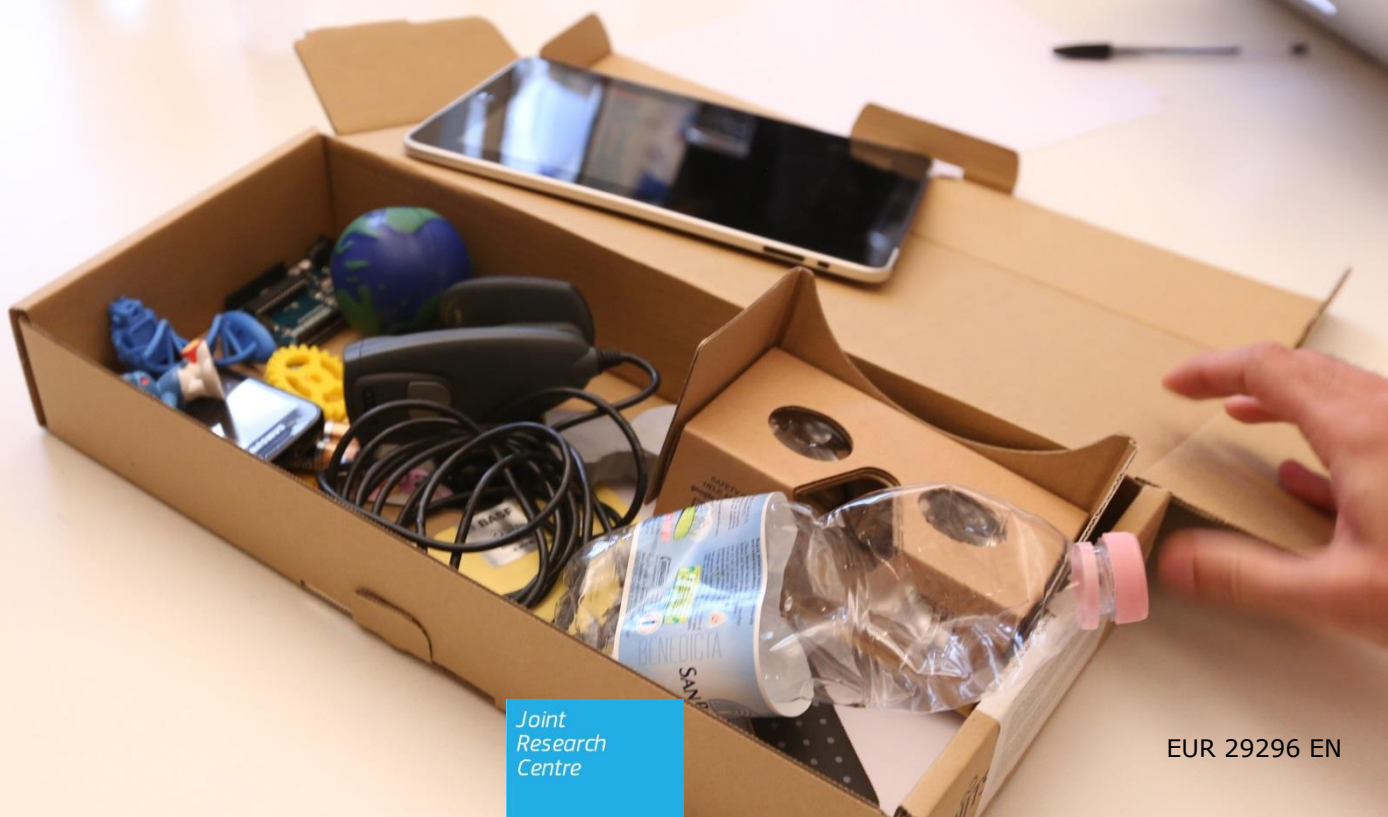


JRC SCIENCE FOR POLICY REPORT

Futures of Work: Perspectives from the Maker Movement

Paulo Rosa
Ângela Guimarães Pereira
Federico Ferretti

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Contact information

Name: Paulo Rosa
Email: paulo.rosa@ec.europa.eu
Tel.: +39 0332 78 6490

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Futures of Work: Perspectives from the Maker Movement

Abstract

The work presented in this report attempts to explore other realms about the future(s) of work beyond the strongly driven narrative of digital transformation. We have addressed one particular grassroots community, the Maker Movement, which is de facto enabling new models of education, collaborative work, and manufacture. Movements like the Maker Movement can be inspirational of policy making in areas of great complexity and uncertainties as work, employment, jobs are. We suggest that debates about futures of work need to mobilise the imagination, insights and expectations of wide ranges of society. Policy making should be nurturing necessary studies, experiments and conversations until some resilient ideas are found.

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Preamble

“The future is already here - it's just not very evenly distributed.”
(Gibbson, 1993)

Futures of work, jobs, skills, and work spaces have been the subject of many studies as they are in continuous transformation. We choose to talk about futures in plural because the future of *work* is continuously in the making and those futures develop differently across political, historical and cultural contexts, and geographies of people and places. *Futures* therefore, entail the idea that they unfold from the present(s) and past(s).

The present report was produced under the Joint Research Centre (JRC) initiative towards enhanced research efforts in the area of *“The changing nature of work: a focus on tasks, skills and the role of the collaborative economy”*. The JRC initiative proposes to address five main research areas which are in line with current European Commission (EC) policy priorities:

- Innovation, growth and job creation in the territorial dimension;
- Digital transformation and the Collaborative Economy;
- New skills and education in the digital transformation;
- The changing nature of work and the social model of the EU;
- Developing a vision for the future of work.

The work presented in this report departed from a critical look at current narratives that seem to sustain debates about *futures* of work and the political, social and economic characteristics of some *presents* of work. Many of these narratives are strongly driven by the digital transformation. But, why is it assumed that ICT is the main driver of change of *work*? Can we aspire to have other drivers to change *work*? In particular, we were interested to study what grassroots movements like the *Maker Movement* can tell us about the futures of work, including a reflection on driving forces and values that may be making the futures of work. These research questions have set us in a journey of engagement with makers' communities, in the pursuit to find insights for the following questions:

- What are the narratives about work futures linked to the *Maker Movement* (promises, claims, assumptions, actors, etc.)? How do these relate to possible EU policies?
- What are the expectations and imaginaries from people associated to the *Maker Movement* with regards to the futures of work?
- And, what are the values entrenched in the makers' narratives, expectations and imaginaries of work?

