 2017. We assess the cases along the three analytical pillars, above, to understand how makers view and exploit the opportunities afforded by CAPS to create societal impact: see section 4

- We also adopt a hands-on approach that we call Innovation Action Research. In this way we collaborate with makers to solve current practical problems whilst at the same time furthering our scientific knowledge through a reflective process of working with practitioners. This includes knowledge transfer based on project findings and implementing new technology enhancements whilst working together with Maker initiatives: see content about WP4 in sections 5.2 and 7.1.

- As a part of this, we develop a state-of-the-art Technology Radar (TechRadar) of both digital communication technologies and digital fabrication technologies that enhance the ability of makers to create societal impact. As such, we provide a structured overview for Maker initiatives to understand how to enhance their use of CAPS: see section 2.3 and the WP5 part of sections 5.2 and 7.1.

- We contextualise the findings of MAKE-IT for four different stakeholder groups, in order to stimulate the practical application in different areas. These stakeholder groups are (1) policy makers, (2) research, facilitation and consultation actors, (3) economic stakeholders, including national and European smart industry initiatives, and (4) citizens and civil society groups. For more information per stakeholder group, see sections 3.5 and 7, especially 7.1 and 7.3.


Societal Impact Analysis
&
Sustainability Scenarios
Stakeholder Expectations
Policy Makers
Citizens
Economy/Business
Research

3.2

Three analytical pillars for examining individual Maker initiatives and making comparisons between them

Jeremy Millard

For further information see Deliverable 2.1 version 2 here: http://make-it.io/deliverables/

The MAKE-IT project has developed, deployed and tested three analytical pillars for examining individual Maker initiatives and making comparisons between them: i) how maker communities are organised and governed; ii) what maker participants do and how they behave through peer and collaborative activities; and iii) the various ways Maker initiatives impact on, and add value to, society. These three pillars are ambitious in scope, and have also been shown in the project to be theoretically sound as well as highly robust empirically when examining both the internal features and the external relations and interactions of Maker initiatives. Additionally, they are able to guide the examination of secondary evidence from the academic and grey literature in support of empirical analysis. As illustrated in the figure, the three perspectives are able to provide a comprehensive but also simple set of insights which show both the 'means' by which Maker initiatives operate and the 'ends' these 'means' produce.

In more detail the three analytical pillars together provide a complementary and integration approach to analysing and understanding Maker initiatives as follows.

Pillar 1: organisation and governance

Pillar 1 examines how maker communities are organised and governed, including strategies and financing, supply chains, management of knowledge and innovation, the institutional environment as well as ethics and social responsibility. Pillar 1 looks at the ways that maker communities using CAPS are organised both internally and externally, the legal and regulatory frameworks that promote or retard them, their IPR implications, security, safety and privacy issues, and the interfaces they have with their institutional and policy environments which include social, economic, environmental and technological systems.

The main multidisciplinary research foci of pillar 1 include:

- Organisational and management studies;
- Studies of open coordination mechanisms, and self- and co-regulation;
- Legal and governance systems and political science;
- Network theory, including examining the roles of random (potentially viral) networks, scale-free networks and small-world networks;
- Internet studies and policies, including collective internet governance, network neutrality, non-discriminatory access, security, safety, as well as privacy, identity, online reputation and anonymity issues ethics, corporate social responsibility and responsible research and innovation (RRI).

In order to operationalise pillar 1, the following research areas were examined, each of which also developed a number of specific research questions derived from the literature and successfully tested during the MAKE-IT project:

1. Strategy and financing: from sponsorship to crowdsourcing;
2. Supply chain: disrupting the producer-consumer relation;
3. Collaboration in complex communities: between control and autonomy;
4. Knowledge production and management: (online) maker spaces as learning spaces;

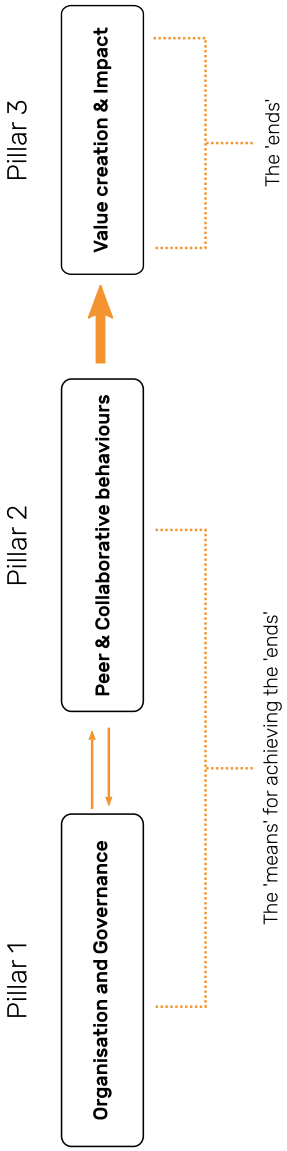

Figure 6. The three analytical pillars of MAKE-IT

5. Open innovation: balancing openness with competitive advantage;
6. How the Maker movement shapes its institutional context;
7. The ethics of maker communities.

Pillar 2: peer and collaborative activities and behaviours

Pillar 2 examines what maker participants do and how they behave, including the processes of social engagement and social influence, participation, collaboration, learning, sharing, community forming and inclusive approaches. Pillar 2 looks at the mechanisms and activities, including generating awareness and leveraging peer pressure, to drive people's behaviours to take-up maker activity and/or establish or join a maker community using CAPS approaches, and to stimulate for better lifestyles through behavioural and system change.

These activities and behaviours include learning, sharing, collaborating and realising new forms of production, including social, economic, environmental and technological issues.

The main multidisciplinary research foci of pillar 2 include:

- Behavioural studies, social psychology and sociology;
- Workplace organisation, management information systems, industrial production and micro-economics;
- ICT use in innovation and especially social innovation studies;
- Online collaboration studies, including motivation, incentives and management;
- Network theory and the study of social networks, social interactions, and the 'wisdom of the crowds' through co-creation as well as peer and collaborative production and consumption;
- Communities and networks of practice.

In order to operationalise pillar 2, the following research areas were examined, each of which also developed a number of specific research questions derived from the literature and successfully tested during the MAKE-IT project:
1. The process of social engagement in maker communities;
2. Self-determination and participation in maker communities;

3. Processes of social influence to stimulate collaboration and learning;
4. Community forming and development;
5. Activities and ambition for social innovation and commercialization.

Pillar 3: value creation and impact

Pillar 3 examines the various ways this impacts on and adds value to society: social, economic, environmental and hybrid value and impacts including overall sustainability. Pillar 3 looks at the ways and extent to which maker communities using CAPS approaches create and capture social, economic and environmental value, including through new forms of local, bottom-up business-, social- and sustainable-models, transversing between non-monetised and monetised accounting frameworks, and impact assessment methods. Local, national and global development issues can be examined. An historical perspective can also be adopted, for example in analysing the Maker movement trajectory as compared to the development of personal computing and other technology innovations, as well as in the context of socio-economic and political developments in moving from a 20th Century characterised by mass production and consumption to a 21st Century characterised increasingly by the mass customisation of production and consumption, and the recent financial crisis and its aftermath. The main multidisciplinary focus of pillar 3 is on impact and scalability effects in the following areas:

- Social value resulting from the use of CAPS approaches by the Maker movement, including social cohesion and inclusion, wellbeing, quality of life, lifestyles, the growing need for authenticity and behaviour patterns, the role of awareness and peer pressure encouraging sustainable behaviours and lifestyles, etc.
- Economic value resulting from the use of CAPS approaches by the Maker movement, including macro-economic issues like jobs, growth, trade, manufacturing and services, the so-called 'factory of the future', work and workplace innovations, the knowledge economy, business model studies, the collaborative and sharing economy, non-capitalist (non-monetary and beyond GDP) forms of economic activity, the move towards 'zero marginal costs' and 'free' economic systems (see below), etc.

- Environmental value resulting from the use of CAPS approaches by the Maker movement, including environmental sustainability, resource efficiency, building the circular economy, carbon reduction, etc.

In order to operationalise pillar 3, the following research areas were examined, each of which also developed a number of specific research questions derived from the literature and successfully tested during the MAKE-IT project:

1. The economic impact of Maker communities;
2. The social impact of Maker communities;
3. The environmental impact of Maker communities;
4. Hybrid and shared value creation, which spans across two or more of the above three.


MAKE-IT
Vienna Plenary Workshop
30 November – 1 December 2016
LAURA's bag
SHUT UP AND DANCE
LEADER
CAFÉ BAG

3.3

Consortium

The MAKE-IT Consortium

Edited from the MAKE-IT proposal (DoA - Document of Action).

The MAKE-IT consortium consists of 9 partners working together that presents a truly cross-disciplinary research team with a very strong representation of the target group of the Maker communities. The partners have been carefully selected to cover the specific objectives of the project, which is rooted in the Maker movement itself. Although there is some overlap in terms of expertise we can generally group the partners into research & technology partners on the one hand (TNO, DTI, ZSI, TUDO and CIR) and practitioners from the maker communities on the other hand (IAAC, HLW, AHHAA, FLZ).

TNO, the Netherlands[1]

TNO (Toegepast Natuurwetenschappelijk Onderzoek), the project coordinator, is an independent research organization whose expertise and research make an important contribution to the competitiveness of companies and organizations, to the economy and to the quality of society as a whole. It is important for TNO to connect people and knowledge to create innovations that boost the sustainable competitive strength of industry and well-being of society. TNO's unique position is attributable to its versatility and capacity to integrate this

1 https://www.tno.nl/en/

knowledge. TNO's Strategy & Policy expertise center is one of Europe's leading units on the topic of innovation, sustainability, and (interactive) policy making. Innovation management and strategies are core research areas of the core group in MAKE-IT. As the overall coordinator TNO has a leading role in the project, it will contribute to the conceptual framework, lead the action research and contribute to the technological developments supporting the action research.

DTI, Danish Technological Institute[2]

DTI, The Danish Technological Institute, is a self-owned and not-for-profit research institution. DTI has a close link to Danish and international business sectors and thus mainly participates in research and development projects, which are of use to society. DTI works across a broad range of industries as well as in leading edge sectors. Being at the forefront of innovation DTI is also experimenting with new forms of collaboration and production and thus runs its own FabLab. DTI is thus a core research partner in this project driving the conceptual framework along the three analytical pillars. In addition, DTI also has its own case in the maker community and is ideally positioned for action research in this field.

Zentrum für Soziale Innovation – ZSI, Austria[3]

ZSI, Centre for Social Innovation, is an independent research institution that conducts research on the social embedding and impact of all types of innovations, and contributes to the design and diffusion of socially accepted and sustainable innovations to meet social challenges. By deployment of innovative research, education, advisory services and coordination of networks, ZSI create new knowledge, reflect and configure existing knowledge, evaluate measures, develop concepts and forward their implementation. As independent and globally acting scientific institution, ZSI is engaged in the development of theories, methodologies, instruments and measures as well as in the dissemination of a systemically conceptualized broad innovation approach. The Technology and Knowledge Unit of ZSI has a long tradition in actively exploring and engaging in socio-technical innovations applying a broad range of participatory methods.

2 *http://www.dti.dk/*

3 *https://www.zsi.at/en/home*

This will also be applied in the case of MAKE-IT, where ZSI will coordinate the case explorations and contribute with their theoretical and methodological expertise to the project.

Technische Universität Dortmund – TUDO, Germany[4]

TUDO, Technical University Dortmund, has a long tradition of researching and teaching at the global intersection between man, nature, and technology. It has developed a unique profile with a special combination of faculties in the natural sciences and engineering, the social sciences and the humanities. This structure produces new knowledge, methodologies and technical innovations. The unit involved in MAKE-IT from TUDO is the "sfs" (social research center), which is one of the largest German research institutes in social sciences. sfs with its focus on application-oriented social research is working on the theoretical foundations of social innovation as well as its practical implementation. Particular interest lies in the fields of education, employment, and sustainable development. sfs has run a series of scientific workshops on social innovation since 2009 and together with ZSI is one of the leading European institutions performing research on social innovation. The scientific expertise of TUDO will contribute especially to the theoretical part of concept and analysis. In addition TUDO will also perform studies on maker communities in their region.

Fab Lab Barcelona[5] @ The Institute for Advanced Architecture of Catalonia - IAAC, Spain

IAAC (Institute for Advanced Architecture of Catalonia) is an academic institution that hosts Fab Lab Barcelona, which is a leading organisation in the worldwide network of Fab Labs. Fab Lab Barcelona is the global coordination entity for Fab Academy, a digitally distributed educational platform where students develop knowledge about the principles, applications and implications of digital manufacturing technologies.

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4 *http://www.tu-dortmund.de/uni/International/*

5 *http://fablabbcn.org/*

As a city and regional hub Fab Lab Barcelona explores the relationship between the digital and physical worlds by integrating digital technologies into research projects focusing on fabrication and empower individuals to build on their knowledge to create everyday objects. As an internationally recognized player, Fab Lab Barcelona is also hubbing a growing global network. IAAC is a core partner in MAKE-IT contributing with scientific as well as practical knowledge to the exploratory studies and following a vision of wider global networking across Maker communities.

Fab Lab Zagreb - FLZ, Croatia[6]

FLZ (Fab Lab Zagreb) is the first Fab Lab in Croatia, registered as an NGO and with good relations with the Faculty of Architecture at Zagreb University, which also undertakes teaching. Fab Lab Zagreb is based on the Fab Charter and its main focus is to promote digital fabrication to general public in cooperation with similar organisations on local level and internationally. Fab Lab Zagreb has experience in local maker workshops and strongly believes that value aided generated in such makers workshops can significantly contribute to local economy, but also to well-being of modern society.

Those are not only places where ideas can be developed to products, but also places where various fields of interest are mixed together and generated new ideas and values. Similar idea and effort are noticed globally and recognized as solid base for further small scale changed in global economy. Digital fabrication, furthermore, is one of the fields of industry and economy, which might have significant influence in future period.

Therefore education from earliest age is one of the important role of those organizations. It is playground that changes the way of thinking from consumable society to productive one, and this is one of most important activity Fab Lab Zagreb emphasizes its further efforts. MAKE-IT fits thus very well with this future vision of Fab Lab Zagreb and offers the opportunity to explore this in a wider European setting.

6 *http://www.fablab.hr/*

HappyLab Vienna – HLW, Austria[7]

HLW (HappyLab) in Vienna is Austria's first FabLab. With currently about 1,500 regular users and a growth rate of 1 to 2 users daily the demand in the metropolitan region of Vienna is clearly visible. Key to this development is the combination of professional equipment and low-threshold access. A goal of HappyLab is to provide Fab Lab infrastructure throughout Austria in the medium term. In order to survive economically aside from large cities such as Vienna new approaches are needed to address a larger target group. Therefore Happylab has developed special offers for children and teenagers as well as people without technical knowledge.The Happylab is an interdisciplinary entry point for all who have creative and/or technological project ideas. It is embedded within a framework of universities, business incubators, funding agencies, specialized SMEs, industries to provide the lab users with services when their idea grows beyond the scope of the lab. A regular exchange with policy makers is also necessary in order to realize the Maker movement as a chance for the society. Collaboration and learning from each other is another important point in the Happylab community. In addition to the physical meeting place provided for joint working and tinkering, a web-based forum and a wiki page also offer the opportunity to exchange experiences. For Happylab MAKE-IT is an important project to study internal processes and value creation as well for exploring new ways of expanding the national network in a sustainable way.

Sihtasutus Teaduskeskus AHHAA, Tartu – AHHAA, Estonia[8]

AHHAA is a foundation founded by Tartu University, Tartu city and the Estonian Ministry of Education and Science. As the biggest science center in the Baltic region AHHAA aims at making science and research subjects interesting for the public. As a local innovator, AHHAA organized the very first Maker Faire of the region in Tartu as part of the Researchers' Night Festival 2014 (the event was called Tartu Mini Maker Faire). The Mini Maker Faire attracted over 150 makers and over 1000 visitors and included acti-

7 *http://www.happylab.at/*

8 *http://www.ahhaa.ee/*

vities encouraging grass root experimenting (such as the constructing of DIY solar panels or extracting DNA). The Mini Maker Faire's success encouraged AHHAA to organize it again in 2015. Maker activities in Estonia are led mainly by the community-driven organisations and groups such as the MakerLab in Tallinn or the Tartu Centre for Creative Industries in Tartu that provide the facilities (rooms) and tools for starting makers looking to set up their businesses but also to established entrepreneurs in need of specialist equipment they do not own yet or the specialist knowledge they lack because of limited personnel hiring capacity. However, as there is no established and government-supported maker space network in the country, AHHAA with its Mini Maker Faire tradition aims to operate as a temporary substitute for a get-together space and event platform for the makers that do not have an official space for meeting like-minded people at other times of the year. Tartu Mini Maker Faire functions as a meeting ground for policy-makers and makers to give the former the chance to see the condition of the maker community in the country in order to influence positive changes in the future legal and economic framework imposed on companies and entrepreneurs operating in Estonia. The Mini Maker Faire also contributed to the formation of a stronger maker-centred network in the country. With the participation in this project, the networking activities will be carried on beyond national borders.

Create it REAL ApS – CIR, Denmark[9]

CIR (Create It Real) has a clearly technical profile, offering 3D printing and related technologies. Complementary to the scientific partners DTI and TNO, who also bring technical expertise to the consortium, CIR has a strong focus on hardware products that are key technologies for the maker communities.

9 *http://www.createitreal.com/*


Maker Faire Barcelona
Mat
Laverne

3.4

Process

David Langley

You can read more on Deliverable D1.3 here: http://make-it.io/deliverables/

The MAKE-IT project is committed to high quality output and responsible research and innovation. Deliverable D1.3 describes a set of procedures that the consortium is committed to adhere to and to improve in the course of the project. A few are described here briefly.The project consists of seven work packages (WP), each has a work package leader. The leader of WP1 is also the consortium manager. The leaders of the WP, together with the scientific lead, form the Work package Leaders Committee (WPLC).

The partner managers form the Project management board (PMB). The coordinator organises and chairs biweekly meetings with the WPLC, which are open for the other members of the PMB. The WPLC has a mandate from the Project Management Board (PMB) for all day-to- day management.

Twice a year, the consortium (in particular the PMB) comes together physically during plenary meetings. The MAKE-IT Advisory Board (MAB) is a group of people from outside the project. The MAB is consulted for important decisions that affect the direction of research and/or are related to adoption of the results from the MAKE-IT project. The MAB members are: Daniel Charny, David Cuartielles, Dale Dougherty, Sherry Lassiter, and Fiorenza Lipparini.To ensure quality, all deliverables the work packages produce, are reviewed by two independent reviewers. Openness and transparency

are two of the guiding principles reflected in the different processes and methods described. At the same time there is a strong awareness within the consortium related to privacy and data protection of individual citizens. These core principles underlying the research work in MAKE-IT correspond with the practices related to Responsible Research and Innovation (RRI).


Bio hacking
Area
WINDOW

3.5

Stakeholders

Massimo Menichinelli

You can also read more in the Deliverable D7.1 here: http://make-it.io/deliverables/

In order to maximise the impact of MAKE-IT, the project addressed the quadruple helix model of multi-stakeholder collaboration based on four types of actors (Arnkil et al., 2010; Hochgerner, 2013). These four types are crucial to the success of the social innovative and collaborative processes they are involved in, and include:

1. Civil society actors (communities, associations, ...);
2. Research, facilitation and consultation actors (research entities or networks, ...);
3. Policy makers in the directly affected fields (education, research, social, technology, ...);
4. Economy actors (social entrepreneurs, funding and support networks, ...).

Therefore, MAKE-IT tried to address all the kind of stakeholders, and the results of the project might be useful for all of them in different ways, here are some examples of potential impact.

1) MAKE-IT addresses civil society actors (it is a basic assumption of social innovation research that social innovation cannot be successful without participatory collaboration of afflicted or addressed social groups).

This includes also individual Makers and Maker communities and organisations. For example, MAKE-IT could help:

- Individual Makers by providing functionalities to Maker CAPS for collaborative project development and for interfacing Maker businesses with other Maker services and platforms. They may be interested in discussing such functionalities and seeing them in practice and experimentation.
- Fab Labs, Makerspaces, Hackerspaces by testing and developing Maker CAPS functionalities for the coordination of city, regional or national networks of Makers and Makerspaces. It would be then interested in understanding more of how Fab Labs can organise collaborative networks among them. MAKE-IT can help them also by testing and providing functionalities for community and lab management; furthermore they may be then interested in understanding the role of CAPS in the management of Maker initiatives.
- People interested in Making and Makers by providing easier functionalities for finding and networking with Makerspaces and Makers. Furthermore, they could work on connecting Makers with other citizens and citizen associations who lack technology and making knowledge but who may be interesting partners for Makers. They may also be interested in understanding how non-Makers can work with Makers communities and laboratories.
- Local associations by providing content and functionalities for opening discussions on strategies for the city and the neighbourhood with a specific focus on manufacturing and unemployment. These associations may be interested in understanding how Makers can be partners in this direction and how Makerspaces can also become local community spaces.
- NGOs by providing functionalities for understanding the impact of the Maker movement, for example by visualising supply-chain and partnership networks in Maker initiatives and communities. Such organisations can help MAKE-IT by providing tools and input in managing strategic partnerships among Makers; they may be interested in understanding how Maker CAPS can be part of a sustainable way of managing business and community initiatives at global level.

2) MAKE-IT addresses research, facilitation and consultation actors (like research entities or networks). This includes also Makers that work in research, facilitation and consultation. For example, MAKE-IT could help:

- Students by providing data and publications on the Maker movement; they may be interested in discussions and communication on how Makers structure their communities at local and global level and the organisation of their activities.
- Researchers by providing data, outcomes and functionalities about the social innovation side of Maker communities and how to improve and implement it at local level. They may be interested in understanding the role of CAPS in the lifecycle of social innovation initiatives with and for Makers.
- Professors, teachers and consultants in understanding principles and practices in participation of Makers in business initiative, and how Makers organise their business initiatives. Also, it can provide functionalities bridging Makers and companies in developing joint projects. They may be interested in understanding how the Maker movement creates value at economic level.
- Consultants by providing data, outcomes and functionalities for understanding how Maker communities generate economic value and how Makers can be engaged in developing business initiatives from their projects. They may be interested in economic sustainability and project management practices within the Maker movement.
- Facilitators by providing functionalities and strategies on the participation of Makers and Makers communities in projects and local initiatives. They may be interested in information related to Makers and cities, Makers and participation and social innovation.

3) MAKE-IT addresses policy makers in the affected and needed policy fields (education, research, social, technology). For example, MAKE-IT could help:

- Deputy mayors by providing data, outcomes and functionalities for engaging Makers in discussions on policy making for urban manufacturing and unemployment. They may be interested in Makers, urban manufacturing and community participation and organisation.
- Education ministers at national level by providing data and outcomes on the size and dynamics of Maker communities; MAKE-IT can also develop and test functionalities for mapping and organising educational making

activities and national level, in order to understand their impact. They may be interested in the size and influence of Maker communities.

- Industry and Innovation ministers at regional level by providing data and outcomes on the economic influence of Makers in traditional manufacturing and size of the Maker movement. They may be interested in Maker CAPS related to cloud manufacturing or pooling Maker business initiatives. Makers can also discuss policies with him on specific online platforms. He may be interested in the relationships between Makers, CAPS and industry.
- Director of think-thank institutes by providing data and outcomes on the political and organisational sides of Makers and the relationships between Makers, manufacturing and business statistics. They may be interested CAPS for the discussion of policies with Makers.
- Policy makers by providing guidelines and CAPS functionalities for project management and project development with VCs, Makerspaces, suppliers, etc.

4) MAKE-IT addresses economic actors (including social entrepreneurs, funding networks and support networks). This includes also Makers who work professionally. For example, MAKE-IT could help:

- Startups by providing guidelines and functionalities for CAPS regarding project management and project development with VCs, Makerspaces, Suppliers, etc.
- Maker CAPS and Maker business initiatives by providing data and functionalities for bridging them with other CAPS and by providing online spaces and processes for collaborative project development. MAKE-IT can also provide data and connections with other business partners for understanding how to develop better supply-chains and related business initiatives.
- VCs by providing data and outcomes related to the business impact and dynamics of Maker communities. They may be interested in CAPS for the development of Maker businesses.
- Co-working spaces by providing guidelines and CAPS functionalities for project management and project development with VCs, Makerspaces, suppliers, etc. They may be interested in CAPS for the development of Maker businesses and the organisation of urban networks of Makers and Makerspaces and related policies.

CASE STUDIES 4

4.1

Overview of case studies

You can read more on Deliverables D3.1 and D3.2 here: http://make-it.io/deliverables/

Christian Voigt (ZSI), Elisabeth Unterfrauner (ZSI), Barbara Kieslinger (ZSI), MAKE-IT Consortium

Following the three main pillars of the MAKE-IT research approach (organization and governance, peer and collaborative behaviour, value creation and impact), D2.1 suggested a number of possible research foci, which were transformed into questions included in different research instruments. This was applied to the qualitative inquiry of 10 cases, depicting different variations and formats of the Maker movement. All ten cases have been carefully selected to capture the diversity of the Maker movement along two dimensions: innovation objectives (including social and commercial innovations) and scope of awareness (ranging from individual or group challenges to societal challenges). For data collection we have developed a case research toolkit that comprises interview guidelines, self-reporting sheets and case description templates. We conducted 3-4 interviews for each case, aiming to obtain an optimum of information variance consciously selecting four types of interviewees:

1. Maker initiative managers, being mainly intermediaries, providers of infrastructures and facilitators;
2. Makers with a commercial orientation, being sources for understanding commercial sustainability of maker initiatives;
3. Makers with a primarily social orientation, being examples for possible

change models in terms of life styles such as personalisation of objects but also in terms of changing the bigger picture of production and value chains; and

4. Female makers, in order to ensure a fair representation, and counter-balance in our research the gender gap existing in the Maker movement.

Fab Lab Barcelona[1]

Fab Lab Barcelona is one of the cases that we have explored to understand how maker initiatives are organized, how makers improve their skills and how they interact with each other and finally, which values are created by making.

Fab Lab Barcelona is part of IAAC, an international centre for education, fabrication and research dedicated on developing architecture capable of meeting global challenges in constructing 21st century habitability.

Besides the Fab Lab in the city of Barcelona, IAAC also provides research opportunities with its Valldaura Labs, a self-sufficient research centre, with a series of labs created to produce and test energy, food and things locally by using close by and available resources to develop technologies and knowledge for services and/or products in the future.

The labs include:

- **Green Lab:** digital fabrication lab making use of natural resources.
- **Energy Lab**: lab for testing the Energrid project, which aims to meet the needs of the Valldaura Labs' self-sustainable environment.
- **Food Lab**: food production is handled by researchers and students and makes use of organic gardens, orchards, edible forests products and farm animals.

Fab Lab Barcelona is the head office for the global coordination of Fab Academy programme together with the Fab Foundation and MIT's Centre for Bits and Atoms. The Fab Academy is a distributed platform of education and research where fab labs around the world operate as classrooms, with stu-

1 *http://fablabbcn.org/*

dents learning the principles, applications and implications of digital manufacturing technology. The Fablab's income derives from three main sources: educational activities (Masters Programme, Fab Academy, workshops); grants (particularly from the EU) and research grants; and from Fab Pro Services (provides access to professionals outside of IAAC).

Fablab Barcelona is led by its director, Tomas Diaz. It follows a horizontal management structure, where group leaders have the final responsibility for their respective working group.Fablab Barcelona is embedded in a network with neighbouring Fablabs, thus the lab shares expertise and services with smaller labs supporting access to digital fabrication for citizens.

The value and impact of Fablab Barcelona is seen in multiple ways: in changing opinions and behaviours in the sense of not only empowerment through making something of your own, but also being in touch with a community of people who are just like you; and education and human capital.

Fablab TI[2]

Fablab TI is one of the cases of the MAKE-IT project where the lab's internal features and relations and interactions with makers and their initiatives were explored to determine how these maker communities are organized and governed. What Makers do in the labs and their interactions with their peers and third parties, and the various ways this impacts on and adds value to society.

Fablab is funded and hosted by the Danish Technological Institute (DTI)—a non-profit self-owned organization of over 1000 specialists and 10 business units aimed at improving the exploitation of new technologies of SMEs via an interdisciplinary approach and advanced technical facilities.

Fablab TI however, is fairly autonomous of DTI and is based on the work of the Inventor Advisory Service started in 1972, and where Danish citizens are offered free of charge support, advice and counselling of their ideas and products.

2 *https://www.dti.dk/specialists/fablab-innovation/37649*

Lab management and personnel consists of:

1. A core team of three persons
    - The Head of the Inventor Advisory Service
    - A Fablab Manager, and
    - A Tangibility Manager
2. 6 Inventor Advirsors
3. 1 student lab assistant
4. 1 graphics student
5. 1 journalist and storyteller

Within Fablab TI there is a strong focus on training the lab's future core team from among its student body.

At Fablab TI having the right mindset to facilitate the process by which ideas leave the lab and successfully enter the market, trumps all other digital fabrication tools/machines in the lab. While all machines are available to users (under the supervision of attendant lab personnel), lab managers and personnel deem makerspaces (e.g. fablabs) to be spaces for more than making, and question:

- What are the machines really needed for?
- What improvements or headway are being sought after with these machines?
- What are managers and facilitators hoping to learn?
- What can users learn and likewise impart on their peers, lab facilitators and managers?
- Who are the users to be targeted and helped?
- What are the ultimate goals of the lab's users?

At Falab TI, makerspaces are spaces for learning, community building and expanding, inclusion, and cooperation between users, their peers and third parties, where necessary. These spaces are essentially about people; the 'hyper-connected humanity' emanating from mobilized individuals; the knowledge derived from sharing ideas while working towards transforming ideas into tangible and potentially lucrative solutions. At Fablab TI, lab managers and personnel work with users to empower their improvement of the

world around them, with tools, methodologies, creativity and continuous motivation.Like other fablabs around the world offering high tech digital fabrication equipment to users (3D printers, laser cutters, CNC machines, etc), Fablab TI with over 40 years of experience and knowledge gained from working with validation and commercialization of ideas from the public under its Inventor Advisory Service is able to go a step further by providing over 2000 Danish students and their teachers with knowledge and training in idea development and idea validation methods using a hands-on/practical and creativity-building approaches where the focus is on the individual rather than the idea itself. Its human-centered innovation processes and experimentation are key tools for experimenting, building and transforming ideas into commercial opportunities (if so desired). In so doing, activities at Fablab TI ranges from peer-to-peer project based technical training to local problem solving and small-scale prototype development and innovative business training.

One man's story sums up the mission of Fablab TI: Carsten Wu Søndergaard suffers from sclerosis and in response to losing his cane repeatedly, invented a magnetic add-on in order to always be able to keep it at hand. He made the first prototypes in his garage, but needed to further detail his product for production, and started visiting Fablab TI. At Fablab TI he learned about the iterative manner in which an idea can be built, taught himself 3D construction and continued making various 3D printed designs of his invention. When Carsten's invention succeeded in reaching a national drugstore franchise, taking charge and managing a business was not an option and once again he returned to Fablab TI to iterate on his business model. Through a series of meetings, presentations and negotiations with different companies he finally landed a license agreement with a Danish company, which took over production and marketing responsibilities, so Carsten could continue doing what he loved most – building ideas.Carsten's case demonstrates that the makerspace is but a small tool in a much larger landscape – the landscape of ideas. He dared to fail over and over again, resulting in him constructing his idea in an iterative, experimenting manner. Making technology available alone would not have guided Carsten to where he is today, but through guidance and sparring with other lab guests and personnel, he practiced and learned about his own aspirations and limitations as an inventor and entrepreneur.

Fab Lab Zagreb[3]

Fab Lab Zagreb (FLZ) is one of the cases that we have explored to understand how maker initiatives are organized, how makers improve their skills and how they interact with each other and finally, which values are created by making. Fab Lab Zagreb is the first Fab Lab that was established in Croatia. It is registered as an NGO and maintains close ties with the Faculty of Architecture at Zagreb University, where it is currently located. Fab Lab Zagreb's main mission is to promote digital fabrication to a general public in cooperation with similar organizations on local level and internationally. Fab Lab Zagreb is strongly connected to its current president and manager, Roberto Vdović, who also teaches at the Faculty of Architecture University of Zagreb. Being pioneers in 3D desktop printing in Croatia, Roberto and two colleagues established the first Fab Lab in Croatia in 2013 and registered it according to the Fab Lab charter.

Fab Lab Zagreb follows three core missions:

The first one is taking a leading role in educational aspect connected to the whole maker and DIY movement (Create@School): how to engage general population to use new digital fabrication technologies to improve STEAM skills, by connecting different education levels, and experiences.

The second mission is highly relevant for the local community (Give-a-hand): to be inspired by the local community problems and issues and find solutions using new technology, DIY (Do it yourself), DIWO (Do It With Others), find individual solutions and solutions for the community. Thus, Fab Lab Zagreb has a strong commitment to solving a wide range of social and other needs and moving towards contributing to meeting wider societal challenges in these areas. It addresses and involves children, unemployed people, people with disabilities, artists and students.