Research work consisted of examining drivers and narratives about the future of work in the media, policy, academia, as well as personal fabrication and collaborative economy discourses. This was followed by engagement of different actors related to the *Maker Movement* by using mixed methods: in-depth interviews and focus groups based on material deliberation techniques in order to explore the plausibility and desirability of the narratives that sustain the discourses and practice of work futures, from the vantage point of the makers' community. This work cannot be understood as representative of a movement which embraces a diversity of objectives and motivations to

operate. The methodology implemented, focused on in-depth interviews and focus groups with a limited numbers of participants, intended to generate insights into the imaginaries and expectations with which these grassroots movements relate to the discourses on futures of work, exploring the three questions enumerated above.

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Executive Summary

The discourses about future(s) of work are permeated with many assumptions and visions that seem to be funnelled by a single narrative: digital transformations will change our public life as well as our received notions of humanness. Work (nature, meanings, organisation, politics,...), a substantial pillar of all human societies will be geared by such transformations, with new opportunities but also new challenges. To think that the future of work is driven just by the imagination and practices of job providers is missing the elephant in the room. The work presented in this report attempts to explore other realms where futures of work are possibly being experimented and invented, where individuals may be re-inventing ways of working responding to other imaginaries that are not necessarily those of industry and business. The report tries to respond to the question: are there (or what are) other drivers somehow concealed by the most commonly found future of work narratives, where ICT seems to be the main driver of change, either portrayed in a salvific role and a safe harbour for companies to thrive, or a stern threat and main cause of work destruction? We have explored these questions with one particular grassroots community, the *Maker Movement*, which does not have homogeneous objectives and motivations but is *de facto* enabling new models of education, collaborative work, and manufacture. Research work consisted of examining drivers and narratives about the future of work in the media, policy, academia, as well as personal fabrication and collaborative economy discourses. Eight thematic narratives were extracted: (1) Automation, (2) Globalisation, (3) Micro-Factories, (4) Sharing Economy, (5) New Skills, (6) Green Economy, (7) Ageing, and (8) Migration. This was followed by engagement of different actors related to the *Maker Movement* by using mixed methods: in-depth interviews and focus groups based on material deliberation techniques. The work carried out provides insights into the imaginaries and expectations with which the *Maker Movement* relates to the discourses on futures of work. It is exploratory and in any way can it be generalised to the EU; in other words the work allowed to explore motivations, driving forces (including values) with which this movement operates, which could inspire needed extended conversations and re-imagination of the futures of work. Further work needs to be done across different Member States, to explore further spaces similar to the ones we have enquired.

Policy Context

The present report was produced under the JRC initiative towards enhanced research efforts in the area of “*The changing nature of work: a focus on tasks, skills and the role of the collaborative economy*”. The JRC initiative proposes to address five main research areas, which are in line with current EC policy priorities:

- Innovation, growth and job creation in the territorial dimension;
- Digital transformation and the Collaborative Economy;
- New skills and education in the digital transformation;
- The changing nature of work and the social model of the EU;

- Developing a vision for the future of work.

The futures of work continue to be a topic of great significance. EU policy objectives support job creation, business competitiveness, economic growth, sustainable development, advance social innovation and improvement of citizens' quality of life. Unemployment rates and distance of many Member States to reach the EU-2020 employment targets (Eurostat, 2017) make this topic rather pertinent.

Main Findings

In the last century, technological advances linked to the mechanisation, electrification, and computerisation of work prompted both the creation and replacement of jobs at large scales, altering as well many forms of work. Nowadays, information technologies are pushing us once again towards a new tipping point, by potentially reshaping the nature of work. It is foreseen that advances in computer power, robotics, artificial intelligence and machine learning, will continue to have a profound impact in the futures of work. Yet, technology is not the only driver shaping the futures of work. Socio-economic and environmental drivers, such as globalisation, ageing population, migration, climate change, and resource depletion are also pointed out as major factors.

The immediate reaction of participants to the aforementioned narratives was that, uncertainty is too high to anticipate next transitions. Reflecting on the present challenges seemed to them to be more adequate; below is highlighted the main findings in regards to the narratives discussed by the participants of the focus groups. Two of the narratives – Narrative 7: *Ageing*; and Narrative 8: *Migration* – were not selected in any of the focus groups by the participants and thus could not be analysed.

- **Automation:** The effects of automation on the futures of work are continuously progressing and growing, and there seems to be no stable anticipatory ideas on this. At the present time, the effects of automation is not primarily in regards to physical activities but rather, and more significantly, about intangible services i.e. current effects of automation are and will be mostly visible on the service sector. Even if the idea that automation is changing the nature of work and also possibly taking many current jobs away, the importance of collaboration between humans and technology is acknowledged as a more plausible paradigm than that of substitution.
- **Globalisation:** Globalisation has paved the way to many transformations in relation to the nature of work, such as redefinition of market players, and privileging existing large companies. The *Maker Movement*, and in particular the FabCity Global Initiative, are equated in the narrative as a framework that could enhance processes of local production, services and know-how paradoxically sustained by global sharing practices and politics.
- **Micro-Factories:** Micro-Factories are not seen, at least in the way they were framed in the narrative, as a viable response to counteract in Europe the impacts of capitalistic models and delocalised production. When linking micro-factories to makerspaces, it becomes even more evident that the aim is not to provide the same types of products. Production is possible in

makerspaces, but not production in the traditional sense of mass manufacture. Indeed, these types of spaces are above all manufacturers of ideas. Focus is on providing learning opportunities *i.e.* in democratising knowledge, that can (or not) be transformed on specific and highly personalised products (democratisation of personal fabrication).

- **Sharing Economy:** The narrative opens the discussion to the meaning of what is indeed the sharing economy and what ideals it should represent. Participants argue that the principles of sharing economy have been distorted because of conflicts of interest, lack of regulation and, above all, because those who own the IT platforms do not act differently from large corporations in the long run. Most criticism is focused on whether or not business models and practices treat workers fairly. The sharing economy concept, as it stands, is not truly about sharing and thus should be revised.
- **New Skills:** Skills and skills development are core to the discourse and imaginary of futures work. Participants suggest that formal systems of education are currently unable to provide the necessary skills for the work of the future, a core role that makerspaces can support. Beyond provide learning spaces in STEM related disciplines, makerspaces have a prominent role in teaching people to be flexible. However, how can the skills acquired in places such as makerspaces be formally recognised?
- **Green Economy:** Ideas of care, of passion, and of ownership are suggested as to be the key dimensions for such narrative to be plausible and to have a stand on its own; otherwise these ideas risk being appropriated as a rhetorical device of installed economies.