The third mission is supporting entrepreneurship (Do Local Go Global): it is related to the previous mission. If locally inspired solutions become interesting for global markets, they can be developed in the maker space (such as MakerBuino).

3 *http://www.fablab.hr/*

In addition, FLZ it is strictly following an open source ethos and promoting openness as part of their educational message. It serves as an entry space for their first experiences with digital fabrication. Fab Lab Zagreb puts a focus on interdisciplinarity in their activities and events, again, with a special focus on achieving educational goals and social goals.

HappyLab[4]

Happylab is one of "our" cases that we have explored to understand how maker initiatives are organized, how makers improve their skills and how they interact with each other and finally, which values are created by making.

Happylab has around 2,000 members in Vienna (there are two more labs, in Salzburg and in Berlin) and is managed by two CEOs, additionally it is supported by 5 staff members, i.e. lab manager, technical support, PR and office support. It is a small-medium enterprise whose sustainability is enabled by membership fees (among other sources of income). The machines, Happylab hosts, are the following: lasercutter, CNC Milling machine, 3D Printer, and Vinylcutter. One of the core missions of Happylab is to be accessible to the widest segments of population and does thus follow principles of empowerment and inclusion. Further, efforts are taken to reach out to pupils at different educational levels.

Accessibility is seen from a financial perspective as well as from a usability perspective. Financially the hurdle to use Happylab is rather low although only those who are paying members are allowed to use the infrastructure. The membership fee however is affordable for most people (from 9 to 49 Euro per month). From the usability point of view the mangers have tried to make the work flows as easy as possible to lower the hurdles for people without any technological background. All the machines are professional machines which work more reliably and allow for a good user experience. Members of Happylab are not requested to respect a comprising code of conduct when using the infrastructure but there are a few rules that are taken seriously. For instance, membership cards are personal and it is strictly forbidden to pass it to another person. This way, Happylab has control over

4 *http://www.happylab.at/*

whether a person is allowed to use a certain machine or not (depending on whether he or she has completed the free training for that particular machine in order to protect the machine from damage).The Happylab members learn and acquire skills, necessary to operate the machines, trough free trainings and additional specific courses (to pay) offered by Happylab formally and more informally in exchange with other members. Courses comprise trainings that are dedicated to children between 10 and 15 years, the Fab Lab Bootcamp that is a week of training on digital design and fabrication, Fab Academy that lasts for half a year, and the Ideas2Product course that aims at supporting entrepreneurs from prototyping to a product on the market.
Happylab creates economic value in the region of Vienna in the sense that it is a nutshell for start-up entrepreneurs and quite some enterprises have been born in Happylab or due to the use of Happylab. Happylab is set up in a way that is ideal for start-ups. Without any risk they can experiment around with professional machines, which would certainly exceed the financial capability of a young start-up.Happylab creates social value among its members. Users of the lab appreciate the networking aspect that they feel among likeminded people who share similar interests. Many projects that have been realised in Happylab, besides its commercial aspect, bear social value.

Mini Maker Faire Tartu[5]

Tech enthusiasts, crafters, educators, tinkerers, hobbyists, engineers, science clubs, authors, artists, students, citizens and entrepreneurs – they all come together at the Mini Maker Faire in Tartu to show their projects, to talk about what they have learned, exchange and inspire visitors to become a maker. The idea is to gather all the people that can be defined as makers to trigger an awareness and emergence of the Maker movement in Estonia and in other Baltic countries. Since its beginning the Tartu Mini Maker Faire has constantly grown: the number of makers has doubled from 2014, where 58 maker teams were present, to 2015, with an average of 1000 visitors yearly. This year Tartu the mini maker fair was fully independent from the science festival which served the recent years as the organisational frame. One could state that 'Making' and the Maker movement in general is associated to historical roots in Estonia. The deprivations during the Soviet Era

5 *http://makerfairetartu.ee/*

encouraged people to re-use materials and be creative with scarce resources. "We really did not have many things around" (interview partner AHHAA). Still the progress of 'consumerism' has jeopardized this link – and the Maker movement is supposed to bring it back. Tartu Mini Maker Faire is mostly focused on creating awareness about the Maker movement in Tartu when the term "maker" was not well-known prior the arrangement of the Mini Maker Faire. As such, it may also have the potential of getting a broader public involved with making and to promoting STEM and creativity among a broad public. Tartu Mini Maker Faire is free for the participation of makers and charges a small amount for visitors, which favours the accessibility of the event to everyone and spread the awareness about making to a broad audience.

As the Tartu Mini Maker Faire starts as an initiative from the Science Centre AHHAA, it benefits from the already established relationships with institutional partners present in the city (local government, ministries, research institutions, associations) but also from the outreach AHHAA has gained over the years among a vast array of stakeholders, among which we find schools, students, families, etc. The mission of AHHAA is to serve education purposes, by enabling the local population to learn more about STEM and nurture curiosity and desire to learn. The Tartu Mini Maker Fair fits well in one of the strategic approaches of AHHAA: to attract makers with an interest for making things, building prototypes, objects for the sake of fun and creativity. The main impact of the Tartu Mini Maker Faire is to promote STEM and creativity among a broad public – but also to create awareness around the Maker movement and the potential in making things. In this highlight, the Tartu Mini Maker Faire does showcase makers who have in mind the environmental impact of their creation, for example by using recycled materials.The Tartu Mini Maker Faire also has the ambition for the next 5 years to attract people with the idea of solving grand challenges of the society by addressing a specific problem, for instance, pollution – in order for the Maker Faire to serve as an inspirational platform to encourage people to engage in more sustainable behaviours.

In parallel to the emergence of the Tartu Mini Maker Faire, other maker spaces have been structured – like a new maker lab in Tartu: SPARK Makerlab – and some maker participants have engaged in maker activities and maker initiatives, in connection with their exhibition in the Tartu Mini Maker Faire.

Create It REAL[6]

Create It REAL is based in Aalborg, Denmark and was founded in 2009 by Jeremie Gay. Building 3D printers started as a hobby until Jeremie decided to quit his job to live out of this activity.

As of today, Create it REAL counts twelve international employees, which are mostly composed of men in their mid-20, with an engineering background. Create it REAL operates as a R&D centre, specialising in developing and adapting the technology behind 3D printing and creating platform solutions to reveal the full potential of 3D printers. They focus on 3D printing technology development, with key products being their software platform (REALvision) and the worldwide first real-time processor dedicated to 3D printing. This technology allows a printing speed 5 times faster than standard 3D printers. It also allows the encryption of 3D files which could solve Intellectual property issues in the future.

Create It REAL offer their platform to 3D printer manufacturers for integration into their own 3D printers and can also assist companies in building their prototypes to enter the 3D printing market. Create It REAL also participates in local and European projects with schools, working in partnership with Aalborg Municipality and teachers. They try to help students to develop their creativity and discover new technologies they may have to use every day in the future. Create it REAL also spend a lot of time in working in different areas of 3D printing to tackle the industry issue and accelerate its development: food printing, Bio printing, new slicing algorithm (software used to prepare a 3D print) are key areas where R&D is important to move forward.Counter-intuitively for an R&D centre, they nurture openness and publish their results to the wider public and showcase their work in exhibitions to address makers and 3D printing community. Create it REAL balances between openness and the competing market.

“One of the reasons why I left open source projects was because I knew the architecture would be a problem for long-term development.” (Jeremie Gay). Still, some openness is yet needed to allow compatibility and flexibility. To navigate the uncertainty surrounding Open Source, Create It REAL

6 *http://www.createitreal.com/*

made the choice of an "in-between", where the option to open is left for future decisions. In parallel, Create It REAL is very open about the activities they are working on. Not being open source fosters innovation but by staying close to open source, it enables compatibility, flexibility and acceptance from makers.Thus, Created It REAL seeks to find a middle-ground, the right balance between commercial activities and openness.

HRW Bottrop[7]

The HRW FabLab is located at the "Hochschule Ruhr West University for Applied Sciences" (HRW) in Bottrop, Germany. Bottrop is located in the Ruhr district, the densest populated area in Germany which has undergone significant degradation after the loss of its industrial base. Due to the explicit orientation on education and empowerment, the HRW FabLab is helping to raise the human capital of the area by teaching practical skills for innovation. Psychological barriers to higher education are consciously broken down by inviting pupils to the FabLab who could usually not imagine following an academic career.

The research and development services benefit especially local SMEs who might otherwise not have the budget for tailor-made R&D services.The HRW FabLab is primarily a laboratory for students at the technical University of Applied Sciences "Hochschule Ruhr West" (HRW) and has also open hours for non-students from the wider community.

The HRW is a technical University of Applied Sciences with focus on computer science, engineering, mathematics, natural sciences and business administration. According to the motto "How to Make (Almost) Anything", the HRW bLab encourages its students to experiment with rapid prototyping in a wide area of fields like robotics, electronics, 3D-design, -printing and –scanning, film-making, clothes-making, drone-making, and the pursuit of various individual projects. The HRW FabLab offers furthermore a wide variety of hands-on workshops and learning experiences in the above-mentioned fields for primary and secondary schools as well as other interested groups like refugees and youth from disadvantaged areas.The FabLab does

7 *http://fablab.hochschule-ruhr-west.de/content/index_ger.html*

not have a formalised membership structure, but the facility manager estimates that it has a user base of approximately 200 people who regularly use the facilities, plus a larger number of one-time users who come to workshops and courses. The FabLab is run by staff and student assistants who are employed by the university and offers research and development services for local enterprises. The FabLab is financed through university funds, federal- and EU-funds, commercial funds through innovation vouchers, education funds for STEM-projects with schools, and project-based funding. On Wednesday evenings the FabLab opens for the wider community where usage of machines is free and open to everyone and student assistants are there to help new users with the development of their projects.

The HRW FabLab's goal is to be extremely innovative and to implement research and development independent of all. The facility manager describes it the following way: "Enter with an idea and exit with a finished product. Irrespective which product we are talking about." The aim is to enlarge the world of possibilities and to empower students, pupils and other users in their personal development and in their prototyping capacities. Furthermore, the FabLab is very actively being put to use to transmit STEAM-knowledge and interests to pupils from primary and secondary education. The FabLab has a particular employee who organises these Maker workshops in the context of STEAM-education and who acts as the local node of the nationwide network "Future Through Innovation".

With its social orientation, the FabLab also organises special workshops for other groups like refugees and youth from disadvantaged neighbourhoods in collaboration with local neighbourhood associations. At the weekly Open Lab, interested citizens and other members from the wider community can use the FabLab and its machinery freely. Local enterprises cooperate with the FabLab for research and development. The FabLab cooperates with other universities, offices for economic development and German Ministries in research projects. Being part of the International FabLab Association, the HRW FabLab also takes part in the Fab Academy.

There is a strong network between the FabLabs in the Ruhr area, so makers of different FabLabs know each other, use each other's makerspaces and the FabLabs collaborate on events like trade fairs.

Dezentrale, Dortmund[8]

Based in Dortmund (Germany), Dezentrale is a Maker initiative, which, since July 2013, offers a variety of digital fabrication technologies (3D printers, a laser cutter, and electronic equipment), respective knowledge, space and the required equipment for mushroom growing. It is a project funded and run by the research institute Fraunhofer UMSICHT that has a strong focus on sustainable energy and resource use and the transfer of scientific results into companies, society and politics. Dezentrale is open to the public on two afternoons a week, whereby the focus is on digital fabrication during the first afternoon and on mushroom growing during the second. In addition, Dezentrale offers a variety of workshops. These cover various themes ranging from introduction to 3D printing over crypto parties to mushroom growing. At the moment, Dezentrale is also involved in research projects that address how collaborative economies emerge from production processes, different possibilities for sustainable energy solutions within the citizens' district, creation of personalized products and equipment for children suffering from rheumatic diseases.

Aiming for an increased participation of the public in research, Dezentrale is supporting the annual festival for more democratic science Innovative Citizen for the third time this year. Dezentrale's goal to open up research and innovation processes for society via its different projects and is also co-organizing the citizen festival Innovative Citizen, an annual festival for more democratic science. Thus, Dezentrale aims to open up innovation and research processes to the wider public. To reach this goal Dezentrale opens its doors to any interested citizen, for whom the usage of space and machines is free of charge. Dezentrale's goal to open up research and innovation processes for society is further pursued by carrying out the fore-mentioned research projects in the Fab Lab facilities and co-organizing the citizen festival Innovative Citizen. Besides the people using the facility, Dezentrale holds close ties to other organisations. Next to the obvious connection to Fraunhofer UMSICHT, the Fab Lab has contact with the Folkwang University of Arts in Essen, the Bielefeld University of Applied Sciences and other networks of various research and practice partners spanning the thematic areas of health care and energy supply. Being located in Dortmund facili-

8 *https://dezentrale-dortmund.de/*

tates connections to organisations engaging at the local level. For example, Dezentrale cooperates with the municipality of Dortmund and especially the department for citizens located in the mayor's office to increase awareness on scientific results of sustainable energy and resource use. Besides the municipal organisations, Dezentrale collaborates with local creative initiatives like 'Die Urbanisten', which is a collective of designers and spatial planners and one of the co-organizers of the 'Innovative Citizen' to increase the awareness. Not all makers active at Dezentrale live in Dortmund. Some commute an hour or longer to use the technology and interact with the community. This might also have to do with the approach of Dezentrale, which regards its work as related to the prevailing ideas of sustainable development and a post-growth society. In that vein, the business models participants experiment with are more directed to a subsistence framework than one of profit maximization. The key question related to all businesses arising from the Fab Lab is: What are alternative business models that don't scale by growth? In general, makers are encouraged to start their own enterprises to pursue their social and ecological ambitions also via commercial routes.

Smart Bending Factory[9]

Can metal shields be ordered on-demand and on time? Probably no one would think that this is very likely. However, one company can do this. The plug-in company Smart Bending Factory (SBF), situated in the Netherlands, developed and implemented a web-based portal through which customers can order their metal sheets and tubes on-demand through the Internet. It allows to offer one dedicated product almost at the production cost of a product from a series of 500 products. The three guiding principles for the SBF are community thinking and working, joint exploration of physical processes in a physical SBF and last but not least, applying the web-based SOPHIA technology.The SOPHIA technology calculates how many parts are required, analyses all the characteristics of the parts, and how it can be manufactured. SOPHIA analyses the product design drawing to indicate for example whether the design is feasible and gives feedback. Thus engineers' work can be focused on designing the product in an optimal way in line with the latest production machines. SOPHIA provides the customer with feedback about the design.

9 *https://www.smartindustry.nl/4-smart-bending-factory/*

It therefore often uses animated movies to indicate any problems or inefficiencies in the design. This enables the customer to make smart choices. Also, draft designs are uploaded in a very early stage, which makes the process increasingly efficient. It implies that SBF allows for maximum flexibility and customer orientation, first-time-right mentality, while keeping the costs of the development to a bare minimum. The ambition of the SBF in the region is that a large number of non-competing OEMs (original equipment manufacturers) in the metal processing industry are put together in a community environment for sharing knowledge, experiences, resources, and information, while exploiting metal product manufacturing process steps together. The broad goal is to stabilize, if possible increase the competitive position of the region and its companies. Key reasoning is that it does not make sense that it is possible for consumers to order a product at home online at a web shop and receive the product the next day, while that is not possible for business customers for their metal products. Those business customers generally have to wait weeks. The SBF vision is to allow for on-demand 3D metal manufacturing. This also provides a solution to the current, regional problem of a shortage of engineers and creating interesting job opportunities, offering young people good work to keep them in the region and stop the brain drain, while at the same time having an eye also on increasing the female participation in this branch.

At present there are eight key partner organizations connected to the SBF. Two are (vocational) educational institutes, which train the potential employees, and six metalworking firms, some small and one large firm, making very diverse products such as for commercial greenhouse farms, for animal fertilization, for enriching uranium, etc. The sharing and cooperation mindset also delivers some cross-overs in this project, more particularly unexpected cooperation between companies and extra (outside the project) cooperation between companies.

Sharing knowledge is important in SBF:

"The SBF organizes regular meetings throughout the year where participants meet up and can learn together … The advantages are: knowledge exchange on particular choices for materials, suppliers, etc. This way there are cross-overs at the level of engineers which is very useful and otherwise difficult to accomplish."

The SBF is a loose partnership offering many possibilities not tied towards specific conditions or structures. It makes it very flexible to strive for above-mentioned advantages. Among different parties there is much openness. Apart from the advantage of sharing and knowledge gain when engaging in SBF from a participating company's standpoint, the SBF contributes to beneficial and sustainable impact along various areas like business, social, and environmental dimensions. Indeed, the SBF is heading to make not only economic-oriented impact through preparing (smaller) steel-related companies for the future. Obviously the SBF does also have positive environmental effects when manufacturers make smarter use of their raw materials such as steel plates, and achieve a higher efficiency, with less waste, shorter transport routes, etc. The more long-term vision is to copy the SBF idea in other regions, setting up 'mushrooms' implementing the SOPHIA software and connecting local firms.

Arduino, Torino[10]

If you aren't able to participate in the world of creation in the digital space, you're left out." (Severance 2014).

There are many different options to create and craft digital artefacts and products. One of them is Arduino. Arduino itself is a microcontroller on a developer board which can be easily ordered and programmed to do a variety of things. The ever-growing Arduino community is made up of everyone from hobbyists and students to designers and engineers all across the world. Arduino started as a teaching tool, and one of the conditions shaping the emergence of Arduino were the requirements of studying interaction design. These students had only about 30 days to study electronics applied to design. So apart from many other things, the Arduino technology had to be very accessible in a relatively short time.

Arduino is, in fact, many boards. Boards are different in terms of memory (Uno versus Mega) or in terms of processing power (Uno versus Due). This aspect actually relates to an on-going discussion of closed hardware products being inspired by Arduino but offering better functionalities at a lower price

10 http://fablabtorino.org/

to maker enthusiasts.Now that the idea of programmable microcontrollers has taken off, different business models are experimented with. In the end, Arduino is not only a technology but also a company that had to grow and stabilize. Even though Arduino is one of the success stories in open source hardware, it's still a relatively small company with few full-time employees. Even so Arduino is low cost and relatively easy to program, the fact that hundreds of thousands of makers are downloading the Arduino programming device, implies a tremendous impact on learning and large scale creativity. The modular character of the Arduino ecosystem linking with all sorts of electronics and a number of functionality enhancing shields, makes it a universal starting point for tinkering with electronics.

Now there are several companies with Arduino products at their core, such as the educational Toy 'Cubetto Playset'. According to Banzi, Arduino is changing the way we design products: non-professional designers can develop products and ask for funding on crowd funding platforms like Indiegogo or Kickstarter, also products can be altered in small ways according to the special needs of users. Another effect we can observe relates to the undoing of the traditional separation between software and hardware development. Easy to configure sensors and actors enable programmers to use environmental data as input to the functionality of their overall product designs. Also bridges are built to other ecosystems, such as shields and libraries that connect your Arduino device with your Android Phone, so that also smartphone or tablet sensors can provide the input for any Arduino action.Thus many fablabs are using Arduinos in the meantime. One of them is the Fab Lab in Torino. The main goal of Fab Lab Torino is to provide a physical space where to talk, develop, and learn things about digital fabrication. So their mission is to promote digital fabrication and be open to all people who want to make something. The Fab Lab has about 250 members each year with approx. 10 – 20 makers are there almost every day, because this is where they run their own projects. However, topic specific communities have even established in Fab Lab Torino, such as the audio hacklab, the Arduino user group, the bio hackers, or the 3D printing club. These clubs have emerged in an organic way. Many different Arduino projects, ideas and classes are shared on the internet like in Pinterest. If you are curious and would like to get more face to face insights consider to visit FabLab in Torino where they support your ideas and provide also help in crafting and programming or have a look at our complete case studies' report.

5 RE-SULTS


WORKSHOP AREA

5.1

An overview of the results of the MAKE-IT project

Massimo Menichinelli

You can read more on Deliverable D7.3 here: http://make-it.io/deliverables/

Several outcomes were generated during MAKE-IT: official documentation, scientific articles, online content (blog posts, social media posts, videos), print content (flyers, posters, stickers, ...), events, software, data and much more. Deliverables D7.1, D7.2 and D7.3 document all of these (until December 2017), and the MAKE-IT website disseminates all of these contents.For example, MAKE-IT produced several documents that communicate the plan and the implementations of its actions, called deliverables, they document the project with the highest details and can be read online or downloaded from the specific Deliverables page[1]. Results from the project are also elaborated and published in scientific conferences and journals, and the articles or their drafts are accessible in the Publications page[2]. Software developed for the project can be accessed in the Software section[3], and datasets openly available are listed in the Open Data / API section[4] as downloadable Open

1 *http://make-it.io/results-overview/deliverables/*

2 *http://make-it.io/results-overview/publications/*

3 *http://make-it.io/results-overview/software/*

4 *http://make-it.io/results-overview/open-data-api/*

Data or open API. Overall, the Results section[5] of the MAKE-IT website contains all these and other results from the project.

Regarding the scientific publications, during MAKE-IT (and at the time of writing[6]) the publications produced were 10 conference papers (1 was rejected, 1 was recently submitted), 8 journal papers (3 were rejected, 1 was recently submitted and 1 was accepted and is currently under development), and 6 papers are currently work in progress.

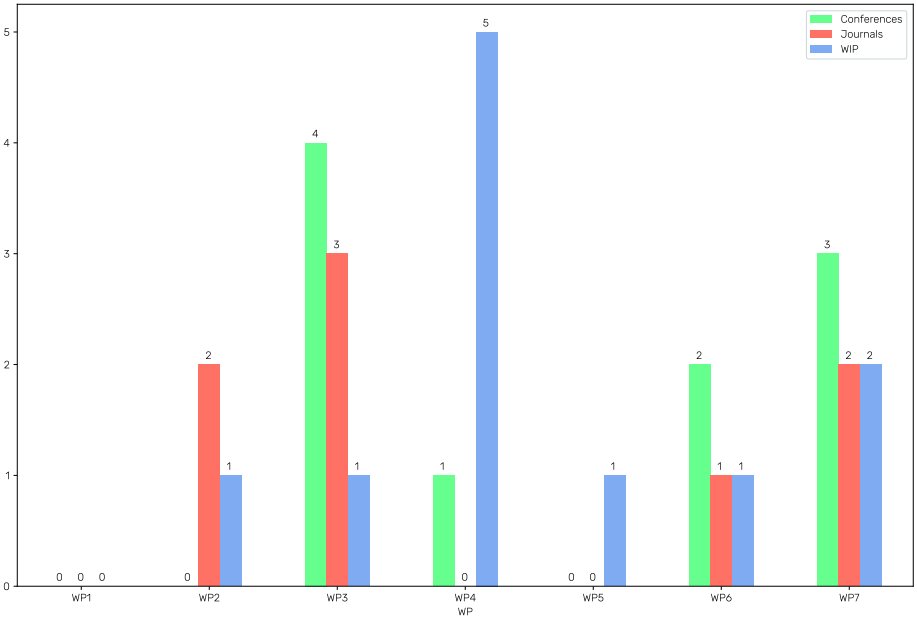

Figure 7. General overview of publications by WP

5 *http://make-it.io/results-overview/*

6 *14th of December 2017*

In order to get a better overview of the many results generated in the MAKE-IT project, in the following chapters of this section we asked all the work packages “What has your WP achieved in terms of direct results?”.

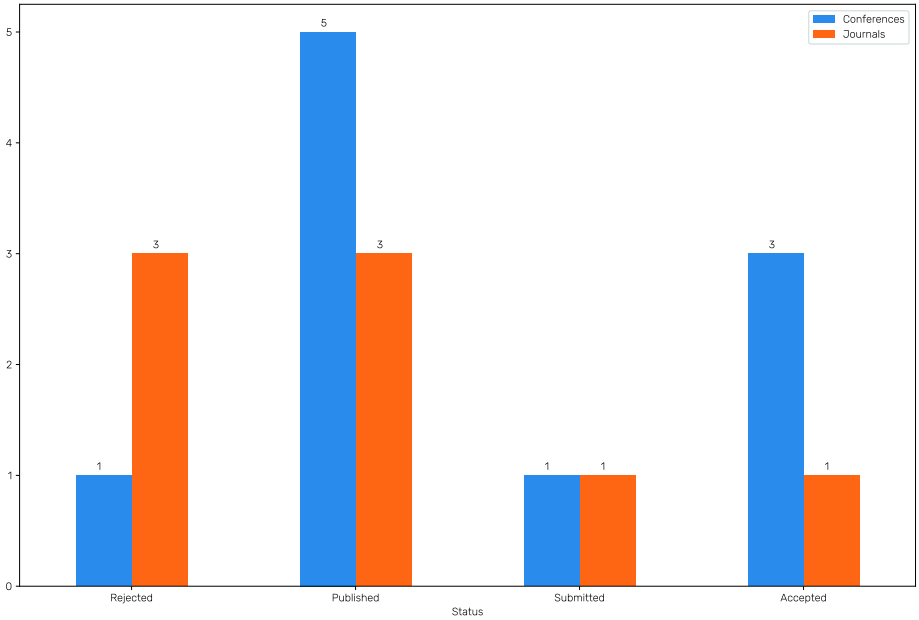

Figure 8. General overview of publications by status

5.2

Results of each WP

Iris Blankers, Jermy Millard, Elisabeth Unterfrauner, Bart Devoldere, Troels Bovbjerg, Bastian Pelka, Massimo Menichinelli

WP1 (Iris Blankers - TNO)

WP1 is designed to ensure that the results and processes of the project are delivered on time, at budget and with the quality stipulated by the European Commission. It is also responsible for the project's own IPR and will ensure continuous project quality control and risk management. Thus it is a supporting WP with little to no direct results on its own. The only possible exploitable result is the handbook on Responsible Research and Innovation. It describes internal procedures of the MAKE-IT consortium.

WP2 (Jeremy Millard - DTI)

The core of WP2 consists of constructing a Conceptual and Methodological Framework to develop and validate the MAKE-IT project's overall theoretical, scientific and methodological coherence across all aspects of its work. WP2 serves as a foundation for MAKE-IT as it facilitates the emergence of a common understanding of the state of the Maker movement and defines the analytical lenses through which MAKE-IT approaches it.A shared conceptual, methodological and scientific framework for the use of CAPS approaches by the Maker movement in relation to three analytical pillars

(organization and governance; peer and collaborative activities; and value creation), has been developed through a number of pilots and iterations. It has provided the core themes running through all the other Work Packages, notably in conducting Case Studies (WP3), Action Research (WP4), Technology Enhancements (WP5) and Impact Assessment (WP6).

In addition, WP2 has developed a monitoring and assessment framework and tools, used in the case studies and implemented during one-on-one interviews with makers at the Maker Faire Barcelona in June 2017. This has deepened the results obtained in the case studies by bringing even more diverse findings to the forefront for triangulation, as well as contributing to more in depth impact assessment studies.

Although, work is still ongoing, WP2 has already highlighted a number of issues. For example, Figure 9 shows one result from the June 2017 survey comparing the social, economic and environmental impacts of Maker initiatives. Economic impacts are generally slightly better than social impacts, but have less significance overall because the percentage of initiatives for which these questions are not applicable is 29% compared with only 17% for the social impact questions.

This leads to a tentative conclusion that for those fewer initiatives that have economic impact goals they are achieving them relatively well, whereas there are more initiatives with social impact goals and most of these are also achieving them quite well. In contrast, environmental impacts are significantly less prevalent and the percentage of initiatives for which environmental questions are not applicable is 60%, indicating both the lack of ambition in this regard as well perhaps the difficulty for makers in undertaking environmental evaluations.

It is the case however, that 70% of those initiatives that do have environmental goals are showing positive impacts. These and many other findings will be followed up in detail in MAKE-IT's deliverable D2.3, available in December 2017, as well as in future blogs.

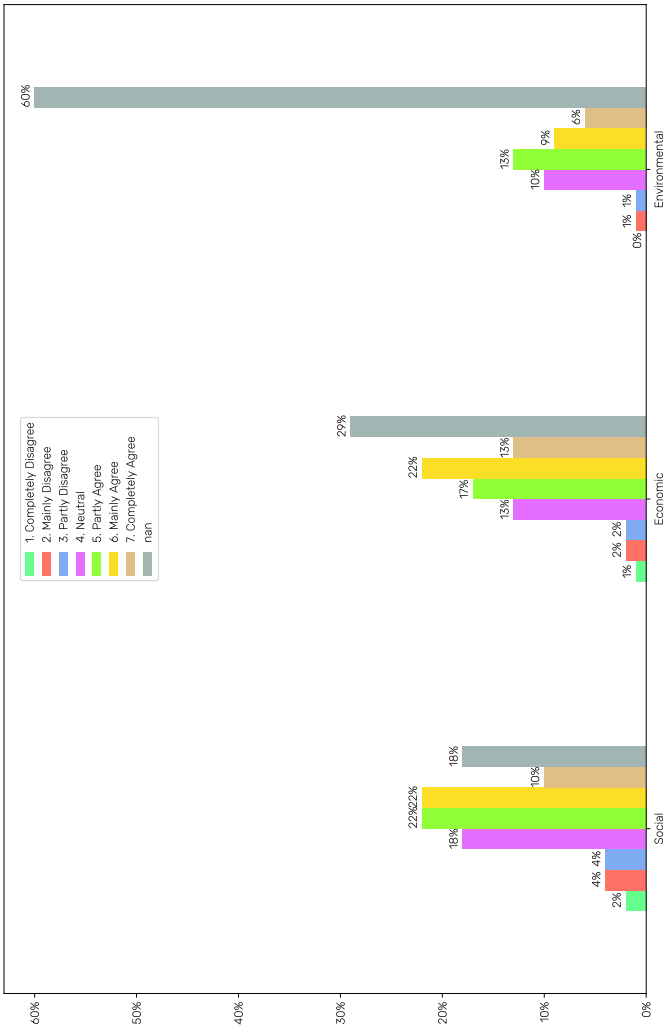

Figure 9. Social, economic and environmental impacts of Maker initiatives: data from a survey (June 2017)

MAKE-IT has also found that the institutional framework has an important role in shaping the direction of the Maker movement, as well as the desire of makers to shape the context they are in. This will lead inevitably to fast changes in the future, which policy makers should be aware of, and be willing to act on.

WP3 (Elisabeth Unterfrauner - ZSI)

WP3, focusing on case explorations, has been based on the research framework as defined in WP2, i.e. the three research pillars, with its research themes and more specifically with its research questions.

In WP3 we have explored ten different European Maker initiatives by carrying out interviews with managers of these initiatives and three makers each. These data was complemented with a survey directed at managers.While the first deliverable (D3.1) focused on individual descriptions of the ten cases, in the second deliverable (D3.2) we did a cross-case analysis based on qualitative analysis method of the data. In total, 39 interviews with managers and makers of the case studies were transcribed and complemented by self-reporting sheets provided by managers. The collected material was subsequently analysed with qualitative analysis methods, combining deductive and inductive coding approaches.

While all deductive codes were based on the three research pillars with its various research themes and potential research questions as identified in D2.1, in the inductive approach additional new codes directly evolved from the material. The analysis resulted in around 1,700 deductive codings. The hierarchical codes that guided our qualitative analysis were derived from the conceptual framework and thus codes were aligned to snippets of the interview that cover research themes and respective research questions.

With this approach and the data we were able to cover all research themes and most of the potential research questions. We have analyzed how maker communities organize themselves and how they achieve financial sustainability (research pillar 1), how makers learn from each other and how they develop their skills (research pillar 2) and finally, which values and impacts are created (research pillar 3).

To distill the essence of the deliverable (D3.2 is quite comprising since snippets of interviews are provided throughout the text), we have compiled lessons learnt and a summary of the main outcomes of all research themes. Additionally we have created a two-pager with nine lessons learnt that was printed as a flyer and distributed at different events. WP3 results further laid the ground for the development of several transfer-knowledge workshops (WP4): e.g. on gender relations, on inclusive makerspaces, on confrontation of cases with lessons learnt, etc.

WP4 (Bart Devoldere - TNO)

WP4's key focus was on innovation action research activities in the form of knowledge transfer workshops and technology enhancements, while further developing the concept of "building meaningful spheres of participation" for the Maker movement in general and individual makers in particular through the use of CAPS.

Foundational to WP4 is the detection of a key problem area for the Maker movement to further develop itself. In essence, it concerns the difficulty for makers to engage different types of stakeholders (e.g., policy makers, researchers, businesses, and fellow citizens) for supporting or being engaged in their various Maker initiatives in one way or another to help an initiative reaching a next level.

Here below we list the different innovation action research activities in the form of knowledge transfer workshops and examples of direct results they provide.