Makerspaces have been emerging with multiple objectives, and our enquiry seems to suggest that the connection between making and jobs creation is neither often desirable, nor is it an objective of the *Maker Movement*. Yet, with and through the *Maker Movement*, a number of transformative ideas and concepts could already be changing or re-enacting lost meanings of work. Such ideas could form a different, but not necessarily new, narrative for work futures. In the discourse of the participants we could identify drivers and values that were promoted both through the in-depth interviews and the focus groups. Whilst some of the identified drivers seem to be embedded in the narratives of our times, some others are somehow not so much articulated in the discourses of policy, business and media accounts; others seem to be relinquished to a second plan, whereas indeed their disappearance could be a stronger driver than existing or emerging technology. We also found in the discourses of our interviewees and focus groups' participants ideas of individual and collective autonomy, agency, solidarity, community accountability, care, articulated as inbuilt values of the *Maker Movement*. We started this work with the question: *is ICT the only driving force of futures of work?* We have found out that many other drivers could be performing futures of work, including persisting values:

Driving
forces

Innovation: Makerspaces can lead to the creation of new products and the development of start-ups, thus offering indirect opportunities of job creation. These spaces are also seen as providing the opportunity to explore and develop unique solutions and local production as opposed to the mass production paradigm. Innovation is not exclusively technological but includes more dimensions i.e. at the social and cultural levels.

Skills: Making is suggested as an effective way to develop new skills, upgrade existing knowledge, and acquire flexibility to face everyday problems. The Maker Movement is conceptualised as a promoter of such skills, also by offering vocational paths to learning, as well as, by rediscovering the importance of disappearing skills. Highlight on the particular importance of collaborative skills beyond human collaboration, i.e. in the context of human-machine interaction.

Open everything: Open source is often heralded as a way to foster innovation although not always depicted as an appealing and economically viable option for starting businesses. More needs to be done, for example in terms of regulation, for this to become a strong driver of work futures.

Sharing: The sharing paradigm permeates multiple facets of the Maker Movement from connecting people, to knowledge, tools and resources available to the community.

Fantasy: Makerspaces are expected to be safe spaces where one can experiment with fantasy without the pressure to deliver or the pressure to succeed (right to fail). Personalisation of creativity is claimed to be an opportunity provided by these spaces to explore concepts and ideas to one's or to the community's interests, concerns or matters of care.

Collaboration: Participants claim that makerspaces help to develop a collaborative attitude among participants, since values of care and solidarity entrench the collaboration driver. Collaboration as opposed to competition could be a strong driver of work futures.

Education: Makerspaces are imagined to be helpful to educate children into the 21st century skills. New proposed models of education rely on learning by doing: experiential, hands-on, experimental, and peer to peer learning. These concepts are not offered as substitutes of formal modes of learning but they could and should co-exist.

Fun: Personal development is described as a prime aim of those joining makerspaces; making is often characterised by the traits of fun and hobbyism. To have fun in one's work is not a farfetched goal and could be a strong inspiration for how work could be imagined in the future, exploring ideas of personal fulfilment way beyond the pay check objectives.

Values

Solidarity: Intrinsic to the making communities, are the bonds among individuals strengthened by shared goals, creative ideas and materiality but also through mutual interdependencies to address individual or collective challenges. Collaboration, openness and sharing are fundamental driving values of the Maker Movement. We suggest that these driving values through which the divergent, the outcasted and the different could enter in dialogue are the gist of solidarities of a reflective kind; this could inspire new solidarities in future work arrangements and benefit the taming of societal challenges.

Autonomy: Ideas of individual and collective autonomy permeate the discourse of makers, blended with ownership associations, as well as ideas of flexibility as an autonomic strategy. Adaptive strategies with regards to work are already in place and are key in the narrative of life learning for example; hence, with regards to futures of work, making seems to offer that type of autonomy.

Matters of care: Caring is inherent and foundational to making. Oftentimes caring and matters of care were associated with people taking ownership of issues and acting upon them. Many people that go to makerspaces experiment, learn by doing, pursue personal quests of creativity and fun but many others do things and engage in individual or collective projects to simply respond to theirs or collective practical needs, in other words their matters of care. Could values of care inspire futures of work and associated jobs?

Time: Time emerges with the possibility of it being experimental and unplanned; ownership of time is regained through making and through building and interacting with the community. The making of time reads as a feature of making and seems to be closer to the notion of time gift, i.e. time outside the time economy of employment relations.

Key Conclusions

Below key conclusions and insights for policy of this study are presented, organised into relevant EU policy themes:

- **Education, training and youth:** Makerspaces are among the places for developing the necessary skills for the 21st century; they can serve as spaces to freely access to alternative or complementary education. More time needs to be spent on activities that require social and emotional skills, creativity, high-level cognitive capabilities and other skills relatively hard to automate. School and university systems should take this into account and adequate resources should be allocated.
- **Research and Innovation:** Makerspaces can have a central role in fostering innovation and the creation of new products and services, but these spaces seem to focus more on the ideation and prototyping phases (makerspaces are not suitable for mass-manufacture). Innovation policies cannot ignore the potential of these spaces to attract people that

otherwise would not have access to tools and knowledge that help them be creative and innovative in solving problems that might affect us all. A great deal of *making* concentrates on actual individual and community needs and not imagined ones.

- **Employment and social affairs:** Employment is not the core business of makerspaces, but employment policies could take inspiration of the makerspaces' operation. Makerspaces can inspire individuals to create their own work, or to find pleasure and satisfaction beyond the income, for example. With regards to jobs, the implementation of a *conditional basic income* for specific contexts could motivate and enable people to work in issues that matter for society, whilst having the necessary resources to do it. Work, jobs and employment policies could take inspiration from the driving values of the *Maker Movement*, such as: solidarity, open culture, sharing, collaboration, creativity, fun, care, and the value of time.
- **Consumers:** EU consumer policy safeguards consumer rights and guarantees the safety of any product within the single market. However, open source DIY kits developed at makerspaces do not always comply with the existing rules and certifications in EU. Some participants point out that in order to promote the *maker culture* and foster innovation, norms and regulations (e.g. EC certification) need to reflect the open source DIY nature of products developed at makerspaces. Specific certification programs and regulation are required that allow, for example, the use of open source DIY kits in educational environments.