Knowledge transfer workshops	Knowledge	Data	Tools	Learnings
"Reaching out to everyone: inclusive maker spaces"	Make participants acquainted with MAKE-IT project and lessons learnt. 'Inclusive maker spaces' and 'inclusive maker projects' from the qualitative analysis in WP 3 building on the insights of D3.1 and D3.2. Discussing tech enhancements that could support inclusive making.	Brainstorming on inclusiveness. Clustering of emerging topics Notes and visualisations of three breakout sessions. Clustering of formulated smart goals.	Workshop facilitation approach description.	How to make maker spaces/initiatives more inclusive with respect to its physical attributes? How would the ideal makerspace look like?. How to make more inclusive offers? How can Online Platforms contribute to inclusiveness of makerspaces? Which smart goals do participants formulate in order to improve the inclusiveness?
"Design your future maker hub".	MAKE-IT case study best practices with respect to inclusive makerspaces. MAKE-IT cross-case analysis with respect to the value of making.	Brainstorming definition of inclusiveness and the 'why' with respect to Maker initiative. Collection of ideas for community centre. Design experiment of makerspace in hub.	Workshop facilitation approach description.	What is the value of making?. How does a maker hub look like in order to attract citizens and different stakeholders? How does an ideal makerspace look like in order to attract citizens and different stakeholders?.
"Gender and open data".	MAKE-IT research agenda with a focus on the 'value creation' pillar. Dimension of diversity. Implications of diversity. Possible strategies for the future, enabling the formation of more diverse communities.	Discussion of Happylab Membership data. Brainstorming open data and related benefits (with a focus on diversity management). Explore potential activities in labs to become more aware of the diversity aspects as well as exchange ideas about how to address these issues.	Workshop facilitation approach description.	Are there stereotypes or gendered perceptions of the typical female or male maker?. Are there different expectations each gender brings to a makerspace?. To what degree do insights from qualitative interviews and quantitative analyses overlap, complement or contradict each other?. Are there activities or use patterns that are dominated by a specific gender?.

“Sustainable business models for labs”.	Sharing experiences derived from working together with entities in the private sector, especially from a Fablab TI perspective where lab users utilize the tools, knowledge and services provided by the fablab, and in turn are provided with professional sparring and mentoring from the lab’s facilitators taking them from the idea development phase straight through to commercialization of their product/ service.	Perception of what the makerspace or Fab Lab is, should be and could be. Experiences and collaborations with commercial companies. Developing ideas and solutions in the makerspace/labs without losing in essence the spirit of the Maker movement. Helping makers to reconcile possible and not anticipated outputs attributed to aspects of making (e.g. potential opportunity to start a business stemming from their lucrative products and services with their desire to continue ‘making’ and being makers.	Workshop facilitation approach description.	What is the premise of a makerspace/ Fab Lab? What collective experiences in commercialization of activities do the participants have?. How can we develop ideas and activities that can contribute to the financial viability of individual labs without diluting the core aspects of the Maker movement?. Do all ideas and activities have to be financially viable to the makerspace/ lab or maker? If not, what are the ways in which ‘spaces’ that are advocating a more socially-relevant focus remain just as viable as a commercially-focused lab?.
“How labs become relevant”	Jobs theory on developing and finding relevance of makerspace initiatives	Ideas about relevance from a user/stakeholder perspective in relation to functional, social and emotional values of a makerspace/lab. The ability of makers and makerspace/ lab users to place themselves ‘outside the four walls’ of the makerspace/ lab; connecting with societal needs and in so doing identifying the “right things” before building “things right” for the users of their products and services; and how makerspaces/labs can contribute to reaching these goals	Workshop facilitation approach description. Approaches and methodologies through which makerspaces/ labs can orient and position themselves in relation to achieving a high degree of relevance to makers and their potential contributions to society.	What constitutes a relevant makerspace / fablab?. What are the needs of the various stakeholders (makers, makerspace/lab owners and personnel, industry, product and service users, etc.)?. What are the functional, emotional and social ‘jobs to be done’ surrounding a makerspace/lab?.
“Facilitation of idea validation”.	What is idea validation and how can human-centered design methods be applied to the facilitation of idea validation?. What characterizes a good idea and what questions should be asked when investigating an idea’s potential?.	Brainstorming about validation. Group presentations. Case exercise.	Workshop facilitation approach description. Tools and questions to validate ideas and facilitate such validation.	Findings through debate and discussion with respect to key questions raised during workshop. Role of makerspace/ fablab manager in facilitating idea validation. Role of makerspace/ fablab personnel in facilitating idea validation.

Here below we list the different innovation action research activities in the form of technology enhancements and examples of direct results they provide.

Technology enhancements	Knowledge	Data	Tools	Learnings
Designing and piloting a "BSOP tool" that facilitates connections between standholders and visitors during maker exhibitions.	BSOP tool code.	Standholders (visitors) goals for connecting with visitors (standholders) and preferred online platforms. Maker faires visitor profile. Observations, interviews, and browsing behavior of Maker Faire visitors using the BSOP tool.	Digital tool to facilitate connections between standholders and visitors during maker exhibitions. Systematic approach for maker faire organizers to implement the BSOP tool.	Versions of BSOP tool. Understanding Maker movement & BSOP. Key features to further develop (must haves versus nice-to-haves.
Designing and piloting a "Tech radar" tool that facilitates learning and exploration of current and future maker technologies.	Current and future technologies relevant for the maker community (including examples, TRL level, and adoption status of these technologies). Introduce the TechRadar tool to the participants. Explore the tool and evaluate every section, step, navigation and content, through the documentation of the user journey.	Usability data across different types of audiences (e.g., students, educators, researchers) across different locations throughout Europe.	Digital tool to facilitate learning and exploration of current and future maker technologies. Usability workshop facilitation approach description.	Usability TechRadar across different types of audiences with different types of purpose. Key features to further develop (must haves versus nice-to-haves).
Surveying the current and potential impact of a core CAPs-related maker platform like "fablabs.io" with makers worldwide.		Fablabs.io user demographics. Fablabs.io potential impact. Fablabs.io key features to further develop.	Fablabs.io as digital platform listing all official fab labs worldwide. Surveys to help researching and further developing a CAPs-related online platform like fablabs.io	Current and potential impact of a core CAPS-related maker platform like Fablabs.io with makers worldwide and how that correlates with makers' characteristics

In its diversity and quantity the complete set of innovation action research activities provide an interesting and complementary set of new data and insights on how the Maker movement and individual makers are (or could be) building meaningful spheres of participation through the use of CAPS. Different and complementary data collections are valuable for current and future (academic) research on the Maker movement, while generating direct impact and results with practitioners at the same time.

WP5 (Troels Bovbjerg – DTI)

Two kinds of tools is developed in WP5. The TechRadar and the BSOP tool. The BSOP tool have also been a part of WP4, so in the following there is only focused on the MAKE-IT TechRadar.

WP6 (Bastian Pelka – TUDO)

WP6 has had four stakeholder workshops that followed a twofold objective: On the one side they produced insights for MAKE-IT's research, as we discussed interim results with external stakeholders and used this feedback to improve our research and development results. On the other side the stakeholder workshops disseminated our research findings to important stakeholders and worked as impact hubs.

WP6 issued two reports: D6.1 - Scientific report on CAPS implications regarding governance, peer collaboration and value creation - and D6.2 - Societal Impact Analysis and Sustainability Scenarios. D6.1 summarises the project's main scientific outputs and aims at an academic audience. D6.2 brings together future scenarios and recommendations and hold specific chapters for each quadruple helix actor set. It's strength lies in its concrete level of recommendations.

WP6 has produced several event appearances, two conference proceedings and a journal paper. Two more journal papers are planned.

MAKE-IT produced the insight that governance, collaborative behaviours and impact can not be described for the Maker movement at large scale, but a better perspective is to look at certain types of makers. WP6 distinguishes three objectives makers pursue (Figure 10) and WP4 differentiates five types of makers (Figure 11).

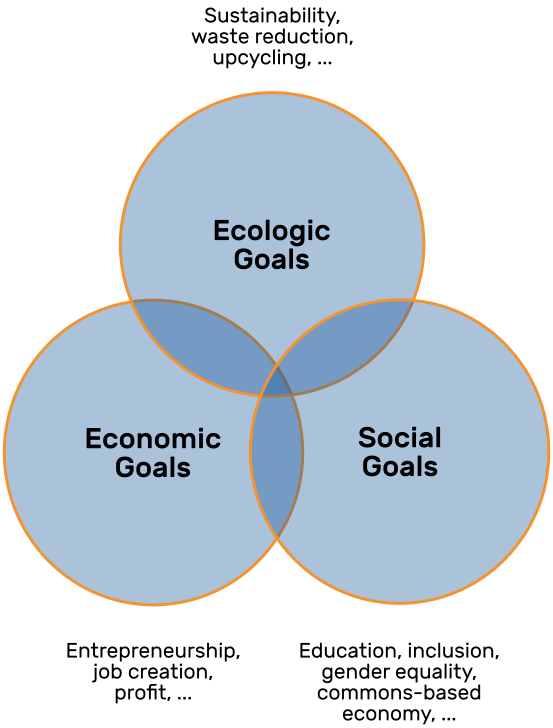

Figure 10. WP6: three objectives pursued by makers

The first cluster gathers what we have termed as "utopian makers" for whom maker values are perceived as incompatible with market values or dissociated from market values. The second cluster analyses the ambiguity, which exists between makers and openness and how this gives room to go beyond the traditional dichotomy between openness and market. The third cluster looks at makers for whom openness is a key to reduce entry barriers to the market. The fourth cluster gathers cases where proprietary ways arefavoured to commercialise maker products.

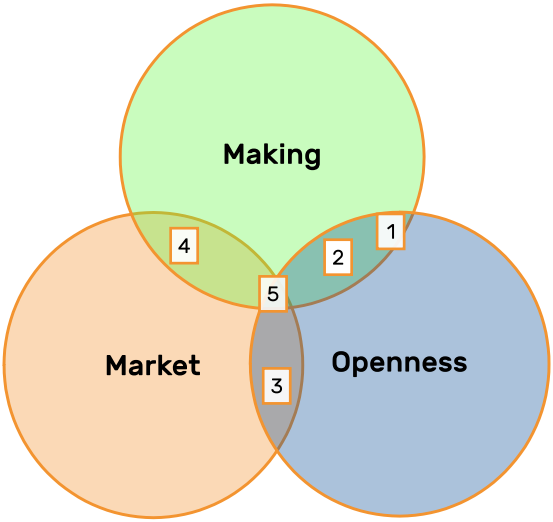

Figure 11. WP4: five types of makers

The fifth cluster looks at cases where openness is turned into a competitive advantage, as long as it relies on a strong community.

Another finding is that the Maker movement - with all their social attitude - is still quite male dominated. We found evidence that societal gender stereotypes are (partly unknowingly and/or unwillingly) reproduced. But female users are still fewer that male and there does exist a gender related access to tools.

WP7 (Massimo Menichinelli - IAAC)

WP7 acted both as a support WP and as a WP that produced its own content, disseminating content from MAKE-IT and providing also collaborations and initiatives for further understanding how CAPS and the Maker movement are connected. WP7 therefore disseminated contents from all the WPs on our own website, social media accounts, by participating in events and by organising few events. The last weeks of the project are dedicated to the finalisation of the book collecting the best content and future strategies and of the software and visualisations that investigates the connections between Makers and CAPS.

REFLECTING UPON THE PROJECT 6


BAR

6.1

Interviews with MAKE-IT partners

David Langley, Marie Nicole Sorivelle, Barbara Kieslinger, Christian Voigt, Marthe Zirngiebl, Matías Verderau, Massimo Menichinelli, Karim Jafarmadar, Roberto Vdović, Helin Haga, Jeremie Pierre Gay

During the MAKE-IT plenary meeting in Vienna (December 2016) we interviewed one person from each partner organisation[1]; we then asked more questions at the end of the project in order to compare expectations with the complete experience. Here you can find the first interviews and part of the second ones here, the remaining part was edited in Section 7.

TNO

You can watch the first full interview here: https://youtu.be/4SxrBA1onF0

What is your experience in the Maker movement?

David Langley: TNO is an applied research organisation in the Netherlands and has quite a track record in helping organisations to innovate and linking different technologies together.

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1 You can watch all the video interviews here: https://www.youtube.com/watch?v=-UX-rOoIyg0M&list=PLlKV_n43-6ttARhrVhfbX4fg1eZtSfD8b

That's in the Netherlands but also in European research projects. So it's an organisation, which is well placed between academia and fundamental knowledge building and practice of businesses and organisations who want to actually make use of new technologies and, in this case, new digital technologies.

What do you expect from MAKE-IT?

David Langley: Often when there's a dominant model, economic model, we sometimes think it can't be changed - that's just the way it is and that's the way we have to deal with it. However, our internet dominant model is very relatively young, it's only been around for 10 or 20 years, so it can be changed and I think one of the great challenges, which projects like MAKE-IT adopt, take on is to see what is the alternative to this model and what is happening, what can we make use of in different ways to change the way that value is created in different ways - financial value, also social value and what that can mean for society. So I think it's really important that projects like MAKE-IT explore these different avenues and new ways of our economy working for us all.

Which do you think are the main issues related to the governance, collaborative behaviours and impact in the Maker movement?

David Langley: Well, that is a broad question! Let us start with the first of these. There are many important things to be learned about how to organise and govern Maker initiatives. Perhaps the most important lesson, that could have a major positive effect on how makers scale up their ideas, is that makers need to look beyond their own focus on their project and connect with stakeholders outside of their comfort zone. So that includes local government officials, businesses with knowledge and resources, people with an understanding of marketing or usability testing, and the ordinary people who will be expected to use what comes out of the maker's project. As for collaborative behaviours, a key issue is how to boost the self-belief and motivation of ordinary citizens to take up making as a part of their lives. Right now, there is a leading group of technically savvy (and slightly nerdy!) makers showing the way forward. But now it is time for ordinary people to follow in their footsteps and that will require maker spaces, and developers of maker tools to help the masses to connect. Finally, as far as the impact of makers is

concerned, there are many Maker initiatives that are caught between competing objectives. On the one hand, makers have a sharing mind set and do not feel comfortable asking for money for their products. On the other hand, many makers are fed up living like students and feel it is time to get paid for their hard work. Reconciling these two viewpoints is a major challenge.

Regarding to governance, collaborative behaviours and impact, what do you think MAKE-IT achieved?

David Langley: I believe that MAKE-IT has made some significant progress in these three areas. For a start, MAKE-IT has provided us with the first well-grounded overview of the European Maker movement in 2017, based on in-depth analyses of many different Maker initiatives, from Fab Labs and Maker Faires to technology developers and educational institutions. This has shown us more clearly than before how makers are using CAPS to function. Another interesting achievement is our BSOP tool, which helps individuals from different walks of life to connect to makers, and interact with them, even if only occasionally and informally. Because of their diversity, bringing these different spheres of participation together can facilitate makers to break free from their own view of a problem and allow them to experiment collectively with new activities and new ideas.

Also, our TechRadar offers makers a structured view of different platforms that can help with their collective awareness and stimulate them to go beyond the tools and applications they already know. And when makers contribute innovative ideas to new technologies, the TechRadar can show them how it fits into the broader field. One other achievement I would like to highlight is our progress in understanding how makers reconcile sharing and commercialization. As I stated before, this is a key challenge that needs to be tackled if makers are to have real impact.We have analysed and described a set of developmental trajectories that Maker initiatives can go through in order to align their objectives and ways of working towards both social value and commercial value. After all, if a maker project becomes financial sustainable, then it has a platform for achieving real social impact. This new understanding has contributed to scientific theory on so-called "institutional logics", and it has recently been published in the journal Business Horizons (Langley et al., 2017).

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

David Langley: Well, we have learned a lot about makers and about their ways of thinking and working. We have also learned that there are fascinating opportunities to be explored when ordinary people roll up their sleeves and get hands-on experience of making. If you think about it, during the whole of human history people have been making things. It is only the last few decades that we have come to think it normal to delegate our making activities to firms. Perhaps the pendulum is swinging back and we will see a new generation of makers hacking into products, changing them and enhancing their use to meet their own particular needs. I envision the emergence of new platforms through which all people are able to design, redesign, make, repair, reuse, share and enhance the things they use in their daily lives. Think of a kind of Spotify-of-things that enables the sharing of objects with both a physical and a digital basis. All these things are possible and the future of making is something that I and TNO, my organization, will be following closely!

DTI

You can watch the first full interview here: https://youtu.be/e3aQ8FRof3k

What is your experience in the Maker movement?

Marie Nicole Sorivelle: It's interesting because we at DTI, we have a Fab Lab, so we have some elements of making in the Fab Lab in the sense that we have our...we have regular Danish citizens who would come in and use the Fab Lab on set days and then we also have businesses who are interested in using the Fab Lab for prototyping or further development of their ideas. And to be honest I mean, I know the Fab Lab was there when I started working but I never really...my focus wasn't on it so much because I did necessarily know what they did until I started working with this project. And then I started going into the Fab Lab a lot more. And it's really cool because you see this sort of collaborative spirit between individuals who are in the lab to make things as well as the person in the lab who is assisting them and the

really cool thing about our lab is that it's not just necessarily used for your normal tinkerers or hobbyists but the individuals who use it, they have a focus, so how can they further develop an idea to take it to the next level. So, we work with them in terms of idea validation, market, sorry, idea development, validation on the market and then commercialization of that product. So, it is a process, which is pretty unique for our lab.

What do you expect from MAKE-IT?

Marie Nicole Sorivelle: It will be good to see what the other partners, especially Fab Labs, how they remain sustainable or what their business models are or what are the features they have, which make them unique and not necessarily just unique but what are the best practices we can learn from these labs and then and sort of incorporate it possibly into our Fab Lab and provide a new and possibly a better experience for our makers. So, basically just capitalise on what's out there and tailor it specifically for our audience and also to share our experiences with the other partners because maybe we're doing something or some things that's really unique that they would like to also emulate. So, it's a matter of give and take, I would think.

Which do you think are the main issues related to the governance, collaborative behaviors and impact in the Maker movement?

Marie Nicole Sorivelle: In terms of organization, governance and related issues, four key issues have appeared as paramount during the surveys carried out under WP2 and the case study analysis of WP3. Openness to and sharing with partners outside the Maker initiative itself seems to be one of the most important issues identified by respondents, but also an issue on which most initiatives are successful to tackle. In contrast, achieving financial and organizational sustainability, although seen as important by the makers we surveyed, is much less successful overall. As we have seen in WP3 and WP4, building sustainable business models is a key problem for makers and makerspaces alike. Similarly, Maker initiatives' intended achievement of gender balance is reported to be relatively poor, even for those initiatives, which prioritise this. Gender balance is therefore still an area of improvement for Maker initiatives, despite having an overall awareness of the gender issue in STEM activities. Lastly, an overall low awareness of the

institutional environment, regulations affecting maker activities and the impact these have on building up a Maker community and commercialising products is another key takeaway from our analysis.

In relation to peer and collaborative behaviors, the issues are clearer and success seems to be greater than for organization and governance. This may be because many makers are still at a relatively informal stage, experimenting and playing with the technology and with co-creative, collaborative and self- and group-learning activities, so this perhaps reflects this early stage of maker development. The most positive issues seem to relate to collaborative learning and knowledge, as well as individual user skills and competences. This probably shows that these reflect the current preoccupation and focus of most makers. In contrast, issues and achievements related to intended business and commercial goals are much more nuanced, and one third of Maker initiatives do not seem to focus on these issues. During the case studies and further surveying of makers, it appeared that a lot of makers are interested in profiting from their products but are unaware of how to effectively undertake this in a financial viable fashion and without compromising their maker values.

In terms of impact, WP2 survey answers have pointed at the fact that economic impacts are generally slightly better than social impacts, but have less significance overall because the percentage of initiatives for which these questions are not applicable is 29% compared with only 17% for the social impact questions. This leads to a tentative conclusion that for those fewer initiatives that have economic impact goals they are achieving them relatively well, whereas there are more initiatives with social impact goals and most of these are also achieving them quite well. In contrast, environmental impacts are significantly less prevalent and the percentage of initiatives for which environmental questions are not applicable is 60%, indicating both the lack of ambition in this regard as well perhaps the difficulty for makers in undertaking environmental evaluations. It seems overall that not enough is currently under way to address environmental issues on a large scale. There are however, some singular examples where an environmental focus is present and 70% of those initiatives that do have environmental goals are showing positive impacts. Regarding technology use, it is clear from an analysis of the TechRadar and broader desk research there some important

conclusions. The overriding conclusion is that, at this early stage of maker development, by far the majority of the technologies used for the activities characterising both governance and collaborative behaviors are not specifically offered to or designed for makers. However, they are clearly maker-relevant and are being used quite intensely by makers, even though they are generally available technologies used across many sectors. The important exceptions include, as would be expected, decentralised, distributed, personalised and bio-manufacturing technologies, 3D design tools and 3D file repositories. In other words, makers like many other digital social innovators and CAPS-like activities are using mainly widely available technology for their own purposes. This also has the advantage of improving sharing, collaboration and mutual learning with other non-maker, but related, activities.

In terms of technology available to be used by makers, the variety and scale are much greater for collaborative behaviors than for governance, supply-chain and similar issues. This probably reflects the fact that the Maker movement is still relatively immature, focused on its own bottom-up development in situ or in relatively small communities operating often quite informally, and using widely already available technologies for this. The more professional and specialist technologies used in other sectors for governance, supply chain management, etc., seem to be less used by makers, perhaps indicating that there is still a relatively wide gap between the bottom-up maker community, on the one hand, and mainstream industry on the other.

Regarding governance, collaborative behaviors and impact, what do you think MAKE-IT achieved?

Marie Nicole Sorivelle: MAKE-IT has achieved a much better understanding of the Maker movement, for example as indicated in question 1. Within the resources it has available, it has provided a systematic and more scientific overview of making and the Maker movement in a European context than previously available. The project has provided a vast documentation on how makers perceive the movement and what challenges are ahead as well as it has provided a measure of the impact of the movement, throughout the work done in WP6. This has been made possible both at the micro level of individual case studies (WP3) through interviews with both makers themselves and managers, as well as at the more macro level comparing these cases,

as well as many others, also by deploying desk research (WP2) and undertaking widespread consultations with experts, policy makers and civil society. MAKE-IT also achieved a better understanding of the technologies available and being used by makers, both through the online TechRadar resource made available, which will become an ongoing tool after the project, but also by analysing how and why individual Maker initiatives use the technology.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Marie Nicole Sorivelle: We have learnt that the Maker movement is not a panacea for the ills of traditional and neoliberal economics and industry, as some pundits have thought. It is not, at least on its own, disrupting the status quo. However, and what is more interesting, it's clear that the Maker movement is just one part (albeit an important part, though perhaps not the dominant part) of a broader set of trends which can be bundled together in some way and which collectively can and do offer such disruptive alternatives. So the Maker movement is part of a bundle of trends including the sharing and collaborative economies, co-creation, crowdsourcing and crowdfunding, circular economy, the repair/fix-it/ tinkering movements, pro-sumerism, mass customization and personalization, distributed manufacturing, open and social innovation (of course also digital social innovation, the open source trend, etc). Some would label this bundle of trends as the 4th industrial revolution, and this certainly does encompass much of it, though it is the more top-down industry view. All these specific trends, and others, are working together more or less in the same direction. We have also learned that the Maker movement is part of a broader cultural change and it may be useful to think about the idea of "making" rather than "makers", and that making is taking place as just one activity intimately mixed/bundled with other activities. Again, the idea is that the Maker movement is not a discrete, separate phenomenon. The making culture reflects the "burgeoning desire amongst many people to move on from a purely consumerist society and to start again 'getting their hands dirty'", and to "think less about promoting and supporting a discrete 'maker culture', and more about a broad and integrative 'making culture'". Thus, "it's important to move away from only seeing making as an instrumental activity for people to make their own products with the focus largely on the technology,

towards also supporting a more widespread change of 'reconnecting brain and hand'". (Quotes from Daniel Charney, a member of MAKE-IT's Advisory Board.) This means in practice, for example, not establishing making only as a separate activity in separate maker spaces, such as in libraries, educational institutes, etc., but ensuring making is an integral and seamless part of the wider range of activities of such institutions. Seeing the Maker movement as just part of a broader social, economic and cultural trend is, in fact, much more interesting and potentially powerful than seeing it on its own.

ZSI

You can watch the first full interview here: https://youtu.be/-UXrOoIyg0M

What is your experience in the Maker movement?

Barbara Kieslinger: For me personally I would say the collaborative part is very interesting because I've been working in e-learning for many years, so it's interesting to see how these rather loose structures collaborate in different ways online and offline and how this all merges together, so we don't make the distinction anymore between what is online, what is offline - it's just a normal way of interacting and of this community building that something is specifically interesting for me. Also their personal networks and the establishment of social capital and, on the other hand, for our institution and also for our whole team, the social impact that can be created with this movement is very important and interesting because we study social innovation from many different points of view and so the Maker movement is really something where there is great potential to have social impact and that's what we want to study here and how far this is really, this movement is really transforming aspects of society; the thing of having access to resources easily and creating your own thing and networking together.

What do you expect from MAKE-IT?

Barbara Kieslinger: From MAKE-IT specifically I expect that we get better insights into how the Maker movement is organised, how they are working, what are trends coming out of it and, just as I said, study in more details

and get more findings of how this can impact our social structures and how social innovation can be created.

Which do you think are the main issues related to the governance, collaborative behaviours and impact in the Maker movement?

Christian Voigt: One of the main issues that comes to mind, is the need to orchestrate all three pillars - governance, collaborative behaviours and impact – in concertation. Given that the Maker movement is not a homogeneous phenomenon characterised by a single set of values or priorities, any naming of issues or list of best practices needs to allow for uniquely organised makerspaces, showing a wide variety of missions pursued. Of course, some high-level rules of operations and value statements are shared within the Maker movement – such as moving from DIY to DIWO ('Do it with others'), the access for all to a pool of maker tools and a focus on local impact, striving to closely connect with the local community and their needs.

Value creation is a choice (1): What creates differences among makerspaces, including the appearance of more or less (economically) successful makerspaces, more or less growing communities and finally more or less 'visible' makerspaces, pushing the makerspaces' success stories – are often conscious choices of developmental paths, i.e. a firm vision of a makerspace's future. Here we have seen that different actors make different choices. Spaces such as Create It Real have their core competencies in improving tools for makers including hardware-protected Intellectual Property, a topic that raises to the top of makers' concerns as soon as making is to earn them a living. Makerspaces, which exist mainly as extensions to universities, libraries or schools (may) have access to funding provided in quasi markets. Quasi markets are simply markets where consuming and paying is handled by different parties, a typical example being public services such as education. Unless we talk about private or charter schools, parents do not pay for the education of their children. Rather, they are dependent on national education budgets and associated policies. Lately we can see more and more initiatives incorporating making in educational programs either as additional out-of-school activities or as integrated activities in STEAM subjects. This way, making blends into education as a means to an end. For example, enhancing kids' engagement with science subjects, creating critical attitu-

des towards ever increasing use of opaque technologies (cf. services including applications of AI) or simply creating a more level playing field for girls and boys or kinds with or without migration backgrounds.

Values statements are not yet values actually creating an impact (2): Even though the Maker movement is relatively new, we could argue that 'Maker Faires' – at least without digital correlates – have existed for some time. Make:Magazine has been started in 2005 and the Center for Bits and Atoms at MIT was established in 2001. When we think of impact, however, we don't have isolated success stories in mind, but a shift of practices affecting a wider group of people. Put differently, we can still see a variety of ways a value statement is implemented. For example 'open access for everyone' – '**open access**' can mean one day a week or 24/7; it can imply mandatory trainings or a high level of previous knowledge to use whatever can be accessed in a meaningful way etc. Furthermore, '**everyone**' can refer to those being able to pay the membership fees, those who can make time during opening hours and those who speak the language of the instructional materials explaining the machine on site (mostly English). And if we talk about 'inclusive' access, then makerspaces are not different than any other places providing services to the general public. Inclusive access doesn't come automatically if service providers haven't spent time on planning and designing for inclusive access. Here the issue is a differentiated approach, we don't think that all machines in a makerspace will be accessible to all by tomorrow, but those places who are accessible to people with diverse needs should be promoted as such.

Regarding to governance, collaborative behaviours and impact, what do you think MAKE-IT achieved?

Christian Voigt: MAKE-IT has provided a sound overview of developments within the various dimensions of governance, behaviour and value creation. The qualitative case studies have been a rich source of insights to put concepts into context and recognise their importance to stakeholders on the ground. Several deliverables, workshops and publications have achieved that these insights have been discussed, fine-tuned and disseminated to a wider audience than the partners of the consortium. The action research component was crucial in that respect to organise 'knowledge exchange' workshops, which also paid attention to long-term changes, asking works-

hop participants to suggest things they would do differently in the future. Lastly the TechRadar tool was developed, allowing novices to get a structured overview of current trends and technologies defining the Maker movement. This tool also includes some useful filtering; so that interested persons can target their search for latest trends to particular areas they are interested in (e.g. collaboration tools, or latest trends in additive manufacturing). Especially the later summary deliverables in WP6 document a good outlook to the future potential of the Maker movement and what it could mean for evolving towards a more sustainable society, reframing the potential of making in terms of their contributions to the Global Sustainability Goals suggested by United Nations is a must for all makers.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Christian Voigt: We learned that a better understanding of the Maker movement's diversity is key to provide optimal support from an academic point of view. As a research institute, we subscribe to the value of applied research, having a systematic, detailed and methodologically sound approach to the collection and analysis of data. We can see that CAPS and the Maker movement are a rich foundation for further promoting social innovations, changing consumption and production patterns or generally, evolving towards more sustainable ways of living. However, we can also see that there is no royal road or silver bullet that would work under all circumstances.

This is where research and operational excellence of makerspaces can meet each other, e.g. implementing a monitoring system looking for what activities make a difference and thinking hard about what indicators would evidence whether a certain objective has been reached or not.

As an example, we could mention our investigation of

1. Typical maker spaces such as thingiverse.com or instructables.com (see chapter 6.5) or
2. The analysis of a single makerspace in Austria with more than 2,700 members (Voigt et al., 2017).

Concerning (1), we could see that even though knowledge exchange platforms are prime opportunities to collaborate, i.e. person X suggests a first version, which is then improved upon by person Y, less than 1% of projects published on instructables.com indicated to include multiple authors. Showing that these platforms can also be used as advertising individual achievements rather than engaging in long-term collaborations with like-minded peers. Both usage patterns are of course valuable in themselves, from a platform's point of view, however, it might be desirable to encourage more collaboration and therefore learning and active knowledge production leading to more innovations on a product level. If that becomes the explicit objective of a platform, it could in turn lead to specific design decisions – e.g. collaboration projects and their unique benefits in terms of interdisciplinary solutions are featured separately. Hence, fine-tuning the impact of CAPS requires an ongoing effort that needs to be implemented by maker organisations themselves, for all the right reasons of becoming more inclusive, widening their attractiveness, being a voice for social change etc. And as shown in the case of (2) this sort of data-driven analysis can also apply to the usage of machines, workshop offerings, or types of membership categories. Fab Labs can monitor the most prevailing practices and see whether these practices correspond to their self-declared value statements.

TUDO

You can watch the first full interview here: https://youtu.be/-S-K8xl_ZH4

What is your experience in the Maker movement?

Marthe Zirngiebl: Regarding governance, when I look at our cases we can see that there's a strong relation between the organisation or initiative that's hosting a Fab Lab or a makerspace and the mission and aim of the maker space, so, for example, one of our case studies is located within a university, which has a strong focus on education and bringing people without a formal education into employment. And then other Fab Labs, which are more, sort of, bottom-up process might have a more entrepreneurial spirit and attract makers that want to follow in that direction as well. And regarding collaborated behaviour, we can see that there is a great tendency to share techniques and to learn from each other how to use the machinery

and how to use certain material but then when it comes to turning your idea into profit...well the collaboration stops to a certain extent. Meaning that the techniques are still shared but specifics are hidden.

What do you expect from MAKE-IT?

Marthe Zirngiebl: I hope that MAKE-IT will contribute to taking Maker initiatives to another level and spreading ideas about changing lifestyles and alternative forms of education to vital scientific spheres.

Which do you think are the main issues related to the governance, collaborative behaviors and impact in the Maker movement?

Marthe Zirngiebl: The Maker movement is "at the move": It is (relatively) new and quite dynamic. Our empirical findings summon the picture of a movement under construction and struggling to define and understand itself. This situation raises the question of how to improve the impact of the Maker movement and how to sustain its outcomes? WP6 revealed several strategies that makers apply to answer this question: Makers strive to improve the quality of makerspaces, improve their internal organisation and experiment with new services (such as mentoring, entrepreneurial support or legal advice). Another strategy we found is to find allies: makerspaces ally with universities, schools, libraries, museums, enterprises and several other entities. These alliances are raising questions of cooperation and clashes of different cultures.

We found many examples where the "maker culture" (examples: prevalence of "bottom up" processes, denial of hierarchies, "sharing" attitude) produce conflicts with the codes, rules and norms of other entities. Many makers struggle with the attempt to measure and evaluate their impact - for own reflection, but also for informing their stakeholders.

But there is no impact assessment tool appropriate to evaluate makerspaces. WP6 collected a rich collection of impact assessment tools, primarily aiming at social entities and/or social entrepreneurs. These existing tools could be assessed by makers in order to find most appropriate tools for their needs.

Regarding governance, collaborative behaviors and impact, what do you think MAKE-IT achieved?

Marthe Zirngiebl: MAKE-IT produced the insight that governance, collaborative behaviours and impact can not be described for the Maker movement at large scale, but a better perspective is to look at certain types of makers. WP6 distinguishes three objectives makers purse (Figure 13) and WP4 differentiates five types of makers (Figure 14).

1. The first cluster gathers what we have termed as "utopian makers" for whom maker values are perceived as incompatible with market values or dissociated from market values.
2. The second cluster analyses the ambiguity, which exists between makers and openness and how this gives room to go beyond the traditional dichotomy between openness and market.
3. The third cluster looks at makers for whom openness is a key to reduce entry barriers to the market.
4. The fourth cluster gathers cases where proprietary ways are favoured to commercialise maker products.
5. The fifth cluster looks at cases where openness is turned into a competitive advantage, as long as it relies on a strong community.

Another finding is that the Maker movement - with all their social attitude - is still quite male dominated. We found evidence that societal gender stereotypes are (partly unknowingly and/or unwillingly) reproduced. But female users are still fewer that male and there does exist a gender related access to tools.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Marthe Zirngiebl: We have developed a better understanding of the Maker movement - especially of their struggle to reach "unusual subjects". TUDO is following up with research on strategies to make maker technologies and pedagogies usable for people with disabilities.

IAAC

You can watch the first full interview here: https://youtu.be/Z9yrPYE-lao

What is your experience in the Maker movement?

Matías Verderau: Fab Lab Barcelona is one of the oldest Fab Labs in Europe, so we have a lot of experience in Maker culture, creating events and now we are developing the Fab City project and inside of that it's the Fablabs.io platform that is a place to put every project, people, events, Fab Labs and institutions of this Maker culture to make them collaborate and create a big community, that's our effort.

What do you expect from MAKE-IT?

Matías Verderau: We expect to build a stronger community, make some connections between the Fab Labs, the creators, the employers and the people. Also add the unusual suspects and this way make a bigger impact in our environment.

Which do you think are the main issues related to the governance, collaborative behaviours and impact in the Maker movement?

Matías Verderau: In terms of the impact of the Maker movement, the collaborative behavior is a key to scale the impact, since this allows connecting the community globally and fostering a democratic access to knowledge. Regarding governance, there are still no clear lines in this sense, which directly affect the impact of the movement. As the movement grows and massifies we can see real changes in terms of governance.

Regarding to governance, collaborative behaviours and impact, what do you think MAKE-IT achieved?

Matías Verderau, Massimo Menichinelli: MAKE-IT has managed to make a current photography of the Maker movement, focused mainly on these issues. This allows a clear understanding of its characteristics and impact, providing scenarios, contents and tools to work on these issues at all levels of society.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Matías Verderau, Massimo Menichinelli: The project has served to understand more in depth the Maker movement and its complexity, how it faces social challenges and the type of solutions that have emerged until today. On the side of our organization, MAKE-IT has contributed to assess and understand the real impact of CAPS on the movement, which affects us directly as we develop CAPS with this approach. MAKE-IT provided a way for understanding better Maker initiatives and their impact, an issue that we'll probably address further beside the working on Maker platforms such as Fablabs.io, the platform of the global Fab Lab network. Furthermore, MAKE-IT provided a context for communicating the Maker movement to the unusual suspects and for learning about the difficulties of such task.

FLZ

You can watch the first full interview here: https://youtu.be/LHWTJv4W6HY

What is your experience in the Maker movement?

Roberto Vdović: We have run the Fab Lab for three years and there is big impact on local community and not so much on government interest, let's say, at least in Croatia.On the local community level we play and one of our mission is education and we make great efforts to go to the schools and show new technology, new makers' technology, digital fabrication technology to kids and I believe impact in that field is great. On the other hand we try to approach the government, the ministry and on this level we are not successful.

What do you expect from MAKE-IT?

Roberto Vdović: I already get great experience from other Fab Labs and great ideas and for sure some of our activities are shaped in the way, in last year, in the way we get some experience from the networking in the MAKE-IT project. So, for me it's also interesting because I'm a maker, those social influences and impact because I was not aware of different kind of impacts.

I feel it but I didn't know about so much. So, when we are now playing some activities with the schools, we take care about social impact and try to figure out what is not direct impact on their work, what they make but also how they communicate, what are the soft skills and so on. So, for me it's very important.

Which do you think are the main issues related to the governance, collaborative behaviors and impact in the Maker movement?

Roberto Vdović: In Croatia (ex YU), history of kind of Maker movement started almost half of century ago in form of Technical Culture. Although this institution is very close to Maker movement, it is not recognised (even it is not recognise itself) as part of Maker movement.

We believe we can learn from this fact about governance and impact of Maker movement. As a Fab Lab we are struggling to be recognised as important part and important point between stakeholders in Quadruple Helix.

We are trying to bring together stakeholders from academia, business. government and local community together. We learned from MAKE-IT how this is important as a tool to achieve some economic strategies. We see this, at least on national level, as process, where we have to bring more resources to achieve this.

Regarding to governance, collaborative behaviors and impact, what do you think MAKE-IT achieved?

Roberto Vdović: For sure, platforms are a great achievement. At least for our institution, knowledge about CAPS and social aspects of their impact was another great achievement of this project.

Importance, even we were very careful about it, of gender equality was emphasised, and we take even more care about planning and performing workshops interesting for both genders, but also show technology especially in schools neutral or engaged in the way both boys and girls find those technology useful and interesting in the future. For that reason, we put more resources to plan workshops with connection to art, to traditional crafts in connection with digital to have more value added.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Roberto Vdović: For FabLab.hr participation in MAKE-IT was most valuable. We learn about possible impact on society and overall social impact on individuals, schools, local communities. We believed there is something more than economic value about activities we are performing, but by participation in MAKE-IT project, those beliefs become more than expectations. We learn how to promote those social aspects, how to approach to both individuals and communities. Fab Lab Zagreb extends activities to different type of institutions learned from partners who are in this project.

HLW

You can watch the first full interview here: https://youtu.be/3r3opCyJ4lI

Which do you think are the main issues related to the governance, collaborative behaviors and impact in the Maker movement?

Karim Jafarmadar: On a micro level - as a makerspace - we experience lots of small regulatory issues we have to deal with on a daily basis. As the Maker movement mainly consists of bottom-up initiatives it does not really fit into the well-established economies of (Western) European countries. Without a real lobby behind, change is only slow and can hamper the growth and full realization of the possibilities of this movement.

Regarding to governance, collaborative behaviors and impact, what do you think MAKE-IT achieved?

Karim Jafarmadar: During the MAKE-IT project we had the chance to look inside our association to get a better idea about our current situation. In our case we got to know our target audiences better and could analyse the differences way of using our infrastructure as well as models of collaboration between the makers. This will help us to identify goals for the future to reach new target groups or serve the existing ones better. Furthermore we have valid data in our hands to present to policy makers and the government.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Karim Jafarmadar: The researchers' look on what we are doing in our makerspace helped us to learn a lot about ourselves. Furthermore, exchange with other Maker initiatives is always inspiring.

AHHAA

You can watch the first full interview here: https://youtu.be/FGK2G4ffBm4

What is your experience in the Maker movement?

Helin Haga: So, I have been organising the very first Mini Maker Faire in the Baltic States for a few years now, so my main experience in contributing to the Maker movement has come through it.

What do you expect from MAKE-IT?

Helin Haga: From MAKE-IT I expect to be networking with like-minded people a lot and I expect also to get a bit of insight into the research background of the Maker movement to make or Maker Faire, for instance, even better.

Which do you think are the main issues related to the governance, collaborative behaviours and impact in the Maker movement?

Helin Haga: I believe that the main issues regarding governance is the fact that the maker scene is not regulated or, on the other hand, can be overregulated when it comes to certain types of technology. Locally in Estonia, there is no single authority in charge of overseeing Maker initiatives and regulating the field. In addition, the collaborative behaviour of makers depends very much on the personalities of makers working together but the makerspaces and the maker events also have a major role to play in supporting collaboration between makers of different ages and backgrounds. The issue of the maker scene being dominated by men is one that needs tackling and looking into continuously in order to promote collaborative behaviour that is more

inclusive. Impact-wise, makers can be more agile to solve difficult technological issues than big corporations but makers often lack the pull in relevant institutions to get their ideas out there, to get them scaled up by the industry.

Regarding to governance, collaborative behaviours and impact, what do you think MAKE-IT achieved?

Helin Haga: I believe MAKE-IT did a good job in mapping different makers, Maker initiatives and maker solutions used in the world to see what is the glue that is holding the entire Maker movement together. It was interesting to see the perspectives of other makerspace or event or platform managers to see why they think the movement is relevant and use this knowledge to reflect upon our own decisions.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Helin Haga: AHHAA has learned that makers are a very diverse group of people who might be, in many cases, difficult to group into a single movement. In addition, we discovered that since "making" is such a natural instinct for Estonians, many innovative makers refuse to call themselves makers but rather see their achievements simply as natural parts of their daily lives. The local makers have no collective preferences or concerns when it comes to CAPS and some makers are more aware of the possibilities, while others are apprehensive in testing different solutions.

CIR

You can watch the first full interview here: https://youtu.be/b9FyBf0yjIg

What is your experience in the Maker movement?

Jeremie Pierre Gay: So what we experience in Create it REAL is research and development in 3D printing, so we are very interested to understand the maker community and to see the impact of the technology that we develop.

What do you expect from MAKE-IT?

Jeremie Pierre Gay: So what we want to understand in MAKE-IT is how the industry, the 3D printing industry, how the Maker movement can grow and become a real industry that has the skill to let everyone have access to those very cool technologies and the way of thinking as a maker.

Which do you think are the main issues related to the governance, collaborative behaviours and impact in the Maker movement?

Jeremie Pierre Gay: The main issue we see during this project is for makers to reach financial sustainability. As Create it REAL is very technology based we have been looking on how to provide technology to address this. We have therefore developed a secure 3D printing solution to allow collaboration between makers in a more professional setup (Business to business). We believe that such technology will fuel the transition from hobby makers to professional makers and has the potential to accelerate the entire Maker movement.

Regarding to governance, collaborative behaviours and impact, what do you think MAKE-IT achieved?

Jeremie Pierre Gay: We believe make it achieved to clearly identify pattern around sustainability that is an issue experienced by the entire community but never clearly formulated. We also believe that this understanding is an important step to start acting upon the problematic encountered by makers.

What have you and your organization learned about the Maker movement and CAPS during MAKE-IT?

Jeremie Pierre Gay: Create it REAL realised that finding the right balance between openness and commercialization was key to scale the Maker movement. This project truly impacted our direction as a company and reconciled our business ambition with our maker spirit.


s "Collective Awareness"?
big data about what's going on and
's actions
ans as well as from sensors
lable to all citizens as open data
and interrelated with other sources of
on/statistics/simulations
extended awareness of the social world,
ment and the consequences of our
dging our behaviours towards:
ental-friendly lifestyles
nomic models
tive global governance

6.2

Interviews with the Advisory Board members

During Maker Faire Rome 2016 we interviewed[2] our Advisory Board members about their experience with the Maker movement and their expectations from MAKE-IT:

Daniel Charny

Creative Director at From Now On:[3]

You can watch the full interview here: https://youtu.be/e1CX8OkShEg

Sherry Huss

Co-creator of Maker Faire[4]:

You can watch the full interview here: https://youtu.be/2ZYii6nxbtM

David Cuartielles

Co-founder of Arduino[5]:

You can watch the full interview here: https://youtu.be/1Y4gMihlvo0

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2 *You can watch all the video interviews here: https://www.youtube.com/watch?v=e1CX8OkShEg&list=PLlKV_n43-6tsdhGBBWzfFu6yFLNpJEOk9*

3 *http://www.fromnowon.co.uk/*

4 *https://makerfaire.com/*

5 *https://www.arduino.cc/*

Sherry Lassiter

President of Fab Foundation[6]

You can watch the full interview here: https://youtu.be/kGbO38mfjEg

Sabrina Merlo

Program Director of Maker Faire[7]

You can watch the full interview here: https://youtu.be/Fz9K4KOr8vU

Fiorenza Lipparini

Co-founder and Research Director of PlusValue[8]

You can watch the full interview here: https://youtu.be/fXAHJh1ykRg

Dale Dougherty

Founder & CEO of Make (Make Magazine[9] and Maker Faire[10]):

You can watch the full interview here: https://youtu.be/woe_LwRCYEA

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6 *http://fabfoundation.org/*

7 *https://makerfaire.com/*

8 *http://www.plusvalue.org/*

9 *https://makezine.com/*

10 *https://makerfaire.com/*

6.3

Interviews with experts: Which are the challenges for Maker CAPS?

The Fab City[11] is a global project to develop locally productive, self-sufficient and globally connected cities; it comprises an international think tank of civic leaders, fab lab champions, makers, urbanists and innovators working on changing paradigm of the current industrial economy where the city operates on a linear model of importing products and producing waste. The Fab City Expert Meeting[12] (Amsterdam, 20th of April 2016) was gathering of world leaders on digital fabrication, innovation and urban design in order to look on future models of operations and research for the Fab City project. During the event we interviewed[13] some of the participants, asking them "Which are the challenges for Maker CAPS?".

Nicolas Lassabe

Artilect - Fab Lab Toulouse[14]

You can watch the full interview here: https://youtu.be/kTNEzsAWZ78

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11 *http://fab.city/*

12 *http://europebypeople.nl/programme/fabcity-summit-2*

13 *You can watch all the video interviews here: https://www.youtube.com/watch?v=kTN-EzsAWZ78&list=PLlKV_n43-6tt9fCsp3UmDBFKk2u-GWntk*

14 *https://www.artilect.fr/*

Daniel Charny

Creative Director at From Now On[15]

You can watch the full interview here: https://youtu.be/riKSonRBNx4

Vicente Guallart

Co-founder of IAAC[16]

You can watch the full interview here: https://youtu.be/AD1nNHOcUZo

Marleen Stikker

President and Co-founder of Waag Society[17]

You can watch the full interview here: https://youtu.be/MI3k3N1Dvkc

Frank Kresin

Research director at Waag Society

You can watch the full interview here: https://youtu.be/rvtcgAPbC3U

Femke Haccoû

Amsterdam Urban Innovation Officer[18]

You can watch the full interview here: https://youtu.be/gl095-LZyVw

Asa Calow

Director of MadLab [19]

You can watch the full interview here: https://youtu.be/ehXhHXMGhco

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15 *http://www.fromnowon.co.uk/*

16 *https://iaac.net/*

17 *http://waag.org/en*

18 *https://amsterdamsmartcity.com/users/femkehaccou*

19 *https://madlab.org.uk/*

Liz Corbin

Institute of Making[20]

You can watch the full interview here: https://youtu.be/O7Mx-SX-h_g

David Li

Shenzhen Open Innovation Lab[21]

You can watch the full interview here: https://youtu.be/Jq3cTE6pQfs

James Tooze

Senior Tutor at Royal College of Arts[22]

You can watch the full interview here: https://youtu.be/2iYj4K3oFYs

Thomas Ermacora

Machines Room[23], LimeWharf[24] and Clear Village[25]

You can watch the full interview here: https://youtu.be/B9XvPZ57nes

Nat Hunter

Strategic Director of Machines Room[26]

You can watch the full interview here: https://youtu.be/idO-4pbhn-w

Sacha Van Tongeren

Independent Program Developer[27]

You can watch the full interview here: https://youtu.be/lBewVV2--Fg

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20 *http://www.instituteofmaking.org.uk/*

21 *https://www.szoil.org/en/*

22 *https://www.rca.ac.uk/*

23 *https://machinesroom.co.uk/*

24 *http://limewharf.org/*

25 *http://www.clear-village.org/*

26 *https://machinesroom.co.uk/*

27 *https://www.linkedin.com/in/sachavantongeren/*


Conclusions Pillar 3: Value Creation & Impact
different winners + losers
Economic Impact
mostly small-scale
+
mostly global-scale
-
Enhanced capacities for innovation and risk-free experiments
Less labour protections for makers (vs. traditional employment)
good for designer
Custom-isation of products fills niches
Making can't replace mass production for cheap goods
quality control not regulated
Threat for existing particular professions (e.g. design)
Environmental Impact
+
-
Reduction of CO2 emissions through local on-demand production
Lack of environmen-tal impact assessment of Maker Mov.
Development of new sustainable materials
Majority of filaments is non-recycled + hazards from maker materials
EU filament factory is an opportunity
Repair / Re- and upcycling culture
Potential increased disposal of home-prints
Social Impact
+
-
Work with disadvan-taged target groups
Lack of inclusiveness in many maker initiatives
Prosumerism = empower-ment of the
Empowerme nt of strata with high
Shared Value Creation
+
-
Combination of social and ecological with economic value creation
Open source sharing of designs and
edding 3000
similar to

6.4

How disruptive is the Maker movement?

David Langley

Originally published on the MAKE-IT blog here: http://make-it.io/2017/10/27/how-disruptive-is-the-maker-movement/

Many commentators highlight the Maker movement's great promise of bringing about a new and fairer economy. They contend that the dominant neo-liberal economic model is reliant on the over-exploitation of natural resources and low wage regions. It leads to the centralization of industrial power, the marginalization of the majority into the role of consumer, and a reduction in the true quality of life for most.

The Maker movement offers a genuine alternative whereby grassroots initiatives gain access to high quality digital fabrication facilities, can share knowledge through online platforms and open source technologies, and they can finance their innovations through mutual crowdfunding campaigns. Futurologist, Jeremy Rifkin, in his 2014 book "The zero marginal cost society" (Rifkin, 2014), goes so far as to say that once maker infrastructure is fully developed, it will bring the price of products and services close to zero thereby completely destroying the capitalist stranglehold on the economy. However, other commentators are less impressed by the Maker movement. The critical analyst, Evgeny Morozov, in his Jan 2014 New Yorker column

(Morozov, 2014), draws a parallel with the arts and crafts movement during the industrial revolution. That too held great promise to democratise production technologies at a time when workers suffered exploitation in new textile factories. But access to tools on its own is not enough to bring about political and social change; makers need to change corporate laws and governmental policies too. Otherwise they are doomed to be side-lined as irrelevant hobbyists, like their industrial age counterparts.

So, is there now evidence of the disruptive nature of the Maker movement? Are we about to enter the collaborative commons era, as Rifkin suggests, where everyone is a maker and the peer-to-peer economy becomes dominant? Or, as Morozov implies, are makers too busy with their cool gadgets to realise that they are simply pawns stuck in a corporation-controlled game?

My answer to these questions is built by looking at a number of indicators that provide an indication of future change. Through participating in the MAKE-IT project, I have had the opportunity to learn about many Maker initiatives and understand the makers' experiences and challenges. Clearly, at the present time most makers remain small-time hobbyists, and there is no major disruptive effect being exerted on the economy. Indeed, a major driving force of many makers is their moral compass guiding them in the direction of the sharing economy, open source principles and a rejection of financial value in favour of social value. This focus in itself is not conducive to developing a competitive drive to scale-up and disrupt existing markets.

Nevertheless, this does not mean that all makers remain economically insignificant or, importantly, that the effect of the whole movement will not be felt on a wider scale. Disruption may take time. The question we can ask ourselves now is: Can we see the first signs of change?

Signs of disruption 1: The Maker movement is still growing, both in terms of numbers and the breadth and depth of people getting involved, as well as the platforms and tools being used. On the one hand, repair cafés and makerspaces are reaching out to a wide cross-section of local communities. On the other hand, increasingly advanced digital design and fabrication technologies, like 3D scanners and sensor technologies, are becoming

Figure 12. How disruptive is the Maker movement? 8 signs for measuring it

accessible to ordinary people. Additionally, as stated by Daniel Charny in his book "Power of Making" (Charny, 2011), more important than a discrete Maker movement is a broad and integrative 'making culture', whereby people get involved in making without considering themselves part of a movement. So the growth of making may be stronger than makerspace member statistics would indicate. Having said that, the growth still needs a long acceleration if the general population is to truly consider making instead

of buying. If I am to estimate the likelihood that current growth signals a future large-scale disruption, I would give it a grade of 5 out of 10.

Signs of disruption 2: Some makers are showing their business maturity to get their creative idea to scale-up. For example, in Denmark, Create It Real, one of the MAKE-IT project's partners, is developing hardware solutions to allow those wanting to sell their designs for 3D printed objects to limit the number of copies made. However, only a tiny proportion of makers have made significant steps in this direction and for many business maturity is not a goal at all. My assessment that current business maturity signals a future large-scale disruption: 3/10.

Signs of disruption 3: Some makers and moving towards connecting to existing firms and making use of knowledge and resources beyond what is available via the makers' own network. Major opportunities for mutual benefit could be exploited if makers connect with firms investing in smart industry / industry 4.0 solutions. An example is the RDM Makerspace collaboration with smart industry partners in the RAMLAB at the port of Rotterdam, to manufacture large metal parts for the maritime sector. Makers can share their creativity and gain knowledge and support in return. Nevertheless, we have not seen widespread examples of this happening and many incumbent firms are themselves adopting distributed manufacturing technologies without including makers at all. So my assessment of this signal of disruption is currently only 2/10.

Signs of disruption 4: The Maker movement has a strong connection to other societal trends. Makers reflect the millennial zeitgeist, as they are digitally savvy, engage in peer-to-peer collaboration and work via many-to-many platforms. Makers also prefer real sharing above the Uber-style platform monopoly, whereby the trend towards having access to functionality instead of ownership of products is particularly salient. Besides this, makers follow open source principles, design products which are environmentally responsible, and generally align with a significant number of societal trends that can help to reinforce the makers' relevance to the broader population. These include the move towards repair and recycling, producer-consumers, distributed manufacturing, open and social innovation, and others. My assessment of this signal of disruptive potential: 7/10.

Signs of disruption 5: Engaging the next generation. There are various programs aimed at giving children hands-on experience of making. The BBC schools program put a maker toolkit and a programmable microcontroller kit into the hands of all 11 year olds in the UK. The Fixperts program stimulates children and others to resourcefully improve the daily lives of people in their locality. If programs like these become a standard part of our education systems, which unfortunately in most areas they are not, they will help children to learn in a practical, self-determining way, and contribute to the growth of competent, autonomous and locally-connected makers. My assessment of this signal of disruptive potential: 6/10.

Signs of disruption 6: Alternative sources of funding are providing makers with independence from corporate banks and allowing their projects to grow. Via crowdfunding platforms, makers are able to scale-up without selling-out. An interesting, if highly unusual, example is the Superbook. Developed by two independent makers, this innovation is an inexpensive laptop shell that enables people to use the computer power of a smartphone like a normal laptop. They started a Kickstarter campaign in July 2016 and received backing of almost $3 million from more than 16,000 individuals. These makers had extensive business experience and unfortunately most makers struggle to access funding. My assessment of this signal of disruption: 4/10.

Signs of disruption 7: The first niches are switching to maker-first rather than buying ready-made products. Some types of things lend themselves to being customised and produced by makers and many mass markets have started as niches. One well-documented example is the kitesurfing community which has led the way in innovations that were later picked up by commercial manufacturers. There are also many 'obsolete' technologies, like old-timer cars and analogue photo cameras that are spawning maker markets. Nevertheless, most products remain centrally produced, and it is an open question if we will see kettles, TV screens and office chairs becoming predominantly maker-made. My assessment of disruptive potential: 4/10.

Signs of disruption 8: There are some law and policy changes that are in line with maker values that are influencing mainstream commerce. In corporate law, the advent of the B-Corp allows a firm's board of directors to make choices that reduce profit and shareholder value in order to create social

or environmental benefit. This means that some firms are acting more like the responsible citizens that makers also strive to be. In copyright law, open source and creative commons licenses are becoming widespread. Giants like Microsoft are increasingly working together with open source communities as they realise that by openly sharing their ideas with others, they too can benefit from the community's input. However, many more such changes would need to occur if the maker mindset is to become the dominant economic logic. My assessment of this signal of disruptive potential: 5/10.

To conclude, I would currently grade the disruptive potential of the Maker movement with a 4.5 out of 10; that is not very disruptive at all. The strongest indicators of disruption appear to relate to societal trends that align with the Maker movement's guiding principles. So many people are starting to support the notion that citizens must reclaim ownership of natural resources and intellectual property, and develop local, inclusive economies. But some of the other indicators show that we are still a long way from experiencing the kind of disruption envisioned by Rifkin.

Perhaps because the Maker movement is predominantly populated by tech-savvy counter-culturalists who reject dominant commercial and legal conventions, they condemn themselves to a role as opponents trying to develop an alternative approach outside of our cultural institutions, rather than effecting change from within. I think we can say that, allied with similar trends like the open source movement that hold the same values dear, the Maker movement is making some progress towards a participative, "collaborative commons" economic model. But it is a long way from bringing about the kind of real economic disruption that will significantly impact upon capitalism. Will that ever happen? The jury is still out. I fear it may be out for some time yet.

6.5

Do we need more collaboration for a truly disruptive Maker movement? First insights from the instructables.com community

Sebastian Mair, Christian Voigt

Originally published on the MAKE-IT blog here: http://make-it.io/2017/11/10/do-we-need-more-collaboration-for-a-truly-disruptive-maker-movement-first-insights-from-the-instructables-com-community/

A central question to the MAKE-IT project is the Maker movements' near and long-term potential to actually disrupt current production and consumption patterns. Of course, that is a multidimensional question whose complexity can't be comprehensively reflected in a single sentence. Disruption is better understood as a process rather than an event, if it is to happen at a societal level. The process of disruption starts with becoming aware of a situation which is not satisfying anymore. However, this realisation will depend on persons' position within the economical ecosystem. Incumbents of lucrative positions within the current system will likely oppose emerging solutions pointing at their shortcomings, often related to a lack of mature and robust implementations of otherwise progressive, forward-looking ideas such as fabricating and assembling products on-site and thereby avoi-

ding shipping and related burdens for the environment. Similarly, there is an argument that making enables people to become more entrepreneurial and therefore create their own jobs, quasi employing themselves.In both situations, we rely – among other things - on the idea of networks as empowering distribution mechanisms of either product knowledge (e.g. 3D models, materials and related parameters for desktop production) or 'how-to' knowledge (e.g. instructions, shared experiences and evaluations of alternative solutions). Hence, one of the 'signs of disruptions' is the emergence of large-scale networks empowering makers to share and comment their knowledge. In this posting, we want to more closely study the relationship between network dynamics, as reflected by their increasing membership and related network characteristics such as various centrality measures, the degree of members (often referred to as 'connectivity') or the largest sub-networks within a community.

The role of online platforms

By analysing existing online platforms such as thingiverse.com or instructables.com, we aim to contribute to a better understanding of collaboration and connectedness within the Maker community. Eventually, this will be of help when pursuing the realization of the movement's real potential due to the identification of missing features or incentives that stop platforms from supporting desirable behaviours. Or, alternatively, we might realise that the existing platforms serve a distinctly different purpose (Unterfrauner and Voigt, 2017) and are therefore less suitable to support the larger picture of digital, social innovation as envisioned within large parts of the Maker movement.However, a note of caution is in order, since we do not claim that online platforms, though arguably an important element, are representative of the entirety of the Maker movements where still a lot of interaction happens offline in places subscribing to different formats (Makerspaces, FabLabs, techshops, hacker labs, wet labs etc.). Still, online platforms help gathering like-minded people, sharing experiences and exchanging ideas. For the moment, we look at each platform separately since they offer unique sets of functions and collect different data, which makes it tricky to apply questions across the board and aggregate insights obtained from diverse platforms.

The case of instructables.com

Instructables is a website specialising in user-created and uploaded do-it-yourself projects, which other users can comment on and rate for quality. It was launched in August 2005. In this section we concentrate on first experiences with instructables.com. In 2011 the platform was obtained by Autodesk, a corporation that produces software for the architecture, engineering and construction business and is best known for its software AutoCAD. Projects (also referred to as instructables) are mainly published as step-by-step instructions, comprising text and images. Data on authors and their projects can be accessed via an API. Each project is organised into one out of eight categories, with technology, workshop, and craft being the most popular categories (see Figure 1). The number-ratio of published projects in any two categories remains roughly constant over time, where the category play relatively lost importance in the last few years and the publication rate in the category costumes has a pronounced seasonal dependence. At a certain time each year, the number of projects published in the category costumes are in vicinity of, or even outnumber the projects published in the category technology. At a more detailed level projects are organised into channels and can be described with key-words. Arduino is both the most frequently used channel and the most frequently issued keyword, which again highlights the communities technical affinity.

The long-term activity clearly indicates growth, but also shows signs of strong fluctuations. For example, we cannot provide explanations for the drop of uploads at the end of 2014 / beginning of 2015 or the decline in the first half of 2017. Overall the movement is still growing, while the relative distribution of categories did not change with time.

Only 0.68% of all projects are created collaboratively

Returning to our initial question of how much collaboration or interaction can be observed within Maker networks, in this case the network of inctructables.com members, we were looking for behaviours such as liking,favouring or downloading each other's' projects. Platforms such as thingyverse.com go even further and collect information of how many members actually 'made' or implemented an object. A prove of the replicability of the shared knowledge.

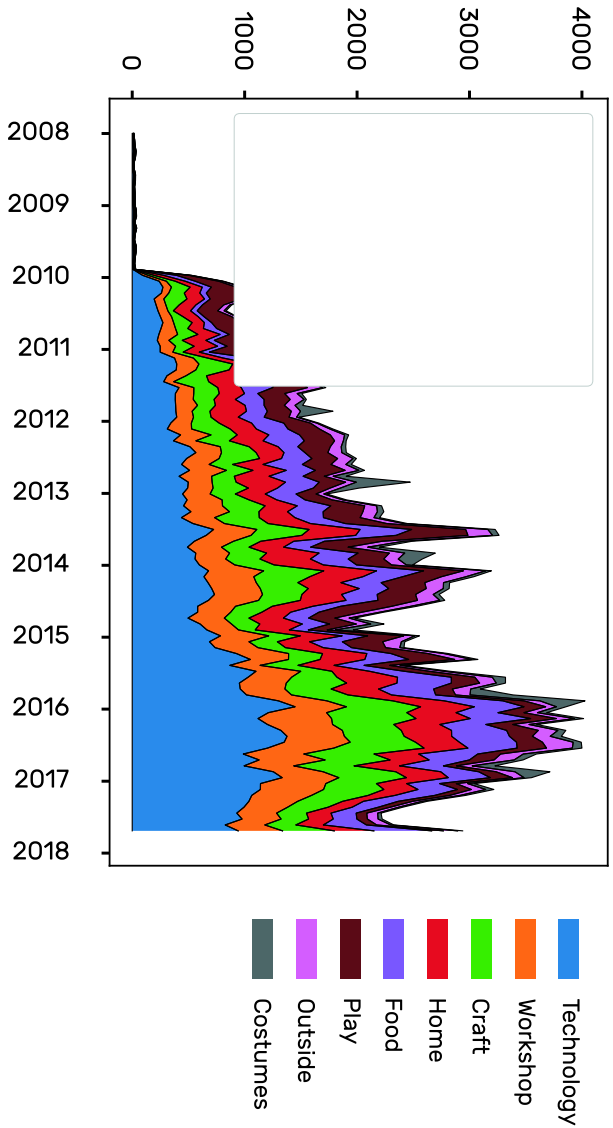


Figure 13. User activity by means of published projects at a given point in time, grouped by project-category.

Surprisingly, despite the apparent openness and inclusiveness of the community, collaborative co-authoring of projects is not popular. Based on our sample, only 0.68% of all projects are created in collaboration, this suggests that most makers operate on an individual basis and do not form large collaborative networks to perform projects. These collaborations are functionally supported yet not incentivised by instructables.com, as co-authors are not given any credits on the web-frontend.

The small amount of collaborative efforts can be studied in terms of networks, where users are represented as nodes that are connected by edges as soon as they publish a co-authored project. As only a small minority of the users co-authored a project, only few nodes are connected with edges and not every user can be reached through a chain of contacts from other users. This situation is similar to performing the small world experiment, where most people don't know anyone – messages won't come across the network. The opposite is found in an experiment by Milgram, involving a much larger community, who probed the personal acquaintance-network of people living in the USA and found the well-known result of 6-degrees of separation between any two people (Travers and Milgram, 1969). Parts of a network, where each node can be reached from any other node via edges are called connected components.

Analysing the increase of connections within a large sub-network

We created a video[28] of the largest component (comprising the most nodes) to learn more about the dynamics in co-authorship networks. The date is in the top right corner. A node is added to the network after a user published his/her first project. Nodes are rendered red, if the respective user published a project at the given point in time. The color changes subsequently to light-red (last publication within the last month), solid grey (last publication within the last four months) and light grey, the edges are rendered red at the point of publication and light grey thereafter. The video shows a naturally grown structure of locally organising makers.