The discussion of the ethics and values by which we would like to live our working life should be an open debate to all; this has been largely relinquished to the ideals of profit and other business oriented criteria. Any discussion on futures of work in social, economical, policy and political terms needs to include all actors of concern, including citizens. All citizens are concerned and we all need to appropriate the conversation and make the imagination of plausible work futures to be ours. We suggest that a debate needs to be organised in the form of a public project, so that the futures of work are not left to self-organisation or relinquished to powerful corporative elites.

Movements like the *Maker Movement* can be inspirational of policy making in areas of great complexity and uncertainties as work, employment, jobs are. It would be important to secure that all possible aspirations and inspirations are crowdsourced and marshalled into the thinking in this area, avoiding the pitfalls of taking for granted narratives that could be obsolete, implausible, inappropriate or even damaging to policies in this area. Debates about futures of work should not be locked up on methodologies that do not mobilise the imagination, the insights and expectations of wider ranges of society. Policy making should look for inclusive methodologies that help with governing challenges and expectations, such as participatory *futuring*, social and political sciences which can foster co-creation of the necessary knowledge to approach this major societal issue.

There are no stable policies or practical solutions to the challenges put by different driving forces with regards to present nature and organisation of work. Equally there are many futures of work, and no report will be definitive. Policy making should be nurturing necessary studies, experiments and conversations until some resilient ideas are found.

Related and Future JRC Work

No report on the futures of work will ever be conclusive. Futures of work are in the making. The *Maker Movement* is not certainly a homogeneous entity as it emerged both from the literature and the empirical study presented in this report; there are very different aspirations among those that call themselves makers, and therefore the relationships with broader societal endeavours are also very different. Therefore, future research should investigate the range of contexts in which the *Maker Movement* develops to draw representative conclusions of its role in performing futures of work or of other areas of social endeavour. In addition, research on other loci where possible work futures could be developing should be investigated.

Two of the narratives that we planned to discuss were never taken on-board by the participants; interestingly they refer to demographic dimensions that we believe are of vital relevance for imagining futures of work: *migration* and *population ageing*. Future research should look at these and other demographic variables.

There are a number of JRC projects addressing the futures of work with equally a number of different angles. The work done in this report, confirms that a comprehensive examination of the complexity, spill-overs and uncertainty associated with studying this topic is better dealt with through interdisciplinary studies. Hence, this topic constitutes yet another opportunity for the JRC to tackle the broad policy questions, by using many different methodologies in which the JRC is competent. The JRC could be a relevant actor to develop mechanisms to address spill-overs in a comprehensive way and facilitate this debate in a strategic way.

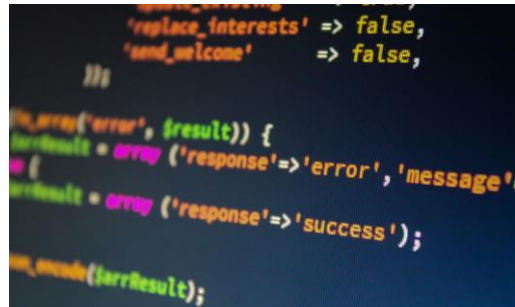
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1 Introduction: Futures of Work and the *Maker Movement*

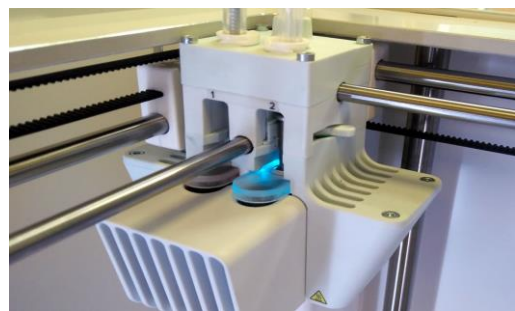
1.1 Towards *Futures of Work*

“It is generally accepted that, in one-to-one contests between computers and humans, the machines now dominate absolutely.” (Ford, 2015)

The technological advances made in the twentieth century, whether in terms of infrastructures, communications or transportations, have been shaping the nature of contemporary life, as well as, the nature of work¹. The mechanisation of agriculture, for example, greatly increased the relative yield of farms per individual farm worker, but it also led to the eradication of many farm jobs. As a consequence, masses of jobless farmworkers moved into cities in search for work, primarily in factories. Likewise, the electrification of factories in the 20th century enabled many stages of the production process to be automated, leading to considerable increases in productivity and lower unit cost of numerous consumer goods. However, it reduced the need for workers performing unskilled² jobs in the assembly lines, pushing them out of the manufacturing sector into new jobs in the service sector.



With the advent of the microprocessor (and subsequently of the computer and digital technologies), our ability to perform computations and manipulate information radically changed. Digital technologies have become an integral part of our lives to the point they have irrevocably changed the way we perform most of our daily tasks, including the way we work, shop, trade, and communicate with our friends and relatives. Indeed, it is foreseen that in a near future computers will not only be an integral part of every product we buy but they will in fact be embedded with our environment, inevitably occupying our physical world as ordinary elements, enhancing our human capabilities and our environment (Greenfield, 2006; Rosa, Câmara, & Gouveia, 2015).



¹ In section 1.2 of this report, we offer a discussion of meanings and framings of *work* and the distinctions between kindred concepts, such as *job*.

² This is sometimes referred to as unskilled work which refers to people in the workforce occupying positions that can be performed by the majority of individuals without the need to have special job training or education (also labelled *blue collar* jobs).

Nowadays, there are very few aspects of the operation of businesses and organisations that are not significantly influenced or highly dependent on digital technologies. There is an on-going fear that as digital technologies continue to influence the world of work and transform industries, computers will cease to be tools that enhance workers productivity and instead become viable substitutes in a wide range of functions, leading to massive unemployment (Ford, 2015; Frey & Osborne, 2017). The situation is particularly alarming as the impact of digital technologies in the future of work is not limited, as observed in the past, to routine jobs. As Ford (2015) and Frey & Osborne (2017) point out, as technology advances, many jobs that we would today consider non-routine, and therefore protected from automation, could eventually be pulled into the routine and predictable categories, and thus be susceptible to automation. While lower-skills jobs will no doubt continue to be affected, the rapid developments in predictive algorithms and increasingly availability of extremely large datasets of information (commonly known as *big data*) may mean that more and more knowledge-based jobs are likely to be handled entirely by computers. In some cases, this might prove to be easier and simpler to do (using software automation) than to computerise lower-skills jobs that involve physical manipulation.