28 *https://vimeo.com/239812750*

A note on licensing

While licensing represents a possible caveat, as this invites or denies for reuse and contribution, it does not seem to have a big impact on any of the collaboration processes. The majority of all projects (84.6%) are licensed under the Creative Commons Attribution – NonCommercial -ShareAlike license, only 4.4% of projects had 'All Rights Reserved'.

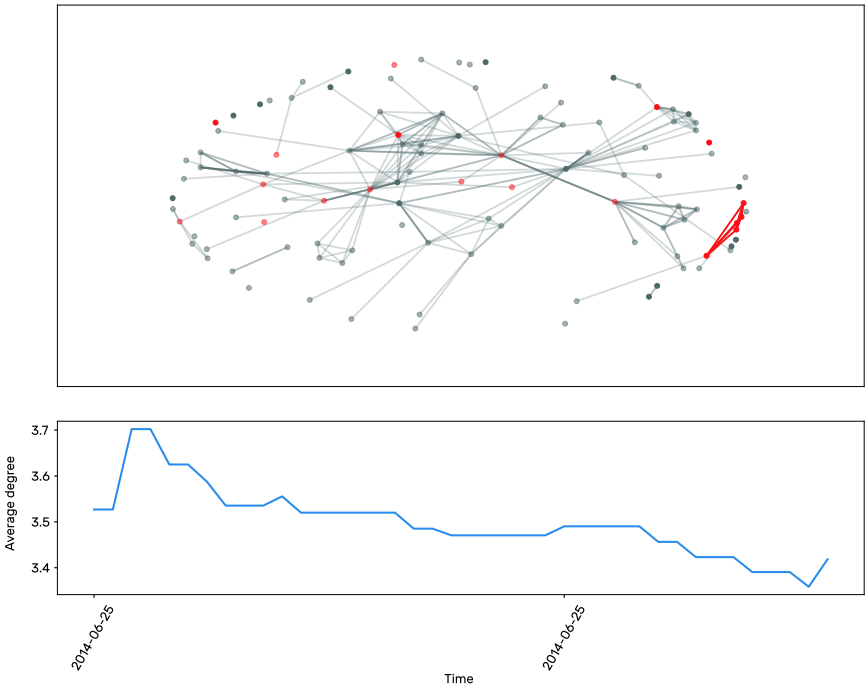


Figure 14. Snapshot showing the emergence of a larger sub-network of people having collaborated at some point in the past

6.6

Lessons learnt from our in-depth cross-case analysis of 10 Maker initiatives in Europe

Elisabeth Unterfrauner

Originally published on the MAKE-IT blog here: http://make-it.io/2017/09/05/lessons-learnt-from-our-in-depth-cross-case-analysis-of-10-maker-initiatives-in-europe/
For further information see Deliverable 3.2 here: http://make-it.io/deliverables/

We have distilled 10 lessons learnt from our in-depth cross-case analysis of 10 Maker initiatives in Europe:

1. **Lesson 1:** Although currently we hardly see a major shift in the production of products in general, i.e. from centralised to de-centralised production, we recognise that maker products have a unique selling proposition since products serve niche markets.

2. **Lesson 2:** Maker products have the advantage to responsively take into account individual user needs. Thus personalised and customised products can be developed effectively and fast.

3. **Lesson 3:** Maker initiatives but also makers themselves have a dense network of links to different stakeholder groups, especially to educational

institutions. These networks seem to be key for achieving sustainability.

4. **Lesson 4:** In the Maker community legal advice is missing in most of the cases and makers are challenged in handling the legal aspects of their doing especially if they have commercial ambitions.

5. **Lesson 5:** Although there are some examples of makers with commercial ambitions, who are ready to offer new solutions, new business models, to combine making, openness and the market, there is still a tension between openness and competitive advantage.

6. **Lesson 6:** Society's deeply engrained cultural stereotypes and value preferences when relating gender with technology, engineering or making don't stop at the doors of a makerspace. However, maker spaces that employ also female facilitators in the lab seemed to be attracting also more female makers.

7. **Lesson 7:** For stimulating the exchange of knowledge and experiences within the community, a trustful environment, both in virtual as well in physical spaces is crucial.

8. **Lesson 8:** Through communication with other makers rooms for reflections are opened up and bring forward the maker's project. A communicative atmosphere in the makerspace can support this exchange.

9. **Lesson 9:** The Maker movement has the potential for economic impact on regional level. The highest economic impact on regional level is due to job creation and start-up businesses rooting in the Maker community.

10. **Lesson 10:** The Maker community showed high awareness regarding environmental issues and brings up environmentally highly relevant products addressing these challenges.

6.7

Final messages

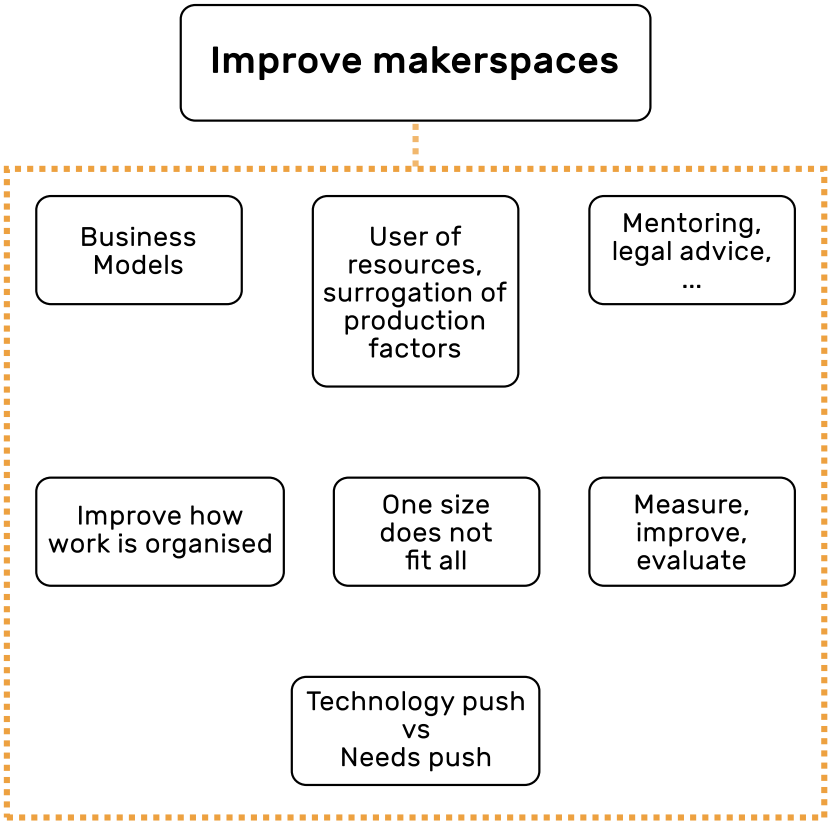
The MAKE-IT Consortium

Several contents were produced during MAKE-IT: here we try to summarise them with pictures and a list. WP6 elaborated three infographics detailing the conclusions from MAKE-IT, one for each pillar, here you can find an edited version of them after we discussed them during our last plenary meeting, which took place in November 2017 in Dortmund (Figure 15, 16, 17).

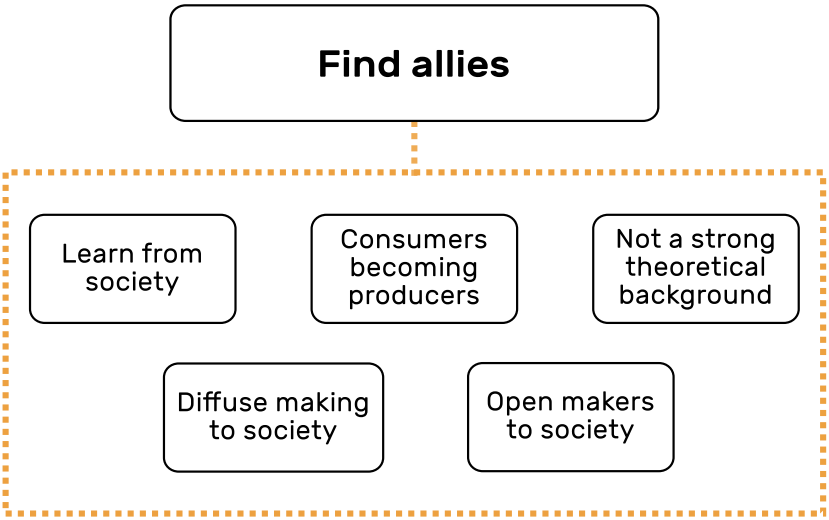
MAKE-IT

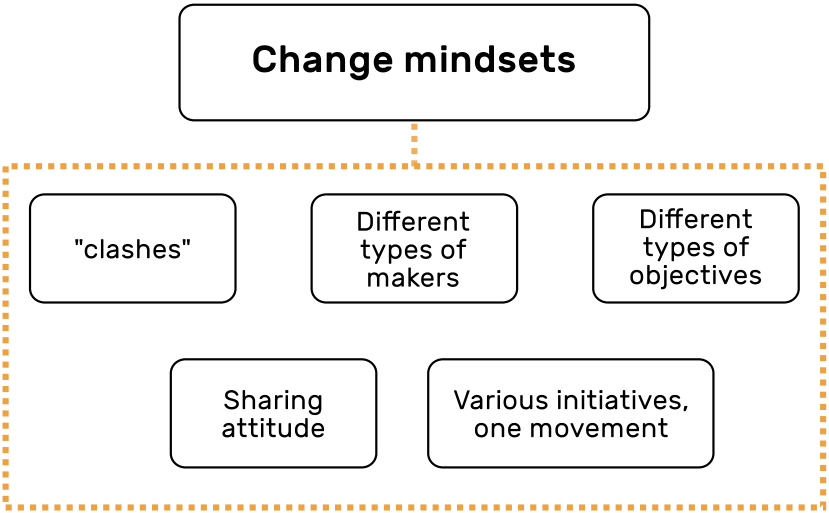
Understanding Collective Awareness Platforms with the Maker Movement

Conclusions Pillar 1 Organisation & governance



How to improve impact & sustainabillity of the Maker movement?

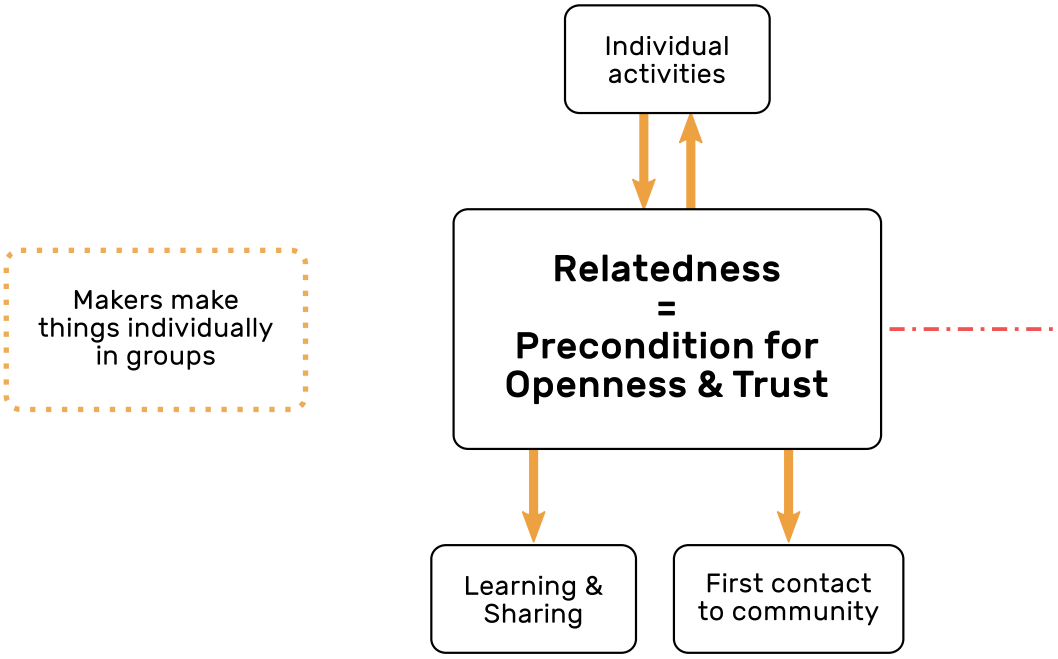




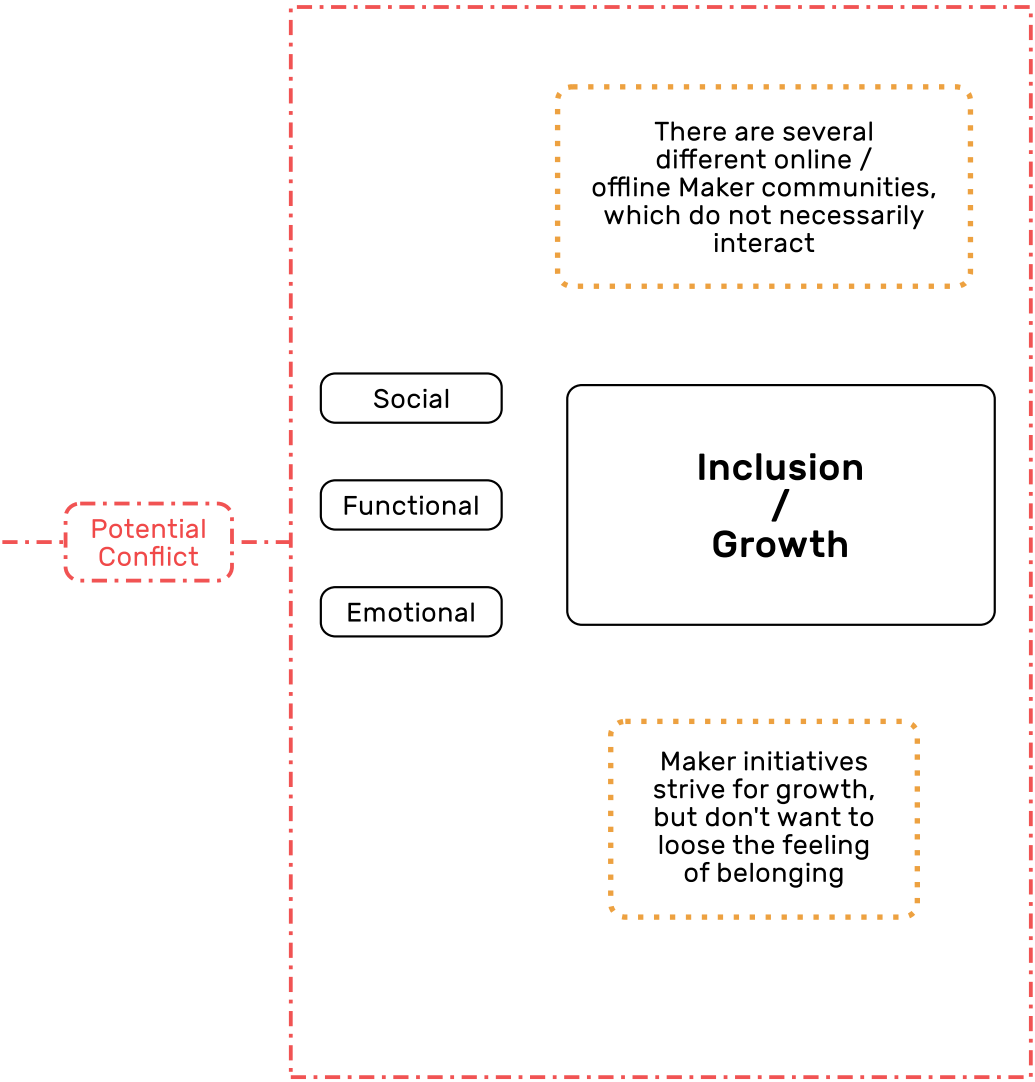
MAKE-IT

Understanding Collective Awareness Platforms with the Maker Movement

Conclusions Pillar 2 Peer and collaborative behaviours



How to engage in a Maker initiative and foster processes of learning?



MAKE-IT

Understanding Collective Awareness Platforms with the Maker Movement

Conclusions Pillar 3 Value creation and impact

Economic Impact

+

Enhanced capacities for innovation and risk-free experiments

Customisation of products fills niches

Training for local industry

Empowerment por prosumers

-

Less labour protections for makers vs. traditional employment

Making can't replace mass production for cheap goods

Threat for existing professions

Rise of prosumerism = loss of customers?

Environmental Impact

+

Reduction of CO2 emissions through local on-demand production

Development of new sustainable materials

Repair / Re- and up-cycling culture

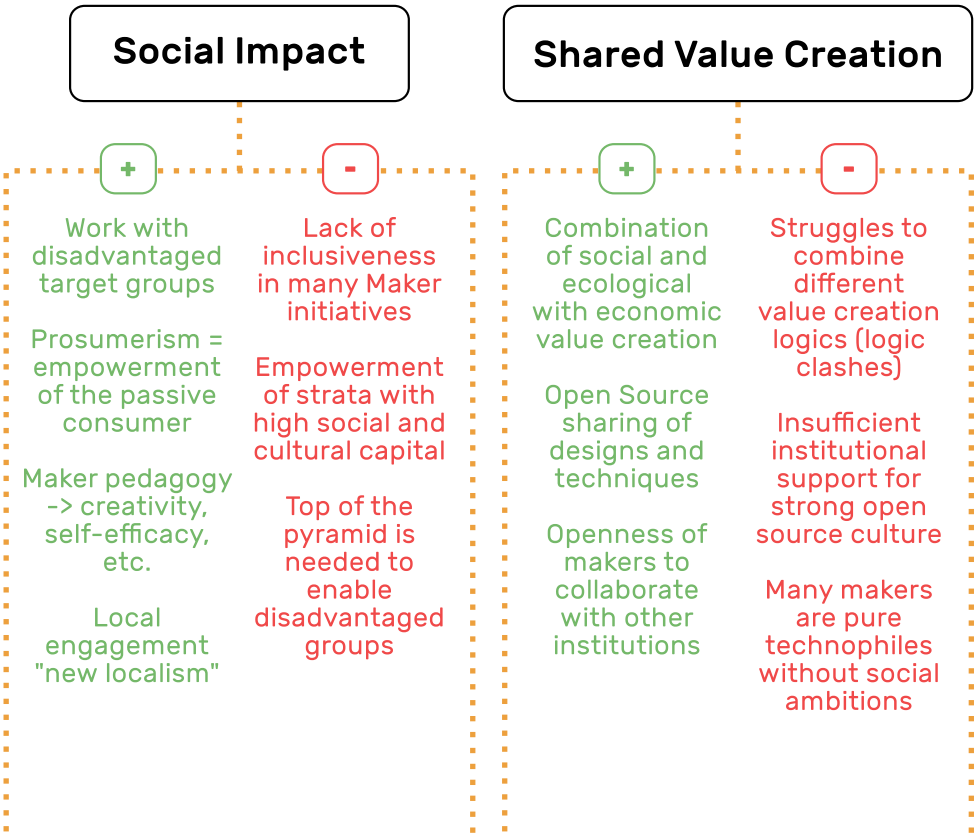
-

Lack of environmental impact assessment of the Maker movement

Majority of filaments is non-recycled + hazards from maker-materials?

Potential of increased disposal of home-prints

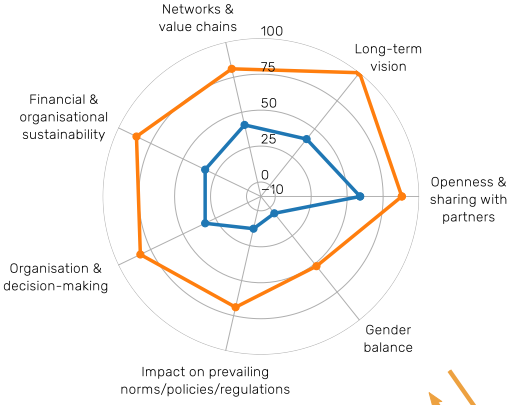
Which are the positive and negative impacts of the Maker movement?



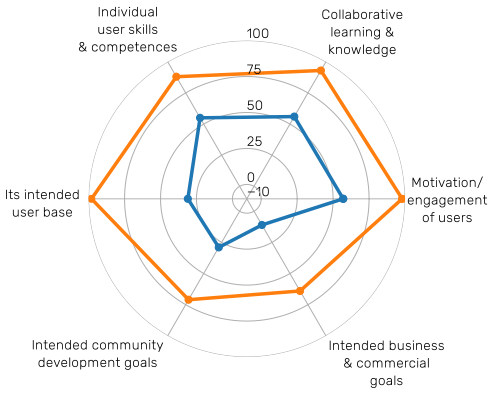
MAKE-IT

Understanding Collective Awareness Platforms with the Maker Movement

Achievement and relevance of the 3 pillars



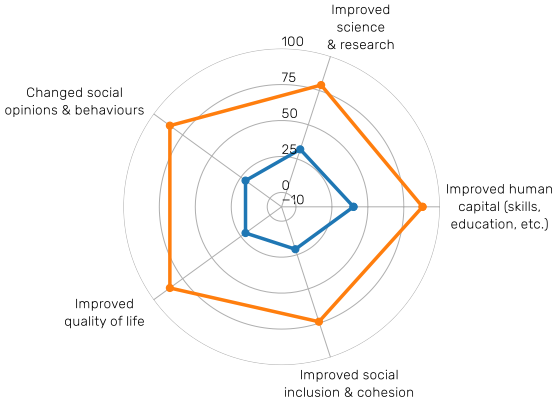
Pillar 1



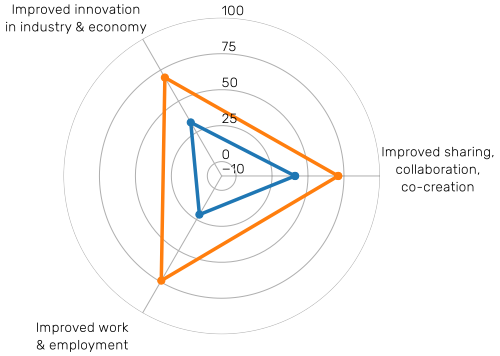
Pillar 2

Achievement
Relevance

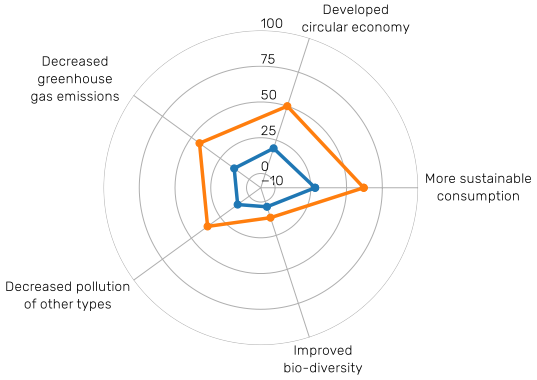
Data for the achievements and relevance of pillars 1, 2 and 3 are derived from detailed interviews with 42 Maker initiatives at the Barcelona Maker Faire, June 2017, corroborated by MAKE-IT's ten in-depth case studies (n=24).



Pillar 3 (social impact)



Pillar 3 (economic impact)

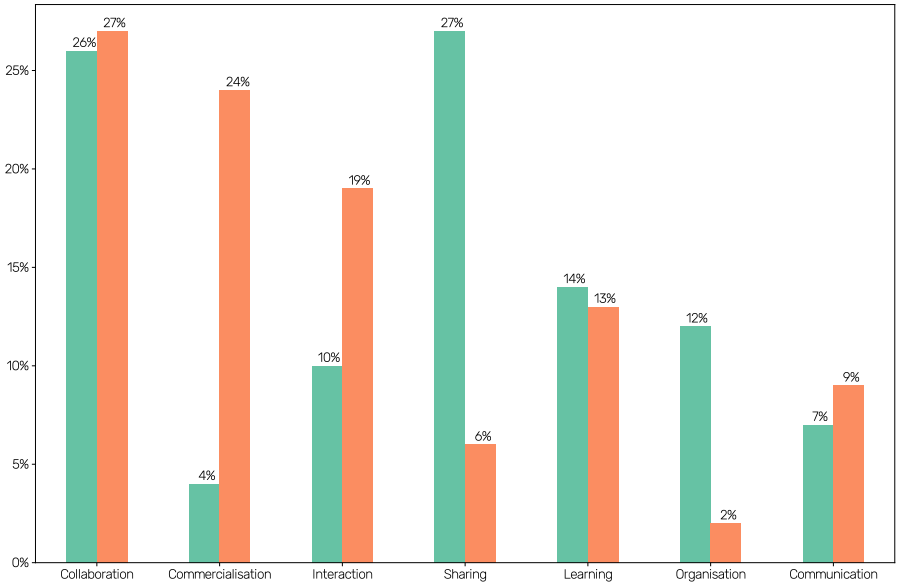


Pillar 3 (environmental impact)

MAKE-IT

Understanding Collective Awareness Platforms with the Maker Movement

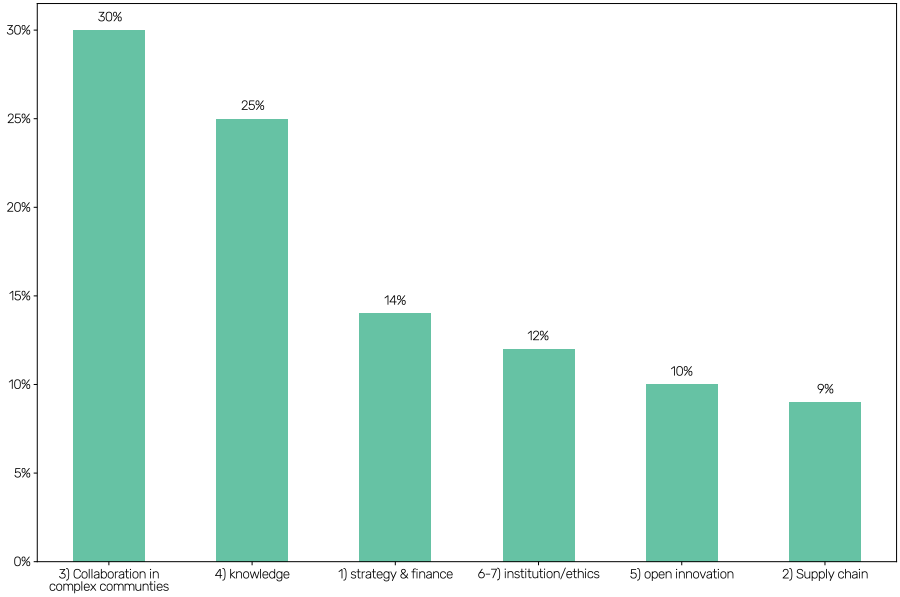
Technology use in pillars 1 and 2



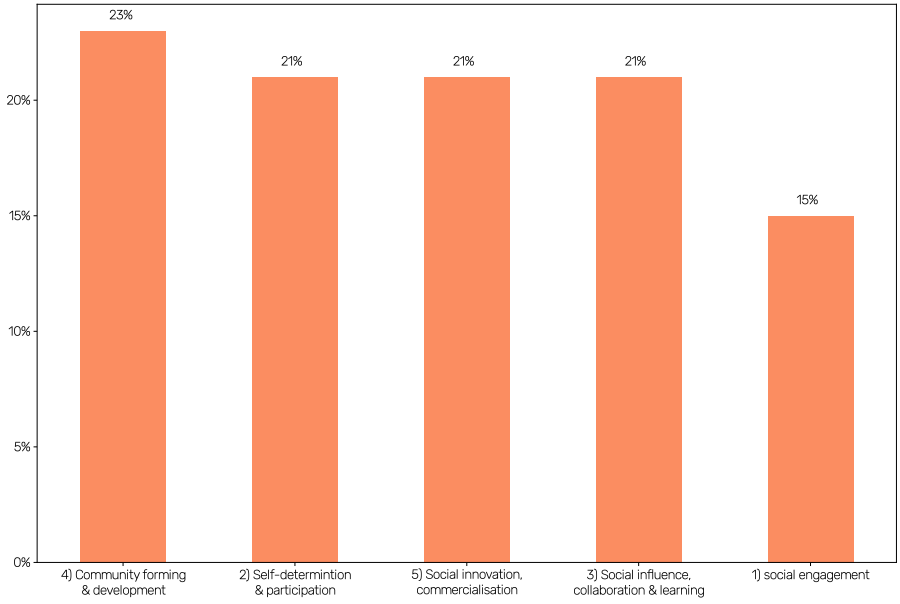
Comparing pillars 1 and 2 in technologies available for different use categories

Pillar 1
Pillar 2

Data for technology use by pillars 1 and 2 is derived from an expert analysis of relevant technologies, and how they are used in practice by makers, as surveyed in MAKE-IT's TechRadar, August 2017.



Technology use for pillar 1's research areas



Technology use for pillar 2's research areas

During the same meeting we also discussed which are the main elements included in the final deliverables, as these could be considered a final message about the results from MAKE-IT. Overall, MAKE-IT worked on providing:

1. An understanding of how Maker initiatives are using Collective Awareness Platforms (CAPS);
2. A (first) picture and exploratory analysis of the European Maker movement anno 2017;
3. A contribution to innovation theory in relation to digital fabrication technologies;
4. A contribution to the Digital Social Innovation (DSI) / CAPS discussion: what can the Maker movement teach us about realizing social innovation?
5. Practical improvements and tools for making activities;
6. Practical support for CAPS developers and users;
7. Scenarios for future development of Maker movement;
8. Recommendations for stakeholders about how to support Maker movement;
9. An overview of development trajectories during the journey of a maker.

FUTURE SUSTAINA-BILITY STRATEGY

7


MAKE-IT
MAKE-IT
OCTOBER
NOVEMBER

7.1

How to exploit the results

Iris Blankers, Jermy Millard, Elisabeth Unterfrauner, Bart Devoldere, Troels Bovbjerg, Bastian Pelka, Massimo Menichinelli

This section was elaborated from the exploitation plans elaborated in Deliverable D7.3, available here: http://make-it.io/deliverables/

Within MAKE-IT (and especially in WP7), the results have been disseminated in the research community, distributed and discussed with all stakeholders, and a special focus has been placed on the exploitation of the results, namely the stakeholder acceptance and implementation of MAKE-IT results in practice.

Developing a complete exploitation strategy has proved to be tricky, especially since there are at least three critical issues for understanding exploitation and therefore for planning for it:

1. Understanding the impact of tools developed: until these are developed, at least in a mature state, it is hard to plan for them (this effort took some time during MAKE-IT);
2. Understanding the impact of the research developed: until there are at least some results ready, it is hard to understand how to exploit them;
3. And ultimately also understanding their connections with the quadruple helix and with the Maker movement, which is still largely unmapped (hence the visualisations developed in WP7).

This whole book consists of a more complex and nuanced exploitation strategy; in this section we focuses on the future of the MAKE-IT results for both exploitation and future work. In next chapters each WP details how its own results could be exploited (distributed, debated with and accepted by stakeholders) by replying to the these two questions:

1. Are there any specific stakeholders that you think are directly interested in these results?
2. How do you think we could exploit the results of the WP within the four categories of stakeholders (research, civic society, economy, policy makers)?

WP1 (Iris Blankers - TNO)

The handbook could be used as an example for other consortia, that need to establish their own internal procedures.

WP2 (Jeremy Millard - DTI)

The diverse and varied results obtained are of value to the MAKE-IT researchers, but are also of significance for researchers in the fields of CAPS, Fab Labs and the Maker movement in general. The work of WP2 has been a first in compiling the state of knowledge regarding the study of CAPS and makers.

We are sure that academics, researchers, students and persons curious about the Maker movement will find inspiration and insight in the conceptual and methodological framework of WP2. This WP can also guide the work of other stakeholders, especially policy makers and government authorities.

The results of WP2 could be exploited as follows:

- Research: Researchers are the main target group of WP2, where the results could be of use in further studies involving CAPS, the Maker movement, Fab Labs or other social movements of similar nature.
- Civic society: WP2 results also hold a strong potential for civic society, and in particular for makers. WP2 identified various thematic streams

which have been further analyzed through surveys among makers. These results have pointed at areas where makers could focus to increase the impact of their activities.
- Economy: WP2 points at the economic impact of making, and could inspire both maker entrepreneurs, innovation support agencies and investors as well as traditional entrepreneurs and enterprises in adopting maker technologies or ways of working.
- Policy makers: Policy makers can gain insights into the existing policy and institutional barriers and opportunities for the Maker movement to grow, as well as the benefits of encouraging a stronger focus on making in society.

WP3 (Elisabeth Unterfrauner - ZSI)

Most likely managers of makerspaces or makers themselves. Many of the cases describe first-hand experiences of these stakeholders, how they recognised issues and what they did to overcome them. However, also policy makers could be a stakeholder group that could get a lot out of the work of MAKE-IT, in that the 'Maker movement' is a unique approach to addressing many related issues in areas such as 'technical literacy and creative problem-solving skills in schools' or 'saving energy or packaging'. At this point we talk about stakeholder such as teachers or leaders of civil society organisations.