It is widely foreseen that technological progress, in particular advances in computer power, robotics, artificial intelligence and machine learning, will continue to have a profound impact in the futures of work. Yet, technology is not the only driver shaping the futures of work. Socio-economic and environmental drivers, such as globalisation, ageing population, migration, climate change, and resource depletion are also pointed out as major factors³. Globalisation, for example, prompted the expansion of businesses and organisations, enabling the production and sales of products worldwide. It also led to the offshoring and outsourcing of jobs and services, dislocating work across borders, in particular in areas related to software development, hardware manufacture, accounting, customer support and telemarketing. The effects of globalisation in the futures of work may be even more felt when high-skill jobs become more vulnerable to offshoring. For now, a more pressing concern is that globalisation is affecting jobs, contributing to an overall increase in income inequality and poorer working conditions (OECD, 2017).

In the past, formal higher education has always been perceived as a means to guarantee a successful job and as a means to counter possible changes in the job market, including job losses. However, the relationship between educational credentials and their returns in the job market has been changing in recent times (Tomlinson, 2008), to the point where acquiring more education and skills⁴ will not necessarily guarantee protection against job loss in the future (Ford, 2015). It is quite impossible to predict the skills that will be needed in the future. Hence, the adaptation and acquisition of new skills either linked to formal education, or to both on and off the job training, is still heralded as the best way for workers to adjust to the upcoming challenges related to the futures of work (see section 3, Table 2).

It is also acknowledged that futures of work will not only revolve around the elimination of jobs (see for instance, Manyika, Lund, et al., 2017; Rotman, 2013); the drivers earlier mentioned are also fostering the creation of new types of work and of jobs. For example, climate change concerns led to the rise of different types of work and creation of related jobs in, e.g. renewable energies, such as wind turbine technicians and solar panels installers, or others such as, sustainability consultancy,

³ For a comprehensive list of references see Table 2 in section 3.

⁴ The term *skills*, in the context of this report, is used to refer to the work-related capabilities of individuals to perform a job successfully.

environmental certification and monitoring. Likewise, digital technologies, and in particular the internet, boosted the creation of Information Technology (IT) related jobs such as, web developers, app developers, social media managers, or data scientists. What becomes equally important is to analyse to what extent emerging forms of work, and associated jobs, have better *quality* than the ones eliminated – let alone the definition of *quality*. As a norm, middle-class jobs are the most likely ones to disappear in economic recessions, whereas new jobs tend to be created primarily in low-wage sectors and, to a lesser extent, in high-paying high-skill occupations that require extensive training (thus leading to high job polarisation) (Goos, Manning, & Salomons, 2014).

1.2 Meanings of *Work* in the making

Discourses about work are shaped and expressed through language, cultural contexts and a series of mind settings at the universal, collective and individual level (Hofstede, 2001). Etymology – see Figure 1 - can offer an initial understanding of the meanings of work, which in English, generally refers to an “*activity involving mental or physical effort done in order to achieve a purpose or result*” (Oxford Dictionaries, n.d.-b). Thus, *to achieve a result* seems to suggest an intentional and goal-oriented activity which is often planned and coordinated (Taris, 2018). In Italian *lavorare* can be traced back to the Latin *labor* which in its origin means exertion, hardship and fatigue related to mental and physical effort (Harper, 2018). Similarly, the German *Arbeiten*, in its etymological explanation, means to exert oneself physically hard.

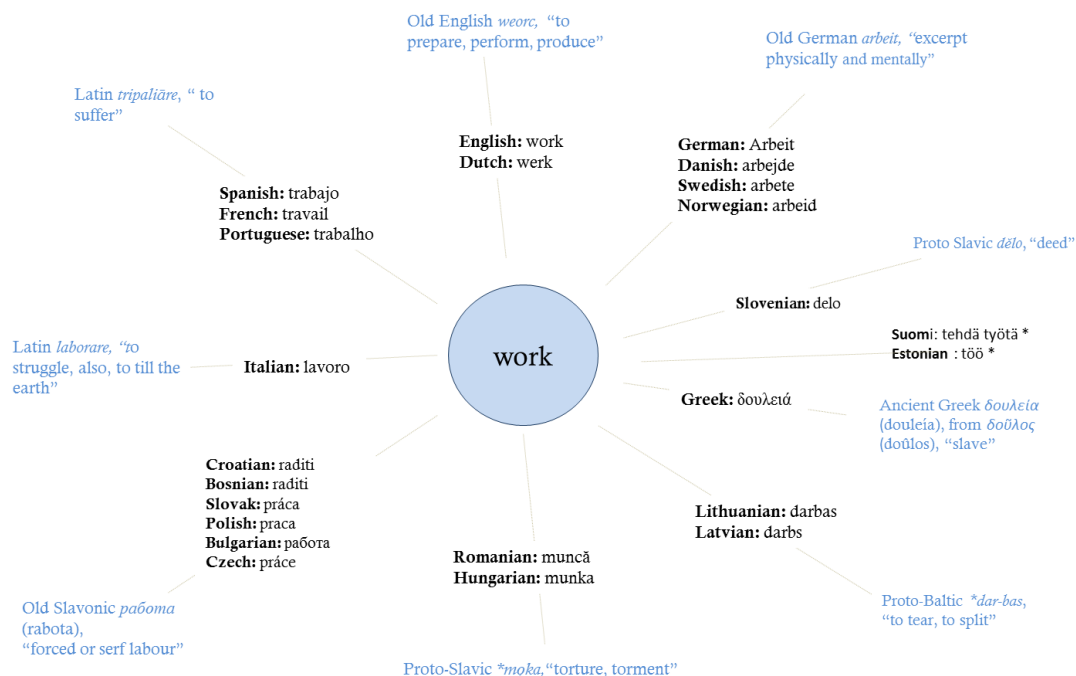


Figure 1: Etymology of the word 'Work'⁵.

⁵ (*) Etymological roots were not found for the Suomi *tehdä työtä* and the Estonian *töö* (interestingly, the latter is also used to indicate the second person *you*). Source: <https://www.wiktionary.org/> (last access: 29 March 2018).

Notably, work is often used interchangeably with job in few languages and across sources and the distinctive meaning of the two depends on translation and context. A review of the corpus of definitions from a lexical standpoint suggests that ‘job’ refers to a specific activity, “*a paid position of regular employment*” or “*a task or piece of work, especially one that is paid*” (Oxford Dictionaries, n.d.-a). *Work* appears to be more holistic and inclusive of other activities in-and-outside the *job*. For instance, does work include civic and volunteer activities, parenthood, or care? Does job refer only to a specific task with an economical reward? How are these connected?