Thinking in terms of the quadruple helix, the results might be interesting for all different stakeholder groups:

- Research: For researchers probably D3.2 is most interesting as it gives insights on some of the fundamental research questions dealing with different Maker initiatives, how they are organized, how makers learn from each other and which values and impacts are created. The study is based on qualitative methods and is thus by no means representative (which is also not the intention of the study to come to conclusions on the Maker movement per se). However, it raises hypotheses that could be further investigated by quantitative means. Desk research suggests, that in the Maker movement there is lack of empirical data to substantiate some of the claims that are expressed by

makers. Thus, researchers aiming at exploring the Maker movement might get inspired by the deliverable to further investigate some of the many research questions.

- Makers/civil society/potential makers: For makers or future makers the two-pager with the key lessons learnt might be the best to exploit. Reactions to the two-pager that we have distributed at various events such as Maker Faires, workshops and conferences were indeed positive.
- Policy makers: Also for policy makers the two-pager with the key lessons learnt might be the most accessible one. There are several lessons learnt that are very interesting for policy makers and potential funders: making as educational approach, unique selling propositions of maker products, etc.
- Economy: There are also some key lessons learnt that are interesting for players in the economy sector e.g. the unique selling proposition of maker products, the opportunity to develop products on-demand and tailored to the needs of the customer, thus to have customized products, etc.

The dissemination to academia is ongoing and fruitful, results have been presented at various conferences and papers published in journals. Also the two-pager with the key lessons learnt have been distributed through various channels (e.g. project homepage, homepage of different partners, advertising through blog posts on the MAKE-IT webpage). Also the two-pager will be distributed at the Maker Faire Rome, which is the biggest European Maker Faire that is visited by all different stakeholder groups, especially makers and potential future makers but also educators and potential investors. However, there are several channels, which could still be explored, e.g. sending a physical copy to maker spaces or to other maker incubators to reach a wider audience.

We see three services in need:

- Highlighting relevance,
- Considering the systemic barriers in the areas where MAKE-IT insights should be deployed and
- Bringing different stakeholder to the same table.

Highlighting relevance means maintaining a continuous dialogue with potential users of MAKE-IT knowledge in order to see how what they expected corresponds to what they achieved and make adjustment accordingly.

Systemic barriers are often not that obvious at first sight. The lack of adoption of certain practices might seem counterintuitive, however if we understand the regulatory environment we can detect barriers which need to be addressed with the relevant stakeholders (e.g. including 'making' in current teacher education programs would be useful but is also a costly and lengthy mission, since the approval process involves decision makers are federal levels, where priorities from different groups need to be conciliated. Stakeholder at the same table can shorten the time it takes to create change and positive impact. What we mean here is that knowledge of each other's limitations can spur the creation of workarounds, as a first step. For example, teachers already organise local 'special interest groups', exchanging their knowledge on 3D-printing or robotics in a school context where questions such as warranties, suitable materials or the nexus to certain curriculum topics is more present than what it might be in a general purpose exchange among makers.

WP4 (Bart Devoldere - TNO)

The many different types of results of WP4 can be used across various types of stakeholders. In the table below I list the different types of stakeholders and how they could use particular results of the knowledge transfer workshops.

Knowledge transfer workshop results	Research	Civic society	Economy	Policy makers
"Reaching out to everyone: inclusive maker spaces"	Researchers can use data and findings from the workshop to better understand drivers and dimensions of inclusive maker spaces (e.g., physical attributes, offerings). Researchers can use the workshop facilitation approach description to run a similar workshop so as to generate additional data and findings.	Fab Lab managers can use the workshop facilitation approach description to run a similar workshop so as to start building a more inclusive makerspace.		Policy makers can learn from the findings on how to use makerspaces for a more inclusive society and how to facilitate maker spaces for becoming so.

“Design your future maker hub”	Researchers can use data and findings from the workshop to better understand the value of making and drivers for attracting citizens and other stakeholders towards makerspaces.	Fab Lab managers can use the workshop facilitation approach description to run a similar workshop so as to start (re)designing their future makerspace. Fab Lab managers and users can use data and findings from the workshop to better understand how to make their makerspace more attractive for others to join.		Policy makers can use the workshop facilitation approach description to run a similar workshop so as to start (re) designing a future makerspace. Policy makers can use data and findings from the workshop to better understand the value of making and drivers for attracting citizens and other stakeholders towards makerspaces.
“Gender and open data”	Researchers can use data and findings from the workshop to further research and discuss dimensions of diversity, implications of diversity, and possible strategies for the future, enabling the formation of more diverse communities. Researchers can use the workshop facilitation approach description to run a similar workshop for generating more ideas on generating and sharing open data for more diverse fab labs.	Fab Lab managers can use results from the workshop to think about possible strategies and activities for the future, enabling the formation of more diverse communities, while trying to identify what types of data are needed and available to start managing diversity in their lab. Fab Lab managers can use the workshop facilitation approach description to run a similar workshop for generating more ideas on generating and sharing open data for more diverse Fab Labs.		Policy makers can use results from the workshop to think about possible strategies for the future, enabling the formation of more diverse communities, while trying to identify what types of data are needed and available to facilitate more diverse Fab Labs in their communities. Policy makers can use the workshop facilitation approach description to run a similar workshop for generating more ideas on generating and sharing open data for more diverse Fab Labs.
“Sustainable business models for labs” and “How labs become relevant”	Researchers can use the content and findings of the workshops to further explore questions related to sustainability and societal relevance of fab labs (e.g., relevant activities, trade-off between viability and core values).	Fab Lab managers can use the approach and findings of the workshop to further develop their ideas on what the makerspace or fablab is, should be and could be, while exploring ideas for experiences and collaborations with commercial companies and other stakeholders, given the spirit of the Maker movement.	Businesses can use the content and findings from the workshop to also reflect on relevant activities and collaboration to be set up with makerspaces/ labs or makers (groups or individually) for mutual benefit.	Policy makers can use the content and findings from the workshop to facilitate collaboration between makerspaces/ labs and businesses, while also reflecting upon how to embed/ constitute and sustain the presence of a relevant makerspace/lab in the community or society more broadly across different types of stakeholders

"Facilitation of idea validation"	Researchers can use the content and findings of the workshop to further explore key questions related to idea validation and how human-centered design methods can be applied to the facilitation of idea validation, while trying to detect drivers of a good idea and its potential.	Lab users can use the tools and techniques to ask the right people the right questions during the process of making as well as physically test and experiment with their ideas. Lab managers can use the tools essential towards becoming better idea validation coaches (and understanding thereof) for the makers during their utilization of the lab's tools equipment, services and personnel.	Businesses can learn how makers and labs try to validate their ideas which can be very informative for similar fuzzy front-end innovation activities of businesses. Business can use the information to assist users in validating their ideas, especially if the idea is potentially lucrative to the company.	

Besides knowledge transfer workshops, WP4 also implemented technology enhancements for innovation action research purposes. In the table below I list the different types of stakeholders and how they could use particular results of the technology enhancements.

Technology enhancement results	Research	Civic society	Economy	Policy makers
Designing and piloting a "BSOP tool" that facilitates connections between standholders and visitors during maker exhibitions.	Researchers can use the BSOP data for further exploring an understanding of the Maker movement and BSOP.	Maker Faires organizers can use the BSOP tool, its code, the systematic use case approach, and the potential further development plan of the tool to use and customize the BSOP tool for their own events to better matching visitors and standholders. Makers can use the BSOP tool when exhibiting their work during Maker Faires or Fab Lab events to better and more meaningfully connect with others. Visitors of maker events can better link with interesting initiatives while still enjoying the event experience	Maker Faire business partners can exploit a potentially additional communication and maker crowd insights generation channel.	A better understanding of the Maker movement and BSOP allows policy makers to finetune their communication and facilitation approach towards the Maker movement and its specific needs

Designing and piloting a "Tech radar" tool that facilitates learning and exploration of current and future maker technologies.	Researchers can use the tool, related information, and potential data capture for researching technologies and the Maker movement. Researchers can use the usability data and existing tool version to further develop and update the tool over time.	Fab Lab managers can use the tool for supporting newcomers of the lab to navigate through the vast potential of relevant maker technologies. Education providers for the Maker movement can use the tool for educating students about possibly relevant Maker technologies and their particular use.	Businesses can use the tool, related information, and potential data capture for better understanding Maker technologies and the Maker movement.	Policy makers can use the tool, related information, and potential data capture for better understanding Maker technologies and the Maker movement.
Surveying the current and potential impact of a core CAPs-related maker platform like "fablabs.io" with makers worldwide.	Researchers can use the survey data for researching Maker demographics and the impact of CAPs-related platforms for developing and sustaining the Maker movement.	Fablabs.io and the broader Maker movement can use the results to further develop central CAPs-related digital platforms like fablabs.io and their features for building their movement.	Businesses can get to know fablabs.io and Fab Labs better to tap into their potential to connect meaningfully with the Maker movement.	Businesses can get to know fablabs.io and Fab Labs better to tap into their potential to connect meaningfully with the Maker movement.

WP5 (Troels Bovbjerg - DTI)

Makers: The comprehensive collection of technologies relevant for the maker community in general is "packaged" in a webpage layout specifically designed for maker beginners – people who are new in the community. Here they will find inspiration in all sorts of technologies for making tangible objects, online collaboration and commercialization.

If they already know some of the technologies or platforms, then they will find similar technologies or platforms for a slightly different purpose, that could fit their needs better.This will also be a valuable tool for Fab Lab managers or similar role in the local community, that facilitate learning and exploring in technologies.

Civil society: The maker community by time has become more and more inclusive and making nowadays is not only about hacking software and hardware, but also welcomes "ordinary people" with handcraft activities. Together with maker education, this is a way into the more techy stuff. An example is maker fairs that have activities for children just about crea-

ting, where this tool will be an easy introduction for "civil society" into the Maker movement.The TechRadar supports bridging the gap between civil society and the Maker movement by providing a great deal of inspiration in the users' own pace.

Economic actors: An overview with future trends and technology development foresight is a valuable tool for companies developing technology themselves or investment funds purely interested in financial support in technology development.

Policy makers: The TechRadar can be used to show local policy makers how diverse the Maker movement is in terms of how the technologies is used. This can be exploited for different purposes, but in an overall perspective to convince local government to support local maker activities. As an example it can show how the Maker movement, with different platforms for commercialization, creates a way for people to follow their dreams in creating and making a business in the local community. If the aim is to start a makerspace and by it, create a habitat for young tech-interested people, in the TechRadar several tools for communicating, managing, organising etc. can be found.

Research actors: we can advise the ongoing CAPSI project, to exploit our results.

WP6 (Bastian Pelka, Janosch Sbeih, Marthe Zirngiebl - TUDO)

For further information see Deliverable D6.2 here: http://make-it.io/deliverables/

Deliverable D6.2 addresses policy-makers and practitioners and provides recommendations how to leverage the impact potential of the Maker movement for all stakeholder groups comprised in the quadruple helix model. The whole deliverable focuses on the exploitation of the research result of the MAKE-IT project. The approach taken in this deliverable is to analyse the Maker movement's impact potential on different levels. In doing so, we point out appropriate impact assessment tools for the reader's reference. Rather than performing a comprehensive impact assessment of the Maker movement (which is

not possible due to the young and still unclear nature of the movement), this deliverable serves as a guideline to point out the different impact potentials that the Maker movement holds for various stakeholder groups and what the necessary tools are to perform an in-depth impact assessment.

On the level of the individual Maker initiative, we perform a cluster analysis of social impact assessment (SIA) models that can be adapted to measure the impact of individual initiatives. As no particular SIA model has been developed yet specifically for Maker initiatives, and as assessment objectives and implementation capacities differ between users, there is no single right answer as to which model might be most appropriate for Maker initiatives. Instead, we discuss the different parameters that are relevant for choosing the appropriate SIA model and provide a matrix of 69 SIA models with their respective approaches and parameters in annex 8.1.

Maker initiative managers, researchers, investors, policy makers and other practitioners can use this matrix as a starting point to select which model might be most appropriate for their particular use scenario and consequently adapt their chosen tool to the maker context.

On the societal level we assess the impact potential of the Maker movement by projecting different pathways it could take in the future through the method of Scenario Building. On basis of the empirical findings within the MAKE-IT project (presented in D3.1 and D3.2) and multiple stakeholder reflection workshops (reviewed in annex 8.2-8.5), we present three possible scenarios to illustrate different directions the Maker movement can take and how this would impact different stakeholder groups.

You can read it also here in chapter 7.3; We regard it as unlikely that any one presented scenario will develop in its strongly presented form, but expect rather that a combination of the different scenarios will manifest which could lead to fragmentation of the currently forming Maker movement into different movement strands that focus each on their particular area of interest and activity. Which strand becomes most strongly pronounced depends strongly on the active involvement and co-creation of the Maker movement by the different quadruple helix actors.

Making and the Maker movement has the potential for four main types of impact relevant as levers for policy makers:

1. Social and cultural;
2. Transformation of the industrial sector;
3. Making production and consumption compatible with environmental sustainability;
4. And improving the efficiency and effectiveness of the public sector itself.

The potential links between makers and other economic actors, including advanced smart industry parties, offer both exciting and uncertain possibilities for the future. Many economic actors are themselves becoming acquainted with advanced digital fabrication technologies that allow for small-scale, bespoke production of customizable and made-to-order products. Whether the commercial firms developing their business practices in this direction will also connect to smaller Maker initiatives is one of the important open questions. In principle, both sides stand to benefit from such collaboration:

- Larger firms could gain creative impetus and develop a locally-grounded connection to highly interested prosumers.
- Maker initiatives could gain access to knowledge and other resources to help their social innovations to scale-up.

There are several disruptions that the Maker movement can pose to established economic actors:

- Makers could in the long term drive some firms or even industrial sectors out of business through price model disruption if firms and industries don't collaborate with makers.
- Traditional notions of firms as the key place of employment can weaken, with more fluid job opportunities exploiting networks of makers.
- Commercial organizations would have to move to become more open systems, imbued with values beyond those of the firm itself, including, for example, the importance of improving social welfare.
- It may become necessary for economic actors to reconceive their products and their markets to take on a new collaborative character with highly-involved consumers.

The Maker movement functions highly interdisciplinary and transdisciplinary and offers new opportunities for research, facilitation and consultancy to engage with makers and Maker initiatives across disciplines and theory and practice.

As interactions between the knowledge sector and the Maker movement increase, the network between Maker initiatives, educational institutions and consultancy is likely to become even denser than it is already, leading to the following impact potentials:

1. In academia, new topics stemming from the Maker movement come to the fore ranging across disciplines like material science, pedagogy of making, legal studies, etc., thus leading to new research agendas in the natural sciences, social sciences and humanities.
2. If studies provide the scientific ground for beneficial effects of making, researchers might have a special role to play in the negotiation process with funding agencies as their studies provide the argumentative basis for convincing funders to support Maker initiatives.
3. The closer collaboration between makers and researchers is likely to lead to fruitful exchanges and mutual influence. On the one hand, making is often done in a manner of trial and error and might benefit from a more systematic approach that is inherent to science. On the other hand, researchers, facilitators and consultancies might also be influenced by some of the values the Maker movement stands for such as openness and sharing and an emphasis on the three key pillars of Responsible Research and Innovation (RRI):
    a. Public engagement
    b. Science communication
    c. Open access.

Civil society institutions and individual citizens may both become producers of goods without necessarily having market aspirations:

- Institutions may want to do so to enhance their services to their clients (e.g. when working with long-term unemployed, people with learning disabilities, in public learning and knowledge institutions such as museums and libraries, etc.) or to produce goods for their own use rather than procuring them externally.

- Citizens can be observed to increasingly move into the direction of becoming 'prosumers' rather than only consumers and employees. This means they produce goods from their own homes and in shared public spaces, either for their own personal use, to contribute to the growing networked communities of open source producers or for commercial purposes as freelancers and entrepreneurs.

This is just an introduction: you can read the full contents on Deliverable D6.2[29]

WP7 (Massimo Menichinelli - IAAC)

WP7 already worked at exploiting the results of all the WPs within the four categories of stakeholders, and especially T7.5 is a lasting document and strategy. Regarding the contents developed by WP7, besides the scientific publications (already shared on the most important scientific platforms), the software and visualisations developed can be adopted by other researchers and the visualisations consulted by all the type of stakeholders, even if such tools would need further work.

29 *http://make-it.io/deliverables/*


HAPPYLAB
HAPPYLAB

7.2

MAKE-IT's impact assessment framework for Maker initiatives

Jeremy Millard

For further information see Deliverable D2.3 here: http://make-it.io/deliverables/

Purpose and development of the impact assessment framework

Taking its point of departure from MAKE-IT Deliverable D2.1 (conceptual and methodological framework), Deliverable D2.2 designed an initial impact measurement framework, also drawing on the requirements and results of other MAKE-IT WPs. The purpose of the framework is to provide a simple, flexible but also robust tool that focuses purely on the important issues that are required to measure and compare in order to understand the actual and potential impacts of individual Maker initiatives, as well better understand such impacts of the Maker movement more generally. An additional purpose is to provide this tool for use by other projects and initiatives after the end of the MAKE-IT project.

It should be noted that the tool does not attempt to examine the detailed workings of individual Maker initiatives, i.e. how they have achieved their impact, as this is the purpose of MAKE-IT's WPs 3 and 4, but instead examines the nature and types of impacts and outcomes they are having.

MAKE-IT's impact measurement framework is designed to assess the impacts of each of the three analytical pillars, as described in section 3.2, as well as additional impacts, outcomes, processes and tools from other MAKE-IT work packages. The impact measurement tool can be used at two levels:

1. Individual Maker initiative level: assesses the impacts, outcomes, processes and tools sought and achieved by a single initiative.
2. Meta level: compares and benchmarks individual initiative impacts with each other in order improve mutual learning and facilitate aggregate analysis. Some results of such an analysis are presented below.

The impact assessment framework was first developed through desk research and presented in MAKE-IT's Deliverable D2.2 in June 2016. It took as its starting point the CAPS Impact Assessment for Social Innovation (IA4SI) questionnaire[1] to ensure some comparability with other CAPS projects.

However, many of the IA4SI questions were subsequently adapted and/or replaced by questions arising directly from MAKE-IT's conceptual and methodological framework as presented in MAKE-IT's Deliverable D2.1 (March 2016). A pilot version of the framework was then prepared after inputs from other work-packages and wider consultations, including the incorporation of additional important changes, for example a specific question on gender as such is not available in the IA4SI questionnaire.

This version was piloted in two of the project's ten cases and led to small adaptations, resulting in version 3 which was then applied to all MAKE-IT cases in the autumn of 2016. Final adaptations were made to version 3 for use in June 2017 at the Barcelona Maker Faire, resulting in an additional 42 responses. This version 4 included new sections derived from findings made by MAKE-IT's WPs 3, 4 and 5 obtained between summer 2016 and summer 2017. The Barcelona June 2017 MAKE-IT impact measurement framework and tool represents the final version, as no further improvements have been made given its validation as a very good tool for measuring the impact of Maker initiatives seen through the lens of MAKE-IT's conceptual and analytical framework.

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1 *http://www.ia4si.eu/toolkit/*

Structure of the impact assessment framework

The impact assessment framework is designed as a 'quali-quantitative' questionnaire to be carried out through an interview conducted by an impartial expert with one or more knowledgeable representatives of an individual Maker initiative. It can be used as a self-assessment tool by the initiative itself, but this is less reliable as there is greater chance that bias and misunderstanding of the objectives of the questionnaire will compromise its accuracy and usefulness, especially for comparative purposes.

The questionnaire's 47 questions are a mix of qualitative, explanatory open questions, plus quantitative 7-point Likert scale questions. These range from asking the respondent whether they completely disagree to completely agree to a series of statements about the initiative, as well as a 'not applicable' option.

The final version of the impact questionnaire has nine main sections, as detailed MAKE-IT's Deliverable D2.3 published in December 2017:

1. Maker type: including location and scale of the initiative
2. Information on the interviewee: including gender, age, nationality, residence, etc.
3. Technology types and technology use (adapted from WP5)
4. Long-term ambitions of the Maker initiative (adapted from WP4)
5. Achievements: organisation and governance of the Maker initiative, i.e. pillar 1 (adapted from WPs 2 and 3)
6. Achievements: peer and collaborative behaviours of the Maker initiative, i.e. pillar 2 (adapted from WPs 2 and 3)
7. Achievements: the Maker initiative's social value creation in the wider society, i.e. pillar 3 (adapted from WPs 2 and 3)
8. Achievements: the Maker initiative's economic value creation in the wider society, i.e. pillar 3 (adapted from WPs 2 and 3)
9. Achievements: the Maker initiative's environmental value creation in the wider society, i.e. pillar 3 (adapted from WPs 2 and 3).

Sample results derived from MAKE-IT's impact assessment framework applied to the Maker Faire in Barcelona, June 2017

The 42 completed questions from the Barcelona Maker Faire each provide both qualitative and quantitative data across the 47 questions. The dataset is available from the MAKE-IT website in the Open Data / API section[2]. The two figures below provide a small sample of some the results obtained from this database.

The three radar graphs above show that in terms of the long-term ambition of Maker initiatives, education, research and social are the most important, with commercial and environmental much less so.

The three radar graphs above show that in terms of the long-term ambition of Maker initiatives, education, research and social are the most important, with commercial and environmental much less so.
There are also clear distinctions between male-led and female-led initiatives, with the former more likely to have technical ambitions and the latter social ambitions. There are also noteworthy distinctions between male and female initiatives in terms of MAKE-IT's pillar 1 and pillar 2 issues (see section 3.2). Male-led initiatives tend to have a better developed long-term vision, impacts on policy, regulatory and market norms, and on financial sustainability. Females-led initiatives, on the other hand, are much more likely to focus on gender balance, openness and sharing.

With regards to pillar 2 issues, the focus is mainly towards user motivation and skills as well as collaborative learning, in each of which female-led initiatives seem to do much better.

The three radar graphs below examine some results concerning maker impacts on social, economic and environmental value creation, differentiated by the scale of the Maker initiative. These scales range from single/individual makers, to makers with limited partners, through small-scale communities of makers and their users, to maker ecosystems of interacting different but complementary makers and other relevant actors, through to maker networks which tend to be very large scale, often national or international in extent,

2 *http://make-it.io/open-data-api/*

consisting of maker relationships built on common needs and interests. It is clear that the larger scale initiatives seem always to achieve much bigger impacts than smaller scale initiatives. However, ecosystems outperform networks in terms of social and economic value creation, perhaps because they consist of well functioning local or regional clusters of complementary actors.

Networks, however, outperform ecosystems in terms of environmental value creation, perhaps because they require an even large scale and much learning between similar initiatives given the need to challenge many more incumbents, infrastructures and norms than social or economic impacts, at least in the early stages of maker development.

Other highlights from the database include:

- In terms of technology types and usage, the whole range available to makers are deployed, with a focus more on pillar 2 than pillar 1 issues, and where females tend to use more general and less specialist technology with a greater focus on interactive and collaborative tools.

- Overall, pillar 2 issues seems to have higher levels of achievement than pillar 1, perhaps because there is more focus on individual aspects, users, sharing, learning, than on organisation, regulation and supply chains at this early stage of maker development.

- Pillar 3 impacts show that social and economic value creation reaches similar levels at about 30% of the maximum possible, although most initiatives report that in the longer term social impacts tend to be more relevant for them. Environmental value creation is much lower at about 15% of the maximum possible on average, and with a correspondingly lower level of longer-term relevance.

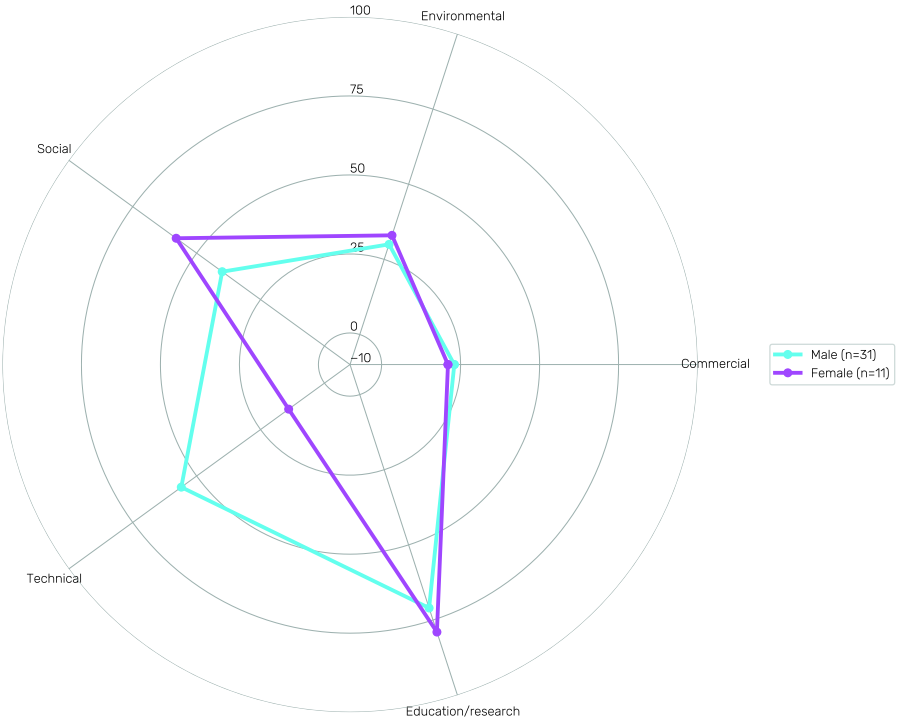

Figure 20.
Selected results comparing male-led and female-led Maker initiatives: long-term ambition

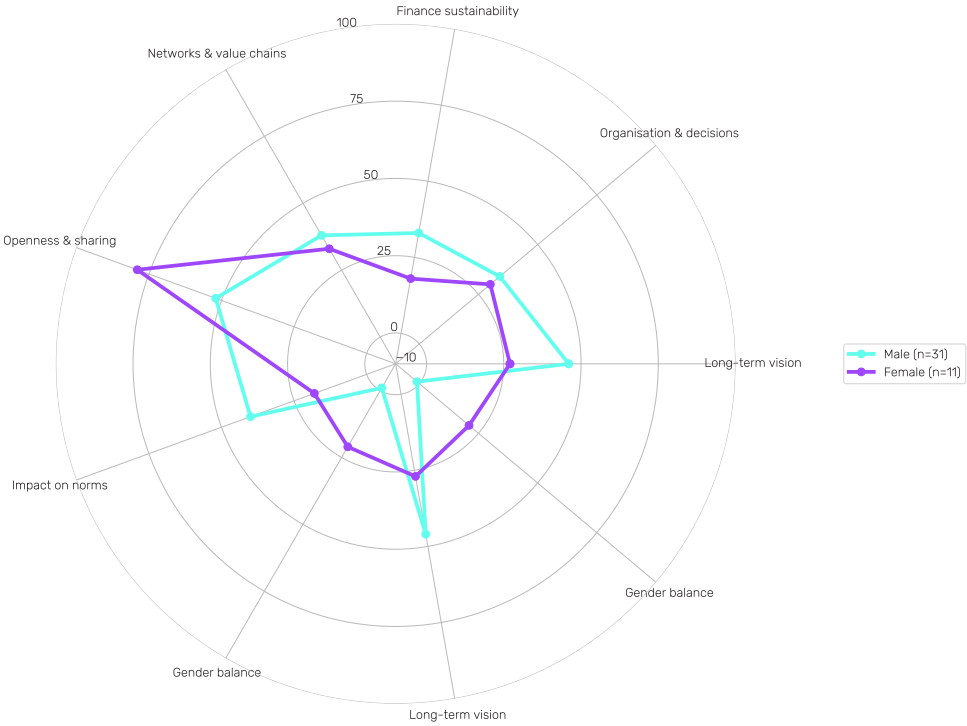

Figure 21
Selected results comparing male-led and female-led Maker initiatives: pillar 1 achievements

Figure 22
Selected results comparing male-led and female-led Maker initiatives: pillar 2 achievements

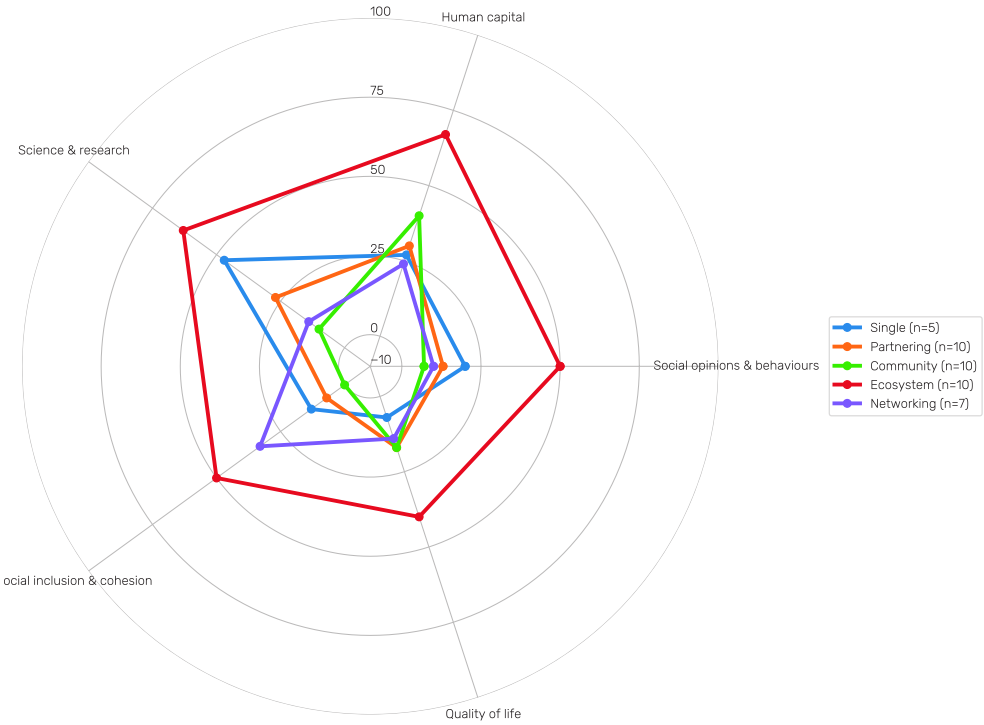

Figure 23
Selected results comparing the impacts of different Maker initiative scales: pillar 3 social impact achievements

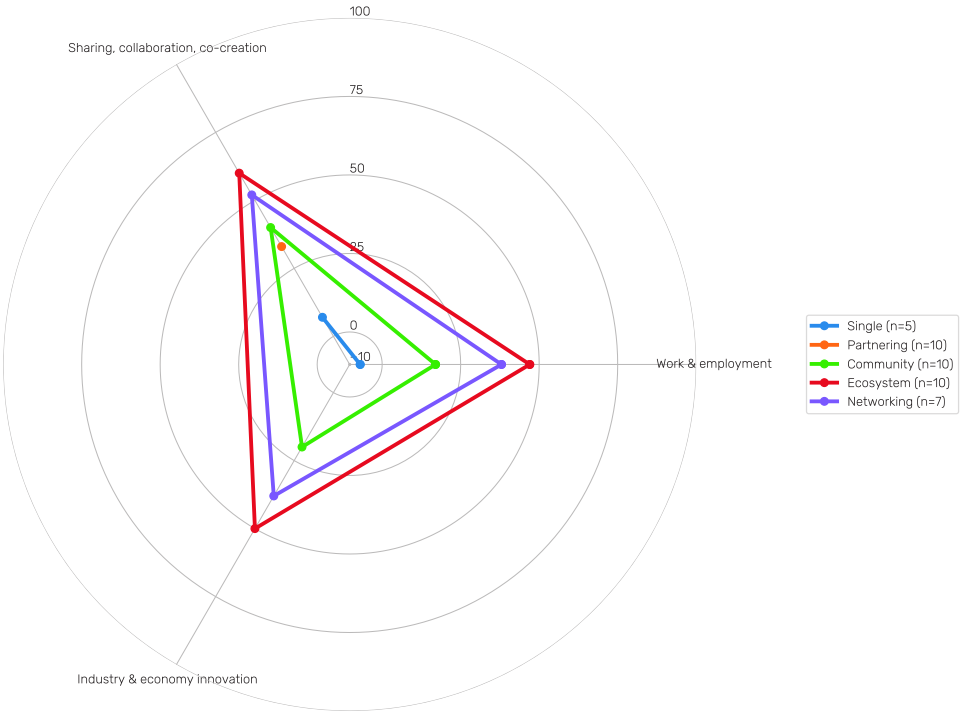

Figure 24
Selected results comparing the impacts of different Maker initiative scales: pillar 3 economic impact achievements

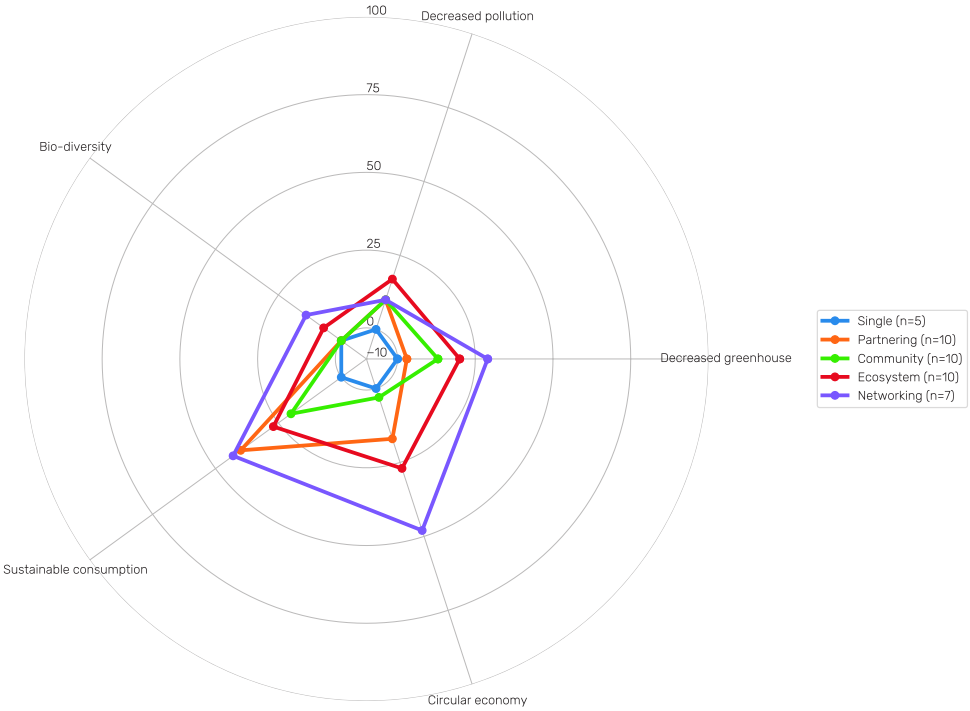

Figure 25

Selected results comparing the impacts of different Maker initiative scales: pillar 3 environmental impact achievements

MAKE-IT
Understanding Collective Awareness Platforms with Future Internet
WP6 Synthesis & Impact Analysis
D6.2 Societal Impact Analysis and Sustainability Scenarios

7.3

Three future scenarios

Bastian Pelka, Janosch Sbeih, Marthe Zirngiebl

For further information see Deliverable D6.2 here: http://make-it.io/deliverables/

Scenario 1: The Maker movement assumes cultural roles and shapes public institutions

Scenario 1 presents a situation in which making activities are embedded in public institutions such as schools and universities, museums and libraries. The uptake of Maker initiatives in hundred thousands of public spaces in the European Union leads to a wide diffusion of maker approaches and attitudes, and making becomes a cultural norm in the public sector. As maker approaches and pedagogies differ from and conflict with heritage rules, codes, hierarchies and attitudes of the public spaces they are housed in, a "clash of cultures" between the Maker culture and the culture of public spaces can be observed which leads to confrontation and mutual co-development. Depending on which institutions Maker initiatives are being housed in or cooperating with, a separation and specialization between Maker initiatives can be observed.

Leitmotifs:

1. There is a "Clash of cultures" between the makerspace culture and the culture of public spaces. There will be confrontation and mutual co-development.

2. A separation/specialization can be observed: different makerspaces are specialising by coupling with different local public learning spaces.
3. Transformation (of both): makerspaces heritage rules, codes and hierarchies from public spaces. Public spaces are opening and flexibilising.
4. Makerspaces in public spaces are following an "educational" and/or "arts" approach – they are used for learning or pursuing arts. The design of pre-market models and research for patents are not on top of the agenda.
5. The uptake of makerspaces in hundred thousands of public spaces in the European Union leads to a wide diffusion of maker approaches and attitudes; though, these are conflicting with approaches, objectives and attitudes of the public spaces they are housed in. Mainstreaming of the Maker movement comes with changes of the movement.

20th December 2032. You are listening to a debate for the 30th anniversary celebration of the founding of the first FabLab at Massachusetts Institute of Technology (MIT). Our guests are:

- Roland Emmerich, 49, German minister for education and research
- David Anderson, 50, venture capitalist
- Aurelien Lufoude, architect and FabLab enthusiast
- Areti Buros, 27, researcher in political science

Moderator: By the year 2032, the Maker movement is housed by public institutions – both physically (with provided rooms, facilities and budgets) and structurally (pedagogical and organisational cooperation). Together the Maker movement and public institutions (like museums, schools, universities, libraries or cultural centres) are forming new inclusive learning and production spaces that combine a "maker"/"hands on" pedagogy with approaches of citizen science, peer education and civic empowerment. But this transformation did not come without frictions and critics. Today, I have invited four persons that have watched, supported and criticized the development of public spaces and makerspaces for almost three decades now. I want to discuss with them 30 years of development in the Maker movement. Good evening. My first question goes to German national education minister Roland Emmerich: 30 years of Maker movement. Is that a success story?

Roland Emmerich: Definitely. Let us look at the numbers: Today more than

5,000 out of the 6,372[3] museums in Germany are offering digital fabrication tools for citizens. Every second of the 112 million visitors has participated in a digital fabrication workshop, hosted by the teams of librarians and makers as fostered by the national initiative on modernisation of libraries in 2020. Each of the 4,000[4] municipal libraries in Germany offers digital fabrication thanks to the funding provided by my ministry in 2025. The 640 libraries of universities and universities of applied sciences were already equipped with digital fabrication tools as early as 2022…

Moderator: Why are university libraries quicker? I thought digital fabrication is a tool for civil society, not for scholars?

Roland Emmerich: I can only point to federal education policy jurisdiction of my ministry. The fostering of public makerspaces in Germany needed a remarkable investment by public funds and our ministry provided this. Each federal state has its own priorities, while universities are funded by my ministry directly…

Aurelien Lufoude: Which is an absolute bureaucracy!

Moderator: Why that, Mr. Lufoude?

Aurelien Lufoude: We applied for funding for our local makerspace, too. You know what? The form sheets filled 36 pages. Plus public procurement procedures. It took us 2 weeks to apply and 3 months for a reply – a negative one.

Roland Emmerich: The funding ratio for our funding scheme "local partnership of makerspaces and public spaces" is high: More than 50% of applications are funded. We provided 650 Million EUR out of our budget!

Aurelien Lufoude: We bought our own material and had it within one week. You see? What I want to say is that the Maker movement and public procurement are still each worlds on their own. We makers are flexible, fast, creative. If we see a problem, we want to work on the solution right away. Put this together with public procurement and hierarchies in schools – no

3 *https://de.wikipedia.org/wiki/Museen_in_Deutschland*

4 *http://www.bibliotheksportal.de/service/faq.html*

fit! Teachers are still bound to signatures of their headmasters and makerspaces in schools are waiting weeks for material supply.

Areti Buros: I must interfere. Our research shows that libraries, schools and museums have created a new attitude within their maker spaces. We have seen opening hours widening…

Aurelien Lufoude: …a joke! Our local library closes at 8 pm, that's when the commercial makerspaces start their main business with people returning from their jobs and starting to learn, share and produce in makerspaces.

Areti Buros: …but most libraries and museums have created spaces with easy entry on weekends, even Mondays. The culture in many public places has changed. Take schools as an example: When schools created their first makerspaces, because some maker enthusiastic teachers wanted to explore the pedagogical benefit of making for education, many people were asking to use those rooms and machines, too. We saw that people from the neighborhood came to visit schools in the afternoon. That changed schools pretty much. And the pedagogy! Making means that you do something and see if it works. It's vice versa to how schools have thought for a long time. This new paradigm entered schools with teachers that were makers. Many teachers used maker approaches for their lectures and pupils liked it. Same in museums and libraries: Staff has been trained, budgets were provided, because people saw that making is an important cultural competence and a good way to learn. It turned out that learning by doing is a good way to facilitate competences to pupils that are slower in learning. Creativity and working with your hands celebrated a renaissance from a pedagogical point of view. And this helped to improve the chances for children with lower cognitive assets.

Areti Buros: May I add another thought, shortly?

Moderator: Please!

Areti Buros: We saw that platforms and social networking sites were quite an important infrastructure in bringing people together and foster the exchange of ideas. This becomes especially visible in learning platforms, but also in neighborhood networks, for example. Initiatives that connected

makers with policy and industry were quite an important step. Platforms and trainings that made tools, experiences, good practices and examples available were very useful. And the links to other movements like the sharing economy or Fab Cities were important, too. I would say: No rise of the Maker movement without social networking sites and digital platforms and communities. And there is another "social" aspect of makerspaces in public spaces: Our research shows that the use of makerspaces in public institutions like schools, museums, libraries and cultural centres is 70% cheaper than in commercial FabLabs. The public ones don't charge entrance or member fees, mostly not even a contribution to procurement of machines. The only costs arising for users are material costs.

David Anderson: …which is a clear subsidy and negative competition argument. If we would give the makerspaces in public institutions into private hands, we could improve the quality of machines, products and staff plus create thousands of jobs for makerspace staff. Public institutions are blocking a huge market.

Areti Buros: I disagree.

Aurelien Lufoude: Me too.

Moderator: Would you say that the integration of makerspaces in public spaces changed those public spaces, too?

Areti Buros: To a limited extend. But that's a question of inertia. A school, a library or a museum are large entities with loads of rules and long-existing traditions. Those did not change dramatically within the recent two decades. And the makerspaces in public spaces are still just one element of a public learning space. This is an element that influenced public learning spaces like no other innovation in recent decades as I explained before, but still: Public learning spaces are big. Thousands of teachers, ten thousands of pupils in one city only. And a history with rules and norms and codes of practice. I think the Maker movement changed more than the public spaces did. But with the rise of makerspaces in public rooms by the early 2020s we have seen production and digital fabrication opening to society. Today 30% of makerspace users in public rooms are non-academics; with only 5% in

commercial FabLabs. 70% of products created in public makerspaces are for own or social use, only 30% have a commercial purpose. It's vice versa for the commercial FabLab makerspaces.

Aurelien Lufoude: …and this even with lower budgets, poor machinery and restricted opening hours. At least many public makerspaces have been equipped with kitchens and fridges (sighs).

Roland Emmerich: I have to say that transforming public institutions into makerspaces was an interesting challenge. My ministry provided funds for procurement of machines and material, training for public servants and released regulations for the use of public spaces. We defined specific rooms within public buildings that are following specific rules but still provide the security, quality and openness of public institutions.

Aurelien Lufoude: But we still have headmasters, caretakers, library and museum directors snooping around and trying to ban food and drinks or music. They don't feel comfy with the notion that people who spend their leisure time in their makerspace want to feel at home there and socialise.

Roland Emmerich: Many Fab Labs in public buildings use dedicated rooms, but smaller locations don't offer much space. We need to respect the different attitudes and using objectives that the visitors pursue.

Areti Buros: But we can see this merging. People and more and more local initiatives are using both – the traditional educational structures and the makerspaces with their tools and machines. Education, art and production are merging. With makerspaces in museums we are seeing the rise of a new understanding – of arts, education and production. Museums managed to put making on the arts agenda and contributed to a new understanding of art – with a "social" and a "production" aspect. Art was brought to visitors and they brought production into museums, both embedded into a new pedagogy of "making". Social innovation is growing especially in public rooms, while commercial makerspaces seem to foster the developments of patents, entrepreneurs and profits. I don't see any reason for supporting private makerspaces with public money; we need more funding and better regulations for free makerspaces.

Moderator: I think this point is clear. Let me ask another question. What happened to the roots of the Maker movement, as laid down in the first FabLab 30 years ago?

Areti Buros: Diversity and specification. While the 2000s and 2010s makerspaces seemed to attract young and well educated people, the introduction of specific maker rooms especially in schools in the 2020s opened digital fabrication to a broader target group. Today, we know makerspaces within public buildings are contributing to digital education of youth – a topic that schools struggled with for long, but the linkage of schools and makerspaces brought this digital and "making" momentum into schools. Many institutions (like workshops for disabled, libraries, cultural clubs) had their own clientele and own approaches. They took maker tools, maker pedagogy and the maker idea and linked this to their institutions, clientele and opportunities. Today we see young and well educated persons in commercial makerspaces – still in a very "social" attitude and producing ideas and tools for society - , but the mainstream making went to public spaces. And those somehow annoyed the young and creative makers. Recent years have seen a much more separated and specialised diversity of makerspaces today. Not to speak of the private making in households and enterprises. That's off our radar.

David Anderson: Maker machines are a huge market. The turnover of machines and materials has succeeded the turnover of the home improvement industry lately. Not to speak of the labour market…

Areti Buros:…in the US and China. We should not forget that 70% of the machines and 80% of materials are produced in one of these countries and 7 of the 10 big sharing platforms for CAD models are owned by US IT-companies.

Aurelien Lufoude: And American lawyers persecuting digital rights…

Roland Emmerich: …which is an important issue. Our government has asked the EU Commission to re-negotiate the digital models copyright act which is far too industry friendly and really costs public institutions in Germany several 100 Million EUR per year.

Aurelien Lufoude: This is the biggest threat to the maker approach at the moment: copyright protection, proprietary interface and machines. All the machines purchased by public procurement are following industrial standards with proprietary firewalls. I would suggest buying open hardware and software instead.

Roland Emmerich: My ministry has signed preferred gross customer procurement procedures with three big suppliers of machines and materials, all meeting our quality and security standards. Each makerspace is free to choose from a wide array of different products, all certified by our initiative to foster the use of maker technologies in public rooms.

Areti Buros: We can see a classic bias here: advanced users and techies plea for machines that allow different setting and fine tunings. But "normal users" are not interested into altering machines or products – they want a product that meets their needs, they want it easy and cheap. That is why supermarkets expand their "making" lots. With all the sharing platforms, speech navigation and artificial intelligence it's so easy to create an object: Press a button or say a word and get a product. That's it for 90% of the products. Most people don't want to alter those available designs, they just want easy, quick and cheap solutions. That's why today more goods are produced in supermarkets than in all other makerspaces together.

Aurelien Lufoude: But that's completely different. Supermarket printing lots are for small and everyday goods. They are replacing industrial production, there is only little customization. The only advantage is that self printed products are fastly available, downloadable from the internet and possibly adjustable. But people only use customization for small aspects, like changing colours. This is another market than what happens in makerspaces.

Moderator: Speaking about other markets…we have not discussed the role of culture and arts in the Maker movement. How about that?

Aurelien Lufoude: Incredibly important. I would say that the arts and culture movement was an important supporter of the present situation. Making combines both: a new way of doing things and a new technology. Both were taken up by artists, cultural movements and education. Making – both as a technolo-

gy and a culture – have changed the way we think about human beings and the post-industrial society today. It changed the human-technology interface and gave a lot of control and meaning back to us humans. If we look back on what big data and artificial intelligence did to the human-technology relation, that was purely technology driven. But by adding an arts and culture approach to technology, this involved new ideas about the role of technology in society. I guess we are more confident about the idea that technology should serve society rather than vice versa today. Plus, there is this notion that technology should be environmentally friendly. I guess that came with the culture and arts movement, too. If you do something yourself, you appreciate it much more and you are more reluctant to be complicit with a "throwaway society".

Moderator: Let us speak about public makerspaces' meaning for society. There is a broader impact, I guess?

Roland Emmerich: Definitely. Latest school rankings demonstrate that our pupils are improving their STEM and entrepreneurial competences. Numbers of patents are rising, many of them can be linked to public makerspaces. And the labour market is profiting, too. IT-competences of the German labour force has significantly improved in the recent decade.

Aurelien Lufoude: Indeed the merging of public spaces and makerspaces can be seen as a major step into creating impact. When I was founding my first makerspace, nobody knew anything about those old 3D- printers we used. Pretty fragile machines at that time. There was no "print on my fingertip" and "one-stop-shop" like we have today: There were no easy to use machines as most "public" makerspaces are using so enthusiastically nowadays. We had an occasional visitor from the neighborhood, but to be honest, our impact was mostly limited to people we already knew. It was hard to get in touch with people that were not "usual suspects". This became clear to me when we moved our makerspace into the public library. People came with questions and requests – I guess more requests, because visitors in libraries have another attitude than makers. They want us to help them, some have very little ICT competences. But I can say that we are in touch with thousands of citizens today. All those sharing platforms contributed, too. It's so easy to find a product you want to create and print it in the library. We are providing citizens with practical knowledge and ICT competences.

Moderator: Quite an impressive statement. May I ask you: What are your motifs? Any aims you want to reach with your makerspace?

Aurelien Lufoude: I am skeptical about industry providing tools, software and solutions for citizens. They want to make money and invent expensive products. We concentrate on products for everybody and have an ecological mission. The use of plastic increased with the spread of cheap printers. But there are more ecological solutions. But the industry – and commercial makerspaces, too! – are using high amounts of energy and environmentally unfriendly stuff. I would say my mission is to empower citizens and protect the environment.

Moderator: And where do we see the making idea in ten years?

Areti Buros: I would say the mega trends will continue. The first one is separation – public makerspaces here, commercial and supermarket makerspaces there and a small group of spaces that are driven by techy people. Each type will continue to specialise and will lose touch to the other type. The second mega trend is transformation. Public spaces will keep up in opening to the maker approach. Ideas will seep into established rooms and change them. But slowly and bilaterally: Makers learned how to use public buildings and this process will continue, too. The third mega trend is diffusion: Both maker tools and makerspaces in public rooms will diffuse. More people will get in touch with them. Elderly, people with disabilities, all.

Scenario 2: Maker initiatives reshape the economy through commons-based peer-to-peer production enabled personal fabrication

Scenario 2 focuses on the open source culture within the Maker movement and illustrates its potential to reshape the economy through commons-based peer-to-peer production and widespread personal fabrication. In this scenario, many communities in the "post-market" and degrowth philosophy are merging and there is a common shift of attitudes: "social", "sustainable", "alternative" and "cooperative" approaches prevail over "economic", "conservative" and "individualistic" ideas. There is a general paradigm shift

within large parts of society from relying on the market for consumption, production and distribution or the state for social provision towards the commons as a mode of governance and provision. Maker technologies are accessible in many spaces hosted by civil society and digital P2P platforms enable the free sharing of templates over the internet.

Leitmotifs:

1. Common shift of attitudes: "social", "sustainable", "alternative" and "cooperative" approaches prevail "economic", "conservative" and "individualistic" ideas
2. "Clash of cultures": makerspace culture vs. economy
3. Diffusion: maker technology in many spaces
4. Diffusion of media competence and internet participation of persons
5. "Brands and certificates assure quality"
6. New Currency models for exchange
7. Commons: market, state, commons – paradigm shift towards commons
8. Important: community and their rules, P2P platforms
9. Many self employed workers -> different culture of work and sharing
10. Many communities in the "post-market" philosophy are merging; more Repairing, Re-Using, Recycling.

20th December 2032. You are listening to a debate for the 30th anniversary celebration of the founding of the first FabLab at Massachusetts Institute of Technology (MIT). Our guests are:

- Maria ("just call me Maria"), 68, member of the Associació de Veins del Barri,
- Adam Keenan, 50, senior researcher in social innovation, Dublin, Ireland
- Charlotte Rosting, 52, Deputy Mayor of Oslo, Norway
- Gerin, 23, engineering student and makerspace manager, Vienna, Austria

Moderator: By the year 2032, the Maker movement has changed a lot: Making and the use of maker machinery have diffused in thousands of organisations, clubs, associations, cooperatives, companies and public institutions. The European umbrella organisation of free commons-based peer-to-peer production enabled personal fabrication organisations ("FC freeProd") states that they are representing 275.000 networks and organisations in the EU with approximately 100 million participants. Tools and pedagogies of the 2010s

so called "Maker movement" are mainstreamed: widely spread and absorbed as a societal paradigm we all know as the freeProd Movement that merged production of physical goods, intellectual properties and rights for access to data and knowledge into one movement. We all love our 3D printers at home and rely on the everywhere available printers in supermarkets, libraries and public buildings. But the 2010s phenomenon of dedicated makerspaces has vanished or diffused. Shared production is promoted by cooperatives – for profit and not-for profit - and civil society associations. They merged maker technologies with civil society activities like sports, arts, job interview training or leisure activities for kids. We have seen the powerful rise of civil clubs for sharing and cooperation within the past ten years. Commons are widely spread and supported by different communities, platforms and organisations and their very specific rules and norms. We rather see a struggle between the sphere of commons production and the traditional proprietary market economy. We also see that environmental protection has become a core objective of many civil society clubs, becoming pro-active in environmental protection and restoration activities, developing environmentally friendly goods and practices, and calling industry out on their pollution and low sustainability efforts. I have invited four experts to perform a little review with me: Which economic value does the commons based peer-to-peer production create? Or did it lead to shrinking job numbers?

Adam Keenan: That's a question for the researcher, I guess! And, yes, we can state a macroscopic impact. Today we see many people working freelance, part time or contract based. Old employment models have vanished and people are trying to find multiple layers of "work" and "income". Cooperatives seem to be part of a balancing situation: If you are looking for something, others in your social networks might be, too. If you are offering something, others might look for it. This came with a common shift of attitudes: "social", "sustainable", "alternative" and "cooperative" approaches are very attractive to a specific clientele today. "Economic", "conservative" and "individualistic" ideas are less favored in this target group that is often organised in cooperatives. Cooperatives are setting rules for those cooperations and the web, blockchains, platforms and digital currencies are the technical backbone they use. At the same level, private enterprises have transformed, too. They are opening to society and customers, but are balancing between openness and profit. The big social network sites were the first to introduce

money for attention – you give your data or click on an advertisement and you receive some minor coins. I guess that's the way enterprises are heading for – cooperation and support for money. Maybe that's an income model for some of us? The 2010s Maker movement proclaimed "bits to atoms" – and with the diffusion of maker technologies and the "making" approach many people became "makers" in that sense. But from today's perspective, it was a stepping stone to a transformation of economy and labour towards a stronger peer-to-peer commons based economy. But let's not forget that this part of the labour market covers only 30%. I don't think that will grow beyond. There needs to be a balance between the private economy and the more free peer-to-peer commons based economy.

Moderator: How did the commons-based peer-to-peer production enable the rise of personal fabrication?

Maria: May I...?

Moderator: Of course.

Maria: I would say it's a lack of alternatives plus the insight that the traditional "market oriented" economy did not provide solutions for the better of society. Market driven enterprises tended to accumulate capital for few people, while most people worked without profiting from the wealth. To me this felt disgusting. Perhaps it helped that people connected via the internet and shared their insight that they were not alone and that there are better economic models for sharing wealth. There were many movements and philosophies that merged: Repairing, Re-Using, Recycling, post-capitalism, the commons movement: many people with ecological and social ambitions joined together. Today we have reduced our dependency on money by voluntary payment methods, exchange platforms, peer-to-peer production and a more ethically oriented production. Many commoners live on micro payments and alternative currencies for their work and it turns out that people are actually paying for ideas and codes, even if it is on a voluntary basis. I run a little shop with products that are offered on a negotiable price basis and I rarely see that someone is not giving something back to me for what they take. This change in the view of what economy means when we realised that what we conceived of 'the economy'

is not contributing to resolving pressing societal issues, was an important stepping stone in transforming our society.

Gerin: To me this was an arousal, too. But it annoyed me that more and more things were protected by pro-industrial laws. Parts of the genome – copyright! Most of the seeds patents – belong to someone. Even water reservoirs in some countries are owned by companies. Pictures, music and 3D models – someone put their brand on and I shall not use it? That's nonsense. Restricting my human rights. That's when people in many countries simply made their own digital content and offered it for free. Made their own computers, automatically publish content in the second the copyright is outdated. An important topic are services, too. Some companies are selling services, because they branded it and copyright protected it. A method to find a partner. Why should I pay a company for that when a commons based partner platform is doing the same? We form a movement that protects the value we produce as citizens from being financialised by the proprietary sector and keep it in our communities for the benefit of all without enclosing it through intellectual property rights. First public institutions like municipalities, social organizations and the third sector said goodbye to copyright protected software, patents, services and methodologies. Because on the one hand they realised that they rather wanted to support the distributed production networks from civil society instead of private corporations, and on the other hand they followed the economic motive of not wanting to pay for the latest versions of proprietary software that came every six months. Private users had their experiences with free contents and when many public institutions went to use free products, that formed a movement.

Charlotte Rosting: Oslo municipality was the first in the world to exclusively use free ICT software, hardware and fabrication with open standards only and passed a law on the fostering of commons-based peer-to-peer production enabled personal fabrication – the "free digital age act". What we simply did was encouraging people to form communities that try to solve their problems. But our idea was not primarily to save costs – which we did – but we see free ideas and access to digital tools as a human right in the digital society. That's why we amended the Norwegian constitution and put this into paragraph 2 – close to values like democracy, division of powers and human rights.

Maria: Many countries still refuse to do so because they want to protect their "old economy".

Adam Keenan: My institute recently conducted a research project for FC freeProd and we counted that 28 of the 34 OECD states are freeProd friendly, meaning they support the freeProd Charter score above 25 freeProd index points and prefer freeProd goods, rights, content and code. That's a good direction, I think.

Moderator: We all have read that on the news recently. But let me investigate on the change of cultures: How did those countries get there?

Adam Keenan: Our research shows that the change from a privatised economy to the commons-based peer-to-peer economy took five parallel developments: Firstly, there was a clear need for a new way of producing and allocating goods, services and rights. Maria mentioned the insight that the privatised economy did not succeed in distributing wealth fairly and this issued societal problems. At the same time, resources and capabilities – the second development - for a transformation of society were growing strong. In the 2020s, access to and use of the internet did a major jump in comparison to the 2010s. We saw a rise in the number of internet users both in developed and developing countries. This brought a lot of competences, resources, ideas and diversity to the web and those people did not see why they should pay for internet access or a right to use some software while there were so many free alternatives. Many of those people were self-employed, temporary workers or freelancers. They brought a new culture of cooperation and sharing to many markets. And I guess it was the spread of very easy interfaces like speech navigation, 3D printers and wearable computers that made people use free products and services and to form some communities. The traditional economy strived to provide high-end products while many commons based solutions were very easy, low-tech and open. That was their way to reach society at a large scale. And the availability of sharing platforms and alternative currency models contributed heavily to make people live from their free products, as did the introduction of commons-based reciprocity licenses which obliged for-profit organisations to pay for the use of the commons if they didn't contribute to it. Those platforms are owned and maintained either by crowds or cooperatives. We see that the commons mo-

vement is strongly building on communities – but those communities needed to build up and to diversify. The trigger was that "normal" people saw a benefit in using and contributing to commons communities. It was cheaper and then there was this momentum of critic towards the market structure. And an important factor was that more and more people connected to the digital world and acted there. I guess "digital competences" was a key element. But therefore, technology had to become much easier – speech navigation and wearables played their part there. Another important element was that people realised that they are not dependent on their jobs in the traditional economy, but could also meet their material needs as commoners. Sharing platforms that were held by their communities did a great deal here, as did the consolidated networks of open cooperatives that produced not only for their own members but also the public good. Still in the 2010s, nobody believed that 30% of domestic growth could be achieved by commons-based peer-to-peer production and this could afflict all sectors of the labour market – including production, care, energy, culture and education. This is the third ingredient: mechanisms of diffusion. The web as technological infrastructure that was accessed by 85% of people in OECD countries and the competences those people acquainted made a perfect seedbed for cooperation and the rise of commons. Functions, roles and new concepts – such as local facilitators and the FC freeProd movement provided a new form of distributed, horizontal governance as a fourth pillar. The concepts of commons-based peer-to-peer production enabled personal fabrication were already there. Like a seed they only needed the other four ingredients.

Gerin: Nice scholarly talk. But what about the problems? There is a big debate on customer protection and product warranty. It is still unclear who takes responsibility for products that are designed by many people and printed by 3D-printer from someone else. We still have a clash of cultures between the freeProd movement and the protected economy. Most employees in the free sector are self-employed and lack social security. The old economy is still using free products and sells them – with only little alteration of their own. Just because nobody is messing with their lawyers.

Charlotte Rosting: But we also see a huge transformation of the economy towards creative commons and peer-to-peer production. A new sector is expanding and existing enterprises have opened up to users, customers and

society. There is no company without a "prosumer"-strategy anymore. IT companies were the first to declare their customers as prosumers and public administration made this approach strong, but no enterprise is developing their innovations in some protected labs somewhere anymore. I guess that's not possible because many of their best researchers are freeProd enthusiasts and leaked a lot of what was once hidden behind firewalls and non-disclosure contracts. The innovative companies today are well linked with civil society…

Maria: …but they are still private companies. And this is dangerous: civil society contributes to the developments of the companies, but the company is the sole proprietor of the developed products and sole financial beneficiary of these interactions. That is supporting financial inequality…

Charlotte Rosting: …of course one has to set appropriate rules: What comes out of the commons needs to be common. But companies are testing the water and trying to re-privatise common products. This is something we need to monitor.

Maria: Another topic are rules, laws and standards. We have been struggling a lot with them in our labs in the past decade. Most laws were made to protect the industry….

Charlotte Rosting: … In Norway we merged the ministries for economy, labour and consumer protection ten years ago – because they were all dealing with the interface of labour, production and freelance work. …

Maria: …I wish we had those politicians in more countries. But fact is that legislation is far more industry friendly than prosumer friendly. In most cooperatives there are very strong rules on what you give to the commons and what you are allowed to do. Where is that with private enterprises? You give them feedback and your data; you purchase their products but you are not allowed to share them? We need a constitutional declaration that favours the commons culture to the proprietary culture. We created the "FC freeProd brand" recently. It certifies that all goods, materials, services and rights of a good were produced according to the FC freeProd testimonial, it goes far beyond the GNU and creative commons licenses, because it also certifies the social aspect of production and states that the whole process of creating a good took place in a socially acceptable man-

ner and the product itself serves a socially valuable purpose. I guess that's how the economy should transform.

Charlotte Rosting: We should not close our eyes in front of some very negative developments, too. We have seen a reduction in "traditional" forms of labour: Part time work, fixed-term employment and freelance work are on the rise. This has negative effects on social security systems. I think there is a relation between this erosion of traditional labour conditions and the innovative momentum the Maker movement brought to the labour market. We see more entrepreneurs, more innovation and more education on one side, but what about stability, safety and social security? We still need to find answers to those questions.

Moderator: Thank you very much for your pleas.

Scenario 3: The Maker movement focuses on start-up incubation and corporate R&D

Scenario 3 is the market oriented scenario in which the Maker movement is absorbed by established industries and focuses on start-up incubation and corporate R&D. Maker initiatives are largely to be found in companies' R&D departments and not accessible to the wider public. The industry "utilised" the "clash of cultures". "Just make it" as a management and design approach is widely spread, but the early "social" attitude of the Maker movement is not so strong anymore as the orientation is towards the development of marketable goods rather than social or environmental impact. In general, a decay of the Maker movement can be observed in this scenario, as "the best heads" of the movement went into industry and there are little educative activities or free sharing of designs left that characterised the early Maker movement.

Leitmotifs:

1. The Maker movement is absorbed by the industry and functions as R&D departments of companies.
2. The industry "utilised" the "clash of cultures": Like the t-shirt culture of the internet generation influenced the dress code in some enterprises

(a bit), the "making" attitude influenced the attitude of some companies (a bit). But not all aspects of the Maker movement can be traced in companies: "Just make it" as a management and design approach is widely spread, but the early "social" attitude of the Maker movement is not so strong anymore.

3. Management and design approaches follow maker culture, whereby some elements of the Maker movement become part of business life, like the slogan 'just make it'.
4. Split of the Maker movement: some makers stick to the present culture of the Maker movement, but an economy like style prevails: most making activities and most interesting products stem from makerspaces in for-profit enterprises.
5. Decay of the Maker movement: "the best heads" of the movement went into industry, bleeding the movement out.
6. Although some hardcore makers may resist the corporate dominance, in this scenario most maker activity is carried out in makerspaces controlled by for-profit enterprises.

20th December 2032. You are listening to a debate for the 30th anniversary celebration of the founding of the first FabLab at Massachusetts Institute of Technology (MIT). Our guests are:

- Elisabeth Narrath, 51, CEO of "Fair Supply Organization", Amsterdam, Netherlands
- Liam Richards, 47, Associate professor in open innovation, Manchester, UK
- Thomas Jørgensen, 57, Industry and Innovation minister at regional level, Copenhagen, Denmark
- Sandra Mitch, 31, CEO of 3DPorting, Porto, Portugal

Moderator: By the year 2032, the Maker movement is absorbed by the industry. Firms have employed most of the best heads that stem from the Maker movement. The few makerspaces still run by civil or public actors have concentrated on education for STEM. I guess it was finally the money the firms offered that drew many leading makers to the corporate research and development departments. The labour market shortage of engineers led to an increased willingness of the industry to attract creative heads. They were willing to accept compromises, too. Companies opened

their hierarchies a bit and re-designed their interior and some procedures. These effects can be understood as an innovation brought into enterprises by makers. Our latest labour market study shows that a good record of products designed in a makerspaces increases job chances and salaries of young engineers significantly. Industry seems to recruit young professionals that are able to think in both creative and economic dimensions. I have invited four experts from different fields for a look back: How did this evolve? Wasn't there a Maker movement that was independent and tried to address societal goals instead of commercial?