From an industrial perspective, models of earning a living can be traced to various forms of production such as artisanal and craftsmanship. The turn to the modern industry throughout the industrial revolution in the late 18th century and early 19th century, brought the mass-production oriented model known as *Fordist* (Supiot, 2001), where clear labour divisions and the eight-hour workday became standardised.

Different aspects of work co-exist or are in transition and have led to present combinations and changes. Current discussions related to work include the shift to more flexible arrangements of jobs, more frequent career opportunities in the places of employment and the importance placed on skills acquisition in the long-term. These changes are occurring in a fast-paced information society and the so-called knowledge-based economy (OECD, 1996), also referred to as the 4th industrial revolution (Schwab, 2017). In retrospect, whilst goods and services were previously traded at the physical market place, over time, services and goods are now accessible through new forms of marketplaces (e.g. online). Broader dynamics, as mentioned in section 1.1, are also driving the nature of work such as the governance of globalisation, demography (ageing population, low fertility rates and longevity), mobility, migration (immigration and emigration), and climate change, amongst others. Moreover, the relationship between work and kindred concepts like *job*, or the actors involved in working and work creation and distribution, as well as the work places have been changing overtime.

In the context of the European Union (EU), to earn an income, a wage, or a salary, remains essential for the purchase of goods and services. It is a form of securing subsistence, though to varying extents and qualities. More so, for instance, earning an income may sustain and provide food and shelter for a family and thus it protects livelihoods and values, such as autonomy and dignity. According to the literature, the meanings and social function of work go well beyond the sole provision of income. *Work, going to work, working* is intrinsically connected to existence and also to identity (Gini, 1998). Looking ahead, the younger generations might be changing the meanings of work when, for example, young people are increasingly seeking work beyond the *pay check* - emphasising purpose and self-fulfilment instead, which may contribute to transforming the role of income.

Bailey and Madden (2016) propose a series of qualities that make work purposeful beyond mere instrumental aspects, i.e. “*when an individual perceives an authentic connection between their work and a broader transcendent life purpose beyond the self*” (Bailey & Madden, 2016, p. 15). In policy documents and political discourse these other functions of work are explicitly framed as a right, as

an aspiration, or even as a condition for individual freedom, social inclusion⁶, and in the whole, a stabilising element of society.

Institutions like the International Labour Organization (ILO) frame work as having a purpose and meaning well beyond the subsistence dimension:

“Decent work sums up the aspirations of people in their working lives. It involves opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men” (ILO, 2015).

The *Charter of Fundamental Rights of the European Union* (European Commission, 2000)⁷, consecrates in its Article 15, the *“Freedom to choose an occupation and right to engage in work”*, namely:

1. ***Everyone has the right to engage in work and to pursue a freely chosen or accepted occupation.***
2. ***Every citizen of the Union has the freedom to seek employment, to work, to exercise the right of establishment and to provide services in any Member State.***
3. ***Nationals of third countries who are authorised to work in the territories of the Member States are entitled to working conditions equivalent to those of citizens of the Union.***

In this study we also try to explore those meanings with the actors involved in the research that we will describe in the next sections.

1.3 What is the *Maker Movement*?

The expression *Maker Movement* refers to a relatively recent phenomenon that has been gaining momentum in the last decade. Researchers trace its origins in the 1970s counterculture, when personal computers and the availability of latest technologies began to be seen as free time activity and opportunity of social emancipation (Lindtner, Hertz, & Dourish, 2014). Today, the typical activities of the *Maker Movement* range from the re-creation and assembly of products by using low-cost or broken electronics and raw (including biological) materials to the employment of new technologies such as 3D printing and laser cutting for the prototype stages. All activities have in

⁶ The EU agenda for growth and jobs prioritises smart, sustainable and inclusive growth to strengthen the EU structure. Inclusion is a term often used in the vision of the EU to refer to priorities of designing a future in which inequalities are reduced, social exclusion is eliminated and inclusive spaces are created - *“All those living in Europe, without exception, should have equal opportunities to adjust to the demands of social and economic change and to participate actively in the shaping of Europe’s future”* (Commission of the European Communities, 2000).

⁷ Every worker in the European Union has minimum rights, which include health and safety at work, equal opportunities for women and men, protection against discrimination and protection under labour law. These are governed by national laws and directed by employment laws by the European Union. This discussion, albeit very relevant for a reflection about the futures of work is however, out of the scope of this report.

common a strong do-it-yourself (DIY) orientation adopting a *hands-on* approach whereby learning emerges as the consequence of in person engagement (Blikstein, 2013; Martin, 2015). The *open-source* paradigm inspires projects development and sharing, which, independently of their success, are often made available on-line to the whole community.

FabLabs, Hackerspaces and Makerspaces can be seen as the physical representations of the *Maker Movement* but there are other expressions of the movement, such as in the concept of Open Source Ecology⁸. These spaces seek to provide communities, businesses and entrepreneurs with the infrastructures and manufacturing equipment indispensable to turn their ideas and concepts into reality. Table 1 offers a description of these spaces.

Table 1: What are FabLabs, Hackerspaces and Makerspaces?

FabLabs

FabLabs (shorter for Fabrication Laboratories) are spaces where people can meet, exchange ideas and collaborate with the common purpose of design and digitally manufacture custom built objects. The concept was developed by Neil Gershenfeld (2005) from the Center for Bits and Atoms (CBA) of the Massachusetts Institute of Technology (MIT), initially with the aim to explore the implications and applications of personal fabrication in those parts of the world that cannot easily have access to tools for fabrication and instrumentation. Hence, the first FabLabs were created in rural India, Costa Rica, northern Norway, inner-city Boston and Ghana. A distinctive feature of FabLabs is that they must comply with the Fab Charter⁹. Moreover, FabLabs have at their core the same hardware and software capabilities, making it possible for people and projects to be easily distributed across them. FabLabs are supported by a global FabLab association¹⁰, responsible for the dissemination of the FabLab concept as well being the connection point between the various FabLabs across the world. The FabLab association objectives also comprise the promotion of collaboration among FabLabs, the share of expertise, the brainstorm of ideas, and the spread of research. FabLabs are commonly set up in the context of an institution, be that a university, a company or a foundation.