Elisabeth Narrath: That's a pretty dark picture you are painting. And quite ignoring the facts. There are thousands of makerspaces that are free from commercial restraints and are working on a not for profit basis. Makerspaces are installed within public institutions and there are still makerspaces run by civil society and free from industry influence.

Sandra Mitch: True. And there is another mistake you made: The industry is heavily contributing to improve wealth in society by providing new products and services and jobs. The R&D departments of European companies have expanded significantly over the last decade, providing both: challenging jobs for highly educated professionals and attractive products for consumers. The spending for research and development by European companies has risen, too. I don't see an antagonism between R&D in companies and not for profit organisations. Both have their domains.

Liam Richards: Indeed. We see a clear separation between companies issuing new products for the market and makerspaces focussing on education and producing pro bono products. Another distinction is the attitude towards ecological goals, which are strong in makerspaces.

Sandra Mitch: This is true for maker departments in firms, too. Makers stemming from makerspaces have brought new approaches to ecological production to many firms.

Thomas Jørgensen: I would say that a sensible industry policy would support this marriage of makers and industry by fostering makerspaces as STEM learning spaces. It turned out that makerspaces have a positive in-

fluence on learning and the development of entrepreneurial skills. This supports the industry and the labour market a lot.

Moderator: But there was a post-capitalist Maker movement once. Favouring open source, sustainability, peer-to-peer collaboration and commons and a FabLab charta. What happened to this?

Sandra Mitch: I don't see these values vanishing. There is a broad uptake of these values in many companies…

Elisabeth Narrath: …that's public relations talk we hear here! I don't see so much change in the behaviour companies show. What we see is that companies try to use the crowd for improving their products, but not for sharing their ideas back to the crowd. You can name it "corporate social responsibility" or "public relations", but the truth is: It's all about profits.

Sandra Mitch: I disagree. Our company is for profit, has created more than 100 jobs in the recent five years, but has a true dedication towards societal values like sustainability, job creation or integration. And we have created a real customer feedback procedure which allows our contributors to download exclusive models. Our customers really appreciate that and contribute to our company's innovation. But let me finish my prior thought: There is a huge market of for-profit makerspaces. They offer digital fabrication for everybody and have quite a good record of patents and highly qualified engineers. What went down are those unprofessional makerspaces driven by young enthusiasts. But why not? We have a broad variety of makerspaces today – so there is no need for a "movement".

Liam Richards: What we can measure is the reduction in the number of makerspaces and participants. Also the budgets of not for profit maker spaces have reduced in the past decade. I guess with commercial makerspaces in every suburb there is no need for makers to create makerspaces on their own. Everything is possible in a commercial makerspace for a small fee. And there are various ways that firms might organise their Maker initiatives. Either bringing makerspaces in-house, using external makerspaces as their crowdsourcing platforms, or investing in maker start-ups, harvesting the best ideas that emerge. If you are interested in making, you can simply se-

lect. And if you are after a well-paid job, the R&D sector is still looking for young professionals. The industry "utilised" the "clash of cultures": Like the t-shirt culture of the internet generation influenced the dress code in some enterprises (a bit), the "making" attitude influenced the attitude of some companies (a bit). And I think other parallels are the Occupy Movement or the Pirate Party: We saw that rising in the 2010s and Pirate Parties entered many parliaments. But within two or three years, they vanished. Absorbed by other parties or evaporated by their own unprofessional behavior. I think some of that story is true for the Maker movement, too. The very professional actors met the industry, others simply were not professional enough to keep makerspaces running beyond their own projects. Many activists founded makerspaces and were active for just some years – maybe their educational years. And after that many activities fell asleep.

Thomas Jørgensen: We can see those values in other movements today. There is a wide variety of social movements that address local problems today; even more than 20 years ago. Youth is much more political and more engaged in politics. The idea to address societal needs by making has lost its fascination to other movements, rooted in local groups or around latest trends in culture, arts and music. Making is still one of them, but I would say that most of the Maker movement went into the entrepreneurial and industrial sector.

Sandra Mitch: That may be true. But we see a broad uptake of maker technologies today: There are more than 80,000 maker spaces in the EU…

Moderator: …85% of them are charging fees. And stealing ideas if you make something in a commercial makerspace all belonging to those three big companies. You obey to their rules which include that they have ownership over everything you develop under their roof…

Sandra Mitch: …Of course they have to charge fees. How should they cover their costs?

Moderator: …There are public makerspaces, too. They only invoice material costs.

Sandra Mitch: … Yes, but they have an educational objective. Those are learning spaces for STEM and entrepreneurial competences. That's not where you invent things, create patents or create jobs. But let me complete my idea: There are more than 80,000 makerspaces in the EU today. And hundred thousands of 3D-printers. The 3D printing business is big in Europe, creating jobs, providing goods for everybody. I would say this is an outcome of the Maker movement of the 2010s. Europe's labour market and the European industry very much profited from this.

Moderator: Another topic is environmental protection. This seems to be a core objective of many community-driven makerspaces and is an important value in the current youth culture.

Thomas Jørgensen: Policy is taking environmental protection serious. We have set different acts for environmental standards, even reaching out to those countries that are producing modern machinery and materials. And there is a clash of interests between many civil society organizations and the industry, of course. But as policymakers we say: "If you want cheap products, you need to look for local production and environmentally safe production." We have issued several certificates and logos to testify that.

Liam Richards: I would say the gap between the environmental protection movement and industry has widened a bit by the introduction of the 3D print. There are 3D printers that are consuming low energy and use recycled materials or biodegradables. But most of the professional machines are using less ecological procedures. Our research shows that the more professional the products are, the less environmentally friendly they are. Modern printed goods combine several different filaments – and that is difficult to recycle. There was a point in the late 2010s where people got excited about the ecological potential of making filament from recycled plastics and how that might reduce the ecological footprint of industries. First, industries could save miles by streamlining their supply chains as they can print more in-house rather than having particular parts shipped to them from around the world. And then these parts could even be made from recycled plastics, so that my old water bottle will fuse into an airplane wing. Now, the first part happened: companies print more in their own facilities instead of having as many parts shipped in from their suppliers as they did 20 years ago.

The other source of enthusiasm, however, was a lost opportunity. The technology was ready to make recycled filaments and use them for industrial production many years ago. However, due to logistics and a lacking policy framework, it was still cheaper to synthesise your own filament rather than using recycled plastics as the source material. The companies producing the recycled and biodegradable materials are thus there, but they're not industry standard, because there is no regulation in place that binds companies to use environmentally friendly materials.

Elisabeth Narrath: But let me add another idea. We are looking back to the past, right? What I miss in this discussion is the question "what do we miss in society today?". I think the Maker movement had some very good ideas about free access to production and the role of production and sharing for integration and self-empowerment. We have to say that due to the commercialisation of 3D printers and the decay of the Maker movement we don't have a broad societal access to production any more. True: We have a high level of innovativeness today. And making has changed the industry a lot. But what about those people that cannot afford using times in makerspaces? Or that simply don't have a makerspace in their neighbourhood, because it's not economically attractive? We all know that there are lots of makerspaces in the cities and wealthier areas, but youth coming from the countryside or living in disadvantaged neighbourhoods simply don't have access. I see a digital production divide here: If you are well educated, you will profit. If not, you lose grip on this development.

Moderator: How about education?

Liam Richards: Makerspaces definitely contributed to rising STEM and entrepreneurial competences. Many makerspaces – either public or commercial – and many company-driven makerspaces support people in realising their ideas. This encompasses training, support of machines and materials and also consultancy in founding enterprises and creating patents. I would say that our economy today is the most innovative, creative and technologically competent ever. Makerspaces have a certain role within this. Many start-ups arise from this ground and policy; industry and education are supporting this very strongly. But I have to approve Elisabeth's demur: We also have a strict digital fabrication divide along economic wealth.

Thomas Jørgensen: Our ministry has issued several programmes on making makerspaces available in rural areas and in any quarter of the city.

Liam Richards: But with which success? It's much easier to apply for loans if you're from a commercial makerspace than if you have developed your prototype in a public library. There is this scent of business that comes with all the start-up scenes, with the training and the close relationship to the R&D departments of big companies. I cannot see that the Maker movement has ever narrowed the knowledge gap in society. It has provided innovation and education to all. True. But there are clientele that profit from this more than others which pronounces distinctions between social classes more clearly and social inequalities are worse with it than without it.


Partner Input
Sustainability Scenarios
WP2
WP3
WP4
WP5

7.4

The Maker movement – ambiguity in potentials and risks for politics, science, civil society and economy

Mathias Cuypers, Bastian Pelka, Janosch Sbeih, Marthe Zirngiebl

Though it is based on older developments like the DIY movement, the Maker movement is quiet a new development, which had its beginning in the first years of the century. And while new maker initiatives emerge all over the world, the question arises: How will the movement develop in the future? How similar to the maker scene of today will the maker scene of the future be?

For the different societal actors, the Maker movement offers potentials for progress as well as risks like the loss of importance. It seems to be crucial for the future of the movement how other actors relate to the Maker movement. Consequently, the future of the Maker movement is promising, but still open for different scenarios of development. In this chapter we want to show which potentials and risks the movement entails for actors from politics, science, civil society and economy.

Policy makers

For policy makers, the Maker movement can be a crucial tool to both change their own organizational structure and realise or restructure certain policies. In order to use these potentials for change, policy makers have to adapt their style of politics actively and e.g. open themselves for other actors from civil society, economy and science.

Regarding new policies, three policy changes are central:

1. On an individual level it will become possible to impart the making approach socially and culturally. By this, the skills and abilities of individuals can be improved. As a consequence, new jobs will emerge and local communities will become stronger.
2. On the macro-economic level, a transformation of the industrial sector could be achieved, by which individual production would replace mass production and strengthen the competitiveness of the European industry.
3. As a third policy, the compatibility of production and consumption with environmental sustainability can be secured.

Regarding their own structures and processes, policy makers will be able to adopt the distinct organizational culture of the Maker movement, which e.g. helps them to reduce the used financial and non-financial resources. They can also use technical tools like 3D printers or laser cutters to produce the equipment they need on their own. Additionally, the ICT skills as well as the problem solving skills of employees could be improved under influence of the Maker movement. These processes of adaptation also support the Maker movement, as their culture and the culture of policy converge.The other way around, policy makers can also help the Maker movement to develop further and support them. For this, they have to find a good balance between structure policies and agency policies in order to support the Maker movement in the best way. Relevant structure policies include e.g. frameworks for measuring progress of maker initiatives, while agency policies e.g. refer to capacity of individuals or groups participating in maker activities. Additionally, it is important to distinguish between a permissive policy, which is important to create good start conditions, and a more active policy, which is important for the further development of the initiative.

Economic stakeholders

Making as an activity is very strongly connected to creating products: If a maker creates an object, she/he may also see the potential to bring this object to market as a product. Out of this reason, the relationship between the Maker movement and economic stakeholders, especially the industry sector, could be closer than the relationship with other sectors. However, the Maker movement is based on different logics than the traditional industry sector, and in the course of a closer relationship between industry and maker actors these logics collide. A connection between the Maker movement and the industry sector could tackle prevalent business models of closeness, e.g. in terms of protection of IP, and establish new ways of production, but also have implications on a functional level, like on employment issues.

Two scenarios are crucial regarding the future relationship between the Maker movement and the economy and both imply the "collision of logics" mentioned above:

1. Firstly, economic actors may absorb the Maker movement into their Research & Development Departments. An absorbance of the Maker movement could by this lead to a new ability of firms to find new business opportunities with the help of creative Makers. Makers will be able to find employment within this new constellation, whether by short-term contracts or combinations of self-employed and salaried positions.
2. Secondly, it may also be possible that the Maker movement develops a widespread commons-based peer to peer production method. This would change the culture of classical industry firms more extensively, as their goal to create financial profit gets extended with the goal of societal progress. Additionally, it would be necessary for them to reinvent their policies of production and pricing. The effects on employment of this scenario are not clear, but it may lead to less financial independence and an increase of work opportunities with greater emphasis on meaning instead of financial revenue.

Economic stakeholders have to anticipate the potential impacts of the Maker movement and behave intelligently to shape the developments in a profitable direction.

Three rules are important:

1. First, they shall deploy the elements of openness consciously, as closeness and openness have advantages and disadvantages depending on the actual situation.
2. Secondly, they have to be aware of constraints between economic and social value creation, if they want to combine them, and have the possibilities to handle such constraints (shared value approach).
3. And thirdly, they have to be conscious on the importance of the balancing between economic and social value creation and be able to think openly on different solutions for different situations. Out of a switched perspective, economic stakeholders can also actively shape the Maker movement by providing resources for them to raise participation and simultaneously respect their sense of self-determination and help them to develop further on their own.

Research, Facilitation and Consultation

First of all, the Maker movement and related aspects have become objects of investigation for the research, facilitation and consultation sector. Important topics, which are present in research agendas, include e.g. the pedagogy of making, sociological topics like the role of digital fabrication or labour studies, economic studies, legal studies and technical studies. This expandable list of research fields suggests the growing impact the Maker movement has on research agendas and research fields since its emergence in the early 2000s. Pressing question include still undefined central terms of the movement, questions of data protection and ethical standards as well as the success of new ideas, e.g. in terms of environmental protection.

However, the Maker movement has also the potential to influence the sector of research, facilitation and consultation on an organizational level. The institutions should be aware of possible impacts. The values of the movement like openness and sharing could be inherited by the institutions of the research sector, which will become more open for collaborations with the industry sector or other actors. Within institutions of the sector, like libraries or schools, the number of maker initiatives may grow, which

would lead to an increase of digital fabrication skills among teachers and pupils – the latter will become digital fabrication natives. The actual process of research could also be impacted by the Maker movement - in the sense of a new inter- and transdisciplinary: The development of new, innovative ideas would occur much more openly for various actors and institutions of the research sector who would participate by opening up their structures for such activities. This situation leads to new opportunities for researchers, e.g. exploring a new field of research and initiating research projects easier.

In another sense, the research sector can also be an important supporter for the Maker movement with a new function to raise awareness on the potentials of making for society. By doing so, the Maker movement has to do research on the most pressing questions like customer, data and IP protection. In this way the sector can become an ambassador for the Maker movement, connecting politics and other potential funders with the Maker movement. More directly, the sector could be able to secure the sustainability of the movement, e.g. when it comes to gender issues: Generally, the Maker movement may have the potential to affect gender issues positively by opening up ICT skills for girls by offering activities both girls and boys are attracted to. However, the use of this potential is uncertain, as the Maker movement may also reinforce gender relations by building up gender specific propositions. In this case and other cases, the research sector may play an increasing role at providing support for maker initiatives or in museums or libraries by trained staff.

Civil society

The maker scene of today takes place within small target groups – and the term of making isn't even well known in many areas in the world. In the future this could change. If making becomes mainstream, this would lead to a change of function of civil society and as well as to certain consequences for citizen. Central for the latter is mainly their transition from consumers, who buy their products in the store, to "prosumers", who produce products on their own. This production does not necessarily occur out of economic purposes. In this way the production of goods gets open for social purposes. Techniques like the download of product templates as well as cultural chan-

ges like the availability of open source goods could help to realize this. The independent producing of goods does not only change personal consumption patterns, but could also be a future possibility to secure livelihood. This however would blend working and living further, which can be seen both as an empowerment and a danger.

Additionally, the Maker movement may also have the potential to bridge a possible digital production divide alongside age, gender, race, class, and other relevant criteria. For example, the reintegration of producing into households could stop a gender divide, which developed, when productive activities were externalized to professional firms and the household became spaces for reproductive activities. By this, the man became the producer, while the woman became the reproducer. The integration of producing into households could break open this gender divide along production/reproduction and household/workplace. However, there is no automatism of the Maker movement to tackle the gender divide and there is even a danger that the Maker movement may reinforce gender relations by not actively being an agent for gender equality and therewith reinforcing technical skills as the turf of men.

As mentioned above, the rise of the Maker movement also raises questions concerning the organizational structure and function of the civil society sector. Traditional civil society organizations are in an interrelationship with the Maker movement. Both can benefit from another, but both also have to secure their relevance in relation to the respective other as well as other stakeholders. Traditional civil society organizations can on the one hand benefit from the Maker movement, e.g. if institutions like museums or libraries are able to adopt new pedagogical concepts from the movement and therewith widening their target group. On the other hand, they also have to be aware of threats, e.g. if online networks become the main mode of communication instead of institutionalized civil society associations.

The Maker movement itself is likely to intensify collaborations with other actors depending on the concrete alignment of the single initiative. By this, the current movement could separate into different movements, which focus on different themes and are connected to stakeholder from different areas. The Maker movement can benefit from these collaborations, but can also lose importance, if other actors can fulfil certain functions better, e.g.

in the field of digital skills. Other civil society actors will consequently also become more dependent on actors from other sectors, if they want to cooperate with the Maker movement. In order to benefit from the development of the Maker movement, they should be aware of the different paths the Maker movement could take and enter partnerships with actors from other sectors as well as adapt their own organizational culture to be prepared for them.

In terms of their organizational culture, maker initiatives and traditional civil society organizations are very different, but an integration of both into each other could in fact also promise advantages for both, as both would get something they not naturally include: The traditional organizations could assume dynamic elements of the Maker movement, which could in turn overtake more stable elements of the organizations. Additionally, as civil society organizations want to support commoners, a possible shift from commercial resources to open source resources may be very important for them. They should also support this shift (e.g. by conferences and other events) as the Maker movement becomes the most valuable for them in this case. The other way around, the sector can help the movement to become a driving force for social (by helping making approaches to become more inclusive), economic (by supporting peer-to-peer production) and ecological (by supporting environmentally friendly materials) sustainability.

7.5

Research and innovation plans for the future

Iris Blankers, David Langley, Jeremy Millard, Elisabeth Unterfrauner, Bart Devoldere, Troels Bovbjerg, Bastian Pelka, Massimo Menichinelli, Marie Nicole Sorivelle, Christian Voigt, Matías Verderau, Karim Jafarmadar, Roberto Vdović, Helin Haga, Jeremie Pierre Gay

This section was elaborated from the final interviews to the MAKE-IT consortium partners and from the exploitation plans elaborated in Deliverable D7.3, available here: http://make-it.io/deliverables/

What do you think your WP could not achieve? What should be addressed in future research and innovation?

WP1 (Iris Blankers - TNO): WP1 is a support work package; it can achieve what it's meant to achieve i.e., coordination and management of partners and work packages. Future research does not apply here.

WP2 (Jeremy Millard - DTI): When it comes to the study of recent, ongoing social movements, things move fast! Our upcoming advanced MAKE-IT framework for analysis, monitoring and assessment will already reveal changes that occurred in the last two years. The work onCAPS and the Maker movement is at its beginning phase. It is hoped that further research and

innovation will continue on the work started by MAKE-IT and document the emergence, structuration and expansion of the Maker movement to increase our common understanding of how social movements grow.

WP3 (Elisabeth Unterfrauner - ZSI): Qualitative research has its unique merits allowing the flexible interpretation of data collected in uncharted areas. As such, it was the right choice for the project. However, certain questions on future policies or structural changes in makerspaces demand a different type of evidences going more towards quantitative studies, possibly taking into account the different socio-economic conditions of countries which are likely to influence:

- Expectations towards makers and entrepreneurs and
- The kind and amount of public support, e.g. in terms of funding, recognition and regulatory easing.

Especially the great variety of cases considered within WP3 is an excellent starting point to think about categories that are relevant to the Maker movement at larger and where we are still missing a quantified 'big picture' on top of the good qualitative impression we already have.

Our study is a qualitative exploratory study, which raises many hypotheses that would need to be tested in order to verify its validity through quantitative analysis. For instance, we have explored the economic value of ten different Maker initiatives but did not measure the impact in economic terms. Further research opportunities are to mention but a few:

- Pedagogy of making: e.g. beneficial aspects of making, hands-on learning, opening black boxes, developing and realising ideas and developing also entrepreneurial skills, creativity, merging of arts and production, repairing skills, etc. contribution to human developmental attributes (such as science, technology, engineering, arts, and mathematics – STEAM)
- Sociology: e.g. role and impact of digital fabrication technology in society, STS studies (science, technology and society "which have revealed and countered cultural stereotypes, power relations, and patterns of social order that are embedded in technologies" etc.
- Technology studies: e.g. emerging technologies due to further development of currently available digital fabrication technology, etc.
- Labour studies: e.g. ICT skills of labour force (due to increasing access

to educational and public Maker initiatives), impact on creation and shrinking of jobs, etc.

- Economy: e.g. which economic value does peer-to-peer production create? Change from privatised economy to commons-based peer-to-peer production? Supply chains of materials and products: scale and scope of economies, inventory management, forecasting, transportation, warehousing, including size, technology, and location, business models of Maker initiatives, etc.
- Legal studies: e.g. how to protect customers' rights in peer-to-peer production? Establishment of standards for interoperability? Research for patents and other options to protect own maker inventions or own personalised or further developed products that build upon open design originally created by others.
- Material studies: e.g. longevity of maker products, biodegradable materials, low energy and recycling of material, supply chains of materials used in Maker initiatives, etc.
- Consumer studies: e.g. making encourages prosumption, merging consumption and production, etc.
- Environmental studies: the following research topics evolved from a workshop with lead makers to understand the future environmental impact of making, issues of energy use, reusing and reducing materials, sustainable consumption and production research, logistics of supply, material cycles, product and material longevity and energy, prevention of waste, and cleaner manufacturing processes, etc.
- Development studies: e.g. How can the Maker movement address global sustainability goals (as claimed by Neil Gershenfeld in his keynote during Maker Faire Rome 2016) to the benefit of Maker initiatives in developing countries?
- Gender studies: e.g. Is there evidence of gender imbalance in machine usage in digital fabrication and if yes, what are the hypotheses behind? How can gender equality in making in STEAM projects be achieved?

WP4 (Bart Devoldere - TNO): Given time and budget constraints, while respecting intended impact and objectives of the MAKE-IT proposal, we did not nor was it the primary intention to:

- Achieve fully developed and market-ready digital tools like the BSOP tool and the TechRadar for servicing the Maker community and various other

stakeholders. Nevertheless, we developed and piloted working prototype tools and appropriate documentation so that the relevant target audience in the maker community can further develop and exploit these tools.
- Reach out to all maker community members worldwide for transferring MAKE-IT knowledge (e.g., best practices, technology enhancements). Nevertheless, we were able to connect and obtain research and output visibility with key opinion leaders and organizations in the global maker community that will further support worldwide transfer of MAKE-IT knowledge.
- Measuring full and long-term impact of innovation action research activities across mindset, behavior, and results of participating individuals and organizations. Nevertheless, we were able to develop a rich data set across different types of maker community members and stakeholders across different geographies, with different types of data formats and related to various research questions. Follow-up (small-or large-scale) projects and uptake of the different digital tools might support and secure a more long-term data collection effort.

Future research and innovation can address the following aspects:

- Conducting similar knowledge transfer workshops to generate additional data for making more informed decisions (across different stakeholders) and conducting relevant research related to maker pace inclusiveness and diversity, and Fab Lab relevance and sustainability.
- Further developing key technology enhancements supporting the Maker movement to connect more meaningfully across stakeholders (cf. BSOP tool and Fablabs.io) and appropriately informing and educating new Maker cohorts and interested other stakeholders about relevant Maker technologies and their use (cf. TechRadar tool)

WP5 (Troels Bovbjerg - DTI): We cannot Insure 100% that the radar will live on after the project ends. We have focused on and worked hard in striving for having "critical mass". In this context it means having enough content in the TechRadar in order to make it useful for a certain user group and thereby hoping this group will adapt it and it will become self-sustaining and even grow bigger with continuing user input. The TechRadar can be further developed. First of all, it's a "living document" which means that continues updates is vital for it to live on. Next, by time more categories can be added

depending on how the Maker movement and use scenarios is developing in the future.Engagement with big Maker movement bodies e.g. Maker magazine, the organization Maker Faire, Fab Academy etc. in order to gain more credibility and reach out more effectively. This was not possible within the timeframe of the MAKE-IT project.

WP6 (Bastian Pelka - TUDO): WP6 reached all goals set in the DoA, but of course every activity could be improved in quality or impact. WP6 is currently working on two more journal paper abstracts.

WP6 revealed the differences within the Maker movement and suggests to differ by types of makers and objectives pursued. Coming research should follow up on this and use those types for deeper understanding of current developments.Another path of research lies in mainstreaming "making" to "unusual suspects". We see potential in opening makerspaces towards target groups such as migrants, children or people with disabilities. Also, the gender issue found in the Maker movement (see 4.6) should be addressed by research, development and agenda setting.

Finally, WP6 strived to complement the overall (still?) very positive perspective on the Maker movement and its development and future pathways with a contrary view: Which dangers lie in the development of the Maker movement? Which effects do we see on labour market, product quality, environmental protection or consumer rights, but also on societal issues like inclusion or inequality? The prevailing optimistic view needs to be contrasted and discussed in order to be prepared for wrong developments.

WP7 (Massimo Menichinelli - IAAC): We tried to reach an audience as diverse as possible, but analytics from the website and social media accounts still show that the audience is concentrated in some countries, age range and gender, pointing out how difficult is to reach a very broad audience. The software developed can be adopted by other researchers and the visualisations consulted by all the type of stakeholders, but since more effort was required in promoting the project, these are just at the beginning of their development. However, these could be further expanded in the future, so while they are still basic, more improvements can be expected. What should be addressed in future research and innovation?

More effort should be done not just in disseminating results, but also in understanding how to do it best. The software and visualisations were thought in order to provide some data and insights about how makers connect, discuss and therefore how could be reached, and therefore more research could be done in order to understand:

- The dimension of the Maker movement, in terms of members and laboratories: this is not an easy task since the movement is mostly bottom-up and continuously changing; important dimensions are:
  - Size;
  - Geographical distribution
  - Evolution over time;
- How to organise discussions with the Maker movement as a whole, and not just the participants of few events, and how to measure such processes and relate them to the dimensions of the Maker movement.

What do you think MAKE-IT could not achieve? What should be addressed in future research and innovation?

David Langley (TNO): As I have laid in chapter 6.4, my opinion is that the Maker movement has not yet realised its potential for changing our economic system for the better. Making as an activity has the potential to democratise our manufacturing processes, and reduce our reliance on the take-make-dispose model of many firms. But a number of significant changes have to be made for this potential to become reality.I believe that the key to this is for makers and industry, in particular what is now being called "smart industry", to work together and to learn from each other. Makers have many talents and limitless creativity, and are strongly embedded in local communities.

Firms have great knowledge and resources and are increasingly open to building relationships with users and other stakeholders, rather than simply produce products to put on shelves to be bought by unknown people.If both parties work together, be could see a synergy that improves business practices, such as designing for repair and reuse, and at the same time provides for a healthy economic climate. I would like to see more research into how this synergy can be achieved.

Marie Nicole Sorivelle (DTI): MAKE-IT has perforce only achieved a snapshot view of the European Maker movement, which is a fast moving and swiftly changing field, both at the grassroots level of hands-on physical making, repairing and related activities, as well as the perhaps even more transformative changes being ushered in by the 4th Industrial Revolution at the more macro scale. The project's contribution is thus important but inevitably limited, and needs to be seen as one of a portfolio of related projects and activities focused on making as well as CAPS and digital social innovations more broadly.

MAKE-IT has thus contributed a relatively in-depth and focused study and analysis, which is very important, but future research and innovation needs to contextualise this within these broader issues. Findings from MAKE-IT reveal there is a strong need to further research and design the interrelations between makers and the market, to look at how making can be incorporated within an economic context, while maintaining its values and creating long term sustainability. The Maker movement is an extraordinary lab with many promising initiatives, which have the potential to disrupt the future of our societies. This potential needs to be unlocked and research can play an important role in assisting these initiatives to take off, by looking closer at the consolidation of social movements and exploring the business models of the future for both makers and makerspaces.

There is also a strong future need to focus research and innovation on a better understanding of the interplay between dramatically changing technologies (not just the specific maker technologies but additionally those makers also need to use like AI, IoT, blockchain, e-commerce, biotech, smart networks, sensors, etc.) and human performance. How is society and the economy changing and how, specifically, are people's skills, lifestyles and work transforming as a result? How should policy makers and all stakeholders prioritise both societal and individual welfare and prosperity as the technology becomes 'smarter' and able to usurp many activities currently performed by people? What is it that technology does best and what do people do best, and how is this interplay changing? Clearly, making is one very powerful illustration of a generally beneficial interplay between new technology and people's needs and aspirations, so how can this be further enhanced, become commercial and financially sustainable but, at the same

time, not deleterious to the human condition? One issue where making has, in principle, great promise is enhancing environmental sustainability, and in this context linking up with the collaborative economy and circular economy movements. However, it has, according to MAKE-IT's findings, not so far been sufficiently focused on this or highly successful. This needs to be prioritised much more, given the existential environmental threats our societies face, for example by working more closely with programmes for sustainable, resilient and nature-based developments in cities as well as in rural areas. The Fab City concept and movement, launched by MAKE-IT's IAAC | Fab Lab Barcelona partner in collaboration with the MIT in the US, is an excellent example of how this can be done on a broader scale, and this initiative needs broader support. Overall, there is insufficient linking of the Maker movement to the societal challenges Europe, and indeed the world, faces. But, as is clear from MAKE-IT's results, this is not at all something making can or should do in isolation, but instead it needs to play a significant part in the broader movements which can.

Christian Voigt (ZSI): Interestingly, it can also lead to the realization that the source of certain imbalances (e.g. the gender distribution in Fab Labs) originates most likely outside the maker space. For example, we found that female makers were four times less likely to join a Fab Lab, but once they had joined – their actual use of Fab Lab facilities corresponded to that of their male peers. So in fact, if makerspaces want to change this situation they would need to enter schools and kindergartens to present making in a child adequate way to kids and parents. Such an action would acknowledge the fundamental role of families and societies in shaping children's preferences – which are harder to influence at a later stage. This 'going beyond' the conceptual borders of makerspaces was not part of the project's mandate, but we can see the value of doing so. Hence, an eminent task for future research and innovation are appropriate mechanisms to investigate long-term effects of interventions during early childhood. Biographical development studies come to mind, which can span several decades looking at education and careers made in a holistic way. Additionally, we can think of social media based investigations, where people platform activities on Twitter, Facebook or Instagram could be taken as quasi-portfolios of their developments. However, the tracking of personal information needs to be designed with care to protect privacy and obtain consent throughout the process.

Marthe Zirngiebl (TUDO): MAKE-IT suggests tools and strategies to assess the impact the Maker movement has on society. But this assessment is - to our understanding: as a matter of fact - not quite developed as other impact assessment tools in other - longer established - societal fields. Coming research and development can build on these results, but more development is needed to create tools that are more suitable for the Maker movement's needs.

Matías Verderau, Massimo Menichinelli (IAAC): I think that what MAKE-IT did not achieve was to go deeper into each of the issues, due to the structure and ambition of the project, it was not possible to go into detail or explore different areas of each topic.

Furthermore, there was more focus on the Maker movement and Maker initiatives and less on their connections with platforms. The exploration of the ten cases provided a lot of insights, but still at a low scale: what about all the other Maker initiatives? Not all the Maker initiatives are the same, and further research and innovation (especially through platforms) is needed at mass scale. But as a first approach for understanding the Maker movement it is very useful and it provides ideas for further improvement of existing Maker platforms.

Roberto Vdović (FLZ): For future activities, it might be interesting to explore how to reach different focus groups, like disabled persons, or remote regions, how to involve them, not only over platform like MAKE-IT, but also with field work. What kind of workshops can be performed with impact on social aspects of Maker movement. One experiment was at Maker Faire in Barcelona with makers, but another was in Sesvete, inclusive workshop for local community. From this kind of workshops, local community Fab Labs can learn how to achieve even bigger impact on society.

Karim Jafarmadar (HLW): MAKE-IT studied a few very different Maker initiatives in depth. For future research it would be interesting to see this on a broader European level to get a better sense on the societal impact of the Maker movement. Furthermore, it could be interesting to see differences between the European way and what happens in the rest of the world.If the Maker movement is really going to change the world for better, there are lots of interesting possibilities for further research.

Helin Haga (AHHAA): I feel that for the local makers, the MAKE-IT project offered little added value. In future research and innovation I would suggest carrying out in depth observations and studies of specific makers and Maker initiatives to look beyond self-reporting and officially publicised information.

Jeremie Pierre Gay (CIR): MAKE-IT had difficulty to achieve a "1 answer fits all" in the sense that every maker community has its own local specificity or area of expertise. It is therefore very difficult to have the one recipe to scale the Maker movement. But the issues that makers are facing were often the same, the recurring one being the financial viability. Create it REAL believe that focusing on core technology will help the scaling of Maker movement but we also understand that a level of customization will be needed to make it truly a success.

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MAKE-IT is a Horizon 2020 European research project focused on how the role of Collective Awareness Platforms (CAPS) enables the growth and governance of the Maker movement, particularly in relation to ICT, using and creating social innovations and achieving sustainability.

This book collects results, reflections from the project and strategies for keeping the work and exploitation of the results in the future.

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