Hackerspaces

Hackerspaces (see for instance, Pettis, Schneeweisz, & Ohlig, 2011) are typically setup from within a community for the community, thus being community-funded and community-managed spaces. The concept behind hackerspaces started in Berlin, Germany and can be traced back to the late Eighties, yearly Nineties, when the first hackerspaces were founded: the *Chaos Computer Club Berlin* and *c-base Berlin*. The idea was to have a non-repressive physical space where people interested in programming and tinkering with technology could meet, work, and learn from each other. As the spaces grew in popularity, the terms *hacking* and *hacker* became broader, going beyond programming activities to include physical prototyping and electronics. An effort has also been made to distance these spaces from the largely negative connotations of the term *hacking* presented in the mainstream media. Each hackerspace can be seen as a unique space in the sense that it has its own organisation, structure, ideology and focus. More than providing the hardware tools and manufacturing

⁸ <https://www.opensourceecology.org/> (last access: 8 February 2018).

⁹ <http://fab.cba.mit.edu/about/charter/> (last access: 8 February 2018).

¹⁰ <http://fablabinternational.org/> (last access: 8 February 2018).

equipment, they provide the learning environment and the necessary support for individuals to develop their projects based on their own interests. Hackerspaces are also all completely independent from each other's, although collaboration between spaces is common.

Makerspaces

The term Makerspaces was originally associated with MAKE Magazine (Cavalcanti, 2013), often in the context of creating tinkering-spaces for children. However, in the last years, the concept became more widespread, going beyond the MAKE Magazine trademark spaces. The concept started to be commonly used by practitioners to refer to any generic space (often also including FabLabs and Hackerspaces) that promoted active participation, knowledge sharing, and collaboration among individuals through open exploration and creative use of technology (*i.e.* through tinkering and making). In this sense, makerspaces do not comply with a pre-defined structure and indeed do not need to have a pre-defined set of personal fabrication tools (or for that matter, any of them to be considered a makerspace). The focus is on having a publicly-accessible creative space that explores the maker mind-set and tinkering-practices.

For the purposes of this report, the term makerspace is inclusive of FabLabs and Hackerspaces, representing collaborative community spaces that respond to the overall characteristics above described.

In academic literature, the *Maker Movement* has been investigated as representative of new forms of education (Kurti, Kurti, & Fleming, 2014; Litts, 2015; Sheridan et al., 2014), STEM¹¹ consolidation (Barton, Tan, & Greenberg, 2016; Bevan, 2017), innovation (Barrett, Pizzico, Levy, & Nagel, 2015; Kera, 2014; Pepler & Bender, 2013), design thinking (Crichton, 2014), and in connection to DIY science (Nascimento, Guimarães Pereira, & Ghezzi, 2014). In recent times, institutions have demonstrated growing interest in the *Maker Movement* with public and private investment to spur innovation through bottom-up approaches (O'Leary, 2012). As an example, *Makerstown*¹² is an event supported by the European Commission happening every year that much resembles a makers' fair: besides showcasing projects and new technologies, particular attention is given to discussing how to place the world of *making* in the EU agenda; the event has dedicated panels and discussions that bring together makers, entrepreneurs and policy makers. Additionally, the model of engagement offered by makerspaces is more and more frequently adopted by companies in spin off projects with the scope to innovate and create new problem solving strategies (Passebon, 2014).

More recently, examples are emerging about the participation of the *Maker Movement* in other social initiatives such the collaborative economy: *Maker Mile*¹³ is a London based project that aims at creating a rich economic ecosystem by putting together makerspaces with tech start-ups, design studios, fabricators, galleries, shops and businesses with the scope of providing reciprocal local support and resources.

A previous study conducted by the authors (see, Rosa, Ferretti, Guimarães Pereira, Panella, & Wanner, 2017) outlined the diffusion of the *Maker Movement* across the European Union (see

¹¹ STEM refers to Science, Technology, Engineering and Maths.

¹² <https://makerstown.eu/> (last access: 8 February 2018).

¹³ <http://makermile.cc/> (last access: 8 February 2018).

Figure 2 and Figure 3), highlighting the types of activities, used tools and community strategies of more than 800 spaces.

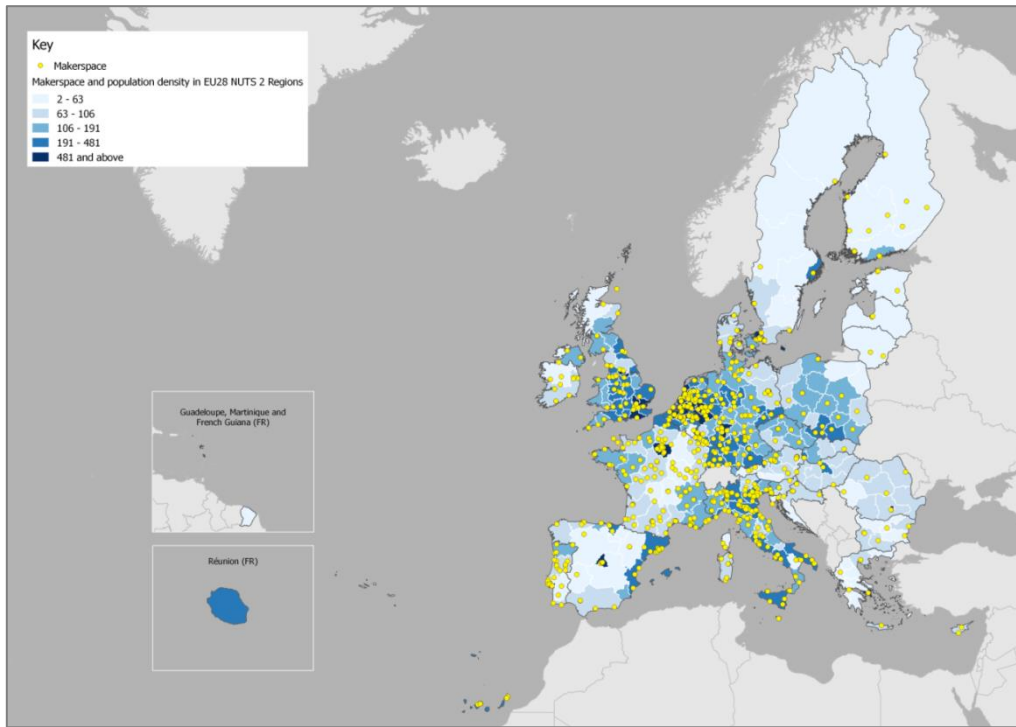


Figure 2: Geographic location of the Makerspaces in EU28 superimposed to the population density in EU28 NUTS 2 Regions. Source: (Rosa et al., 2017).

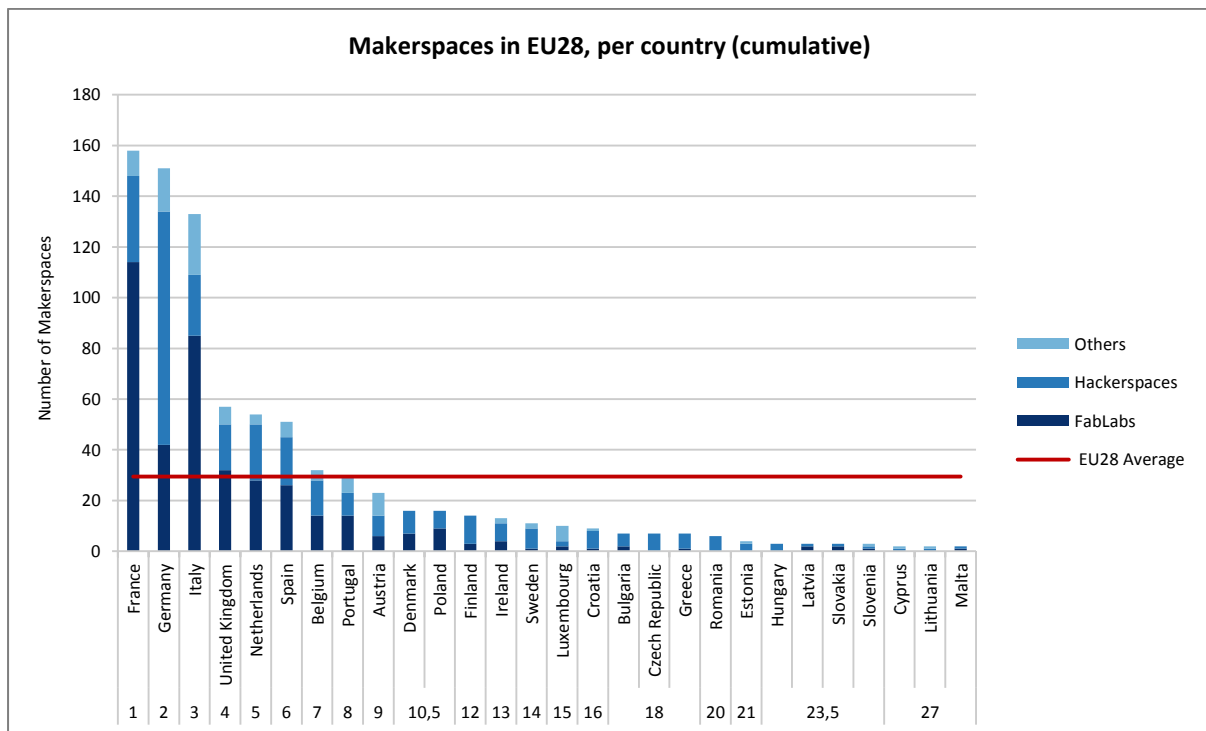


Figure 3: Total number of Makerspaces in EU28, listed by country and typology (cumulative). Source: (Rosa et al., 2017).

The data collected beyond providing an initial glimpse of the dimension of the *Maker Movement* in the European Union, showed that this is not a homogeneous movement, both in terms of spatial distribution and identity. Western European countries have a higher number of makerspaces with France, Germany and Italy accounting for more than half of the makerspaces in EU. It is also interesting that all major capital cities in EU have at least one makerspace, illustrating the spatial spread of the movement to all countries in the EU and pertinent cities.

In the context of the current report, the emergence of makerspaces is enabling new models of education, collaborative work, and manufacture. These spaces function as multidisciplinary learning environments that stimulate new ideas and concepts for products, accelerating invention and design cycles (and thus function as tech incubators). This is mainly possible due to, *i)* the digital fabrication technologies (3D printers, laser cutters, CNC milling machines) available at these spaces, and *ii)* the collective knowledge of the *maker* community. In this new manufacture model, we witness as well a shift in the nature of the producer, *i.e.* back to the small and skilled producer. The accessibility and affordability of personal fabrication technologies renders everyone potential producers, introducing a decentralised and highly customised manufacture model. *Makers* are increasingly becoming entrepreneurs, leading the development of rapid prototyping 3D printers, autonomous robots, and other digital smart devices. Indeed, a number of successful companies (worldwide) already emerged from these spaces. Notable products include the MakerBot¹⁴ and Ultimaker¹⁵ 3D printers, the Pebble¹⁶ smartwatch, and the Arduino¹⁷ electronics prototyping platform. Though, is there significant job creation through makerspaces? Is this tinkering re-inventing the futures of work?

We would like also to highlight the role of makerspaces on emerging education models. These spaces allow for new curricula to develop, as well as for a practical application of theoretical concepts learnt at school, being also an opportunity for students to become part of a community of practice and become more interested in STEM disciplines. The aim is to enhance existing practices and expertise by transforming education from a passive activity to one more experimental and connected to real world. Is *learning by making* an important component in the modernisation of education? What do youth learn through making? And, to what extent can interest-driven, hands-on learning contribute to fill the skills gaps in the labour market? These were just some of the questions we faced when exploring how the concept of *learning by making* can be an added-value in the learning process and the acquisition of skills (for instance, the importance of failure to the creative process and professional development).

The authors of this report believe that it is worthwhile exploring how makerspaces can thrive as inclusive platforms able to prepare citizens with transferable and tangible skills, as well as how makerspaces are contributing to redefining the futures of work as practices. In particular, we are interested to explore how those practices could empower citizens by providing access to technology and equipment, networks, and spaces.

Finally, what kind of societies and values does the *Maker Movement* promote? The *Maker Movement* has the potential to change and shape the world in small but significant ways, by nurturing the creation of *tinkering* environments in which individuals engage and adapt their

¹⁴ <http://www.makerbot.com/> (last access: 8 February 2018).

¹⁵ <https://ultimaker.com/> (last access: 8 February 2018).

¹⁶ <https://www.pebble.com/> (last access: 8 February 2018).

¹⁷ <https://www.arduino.cc/> (last access: 8 February 2018).

physical world in a meaningful way through *making* and *hands-on* practices (Enderle & Patrick E. Murphy, 2015; Wilkinson & Petrich, 2014). Makers' access and freedom to cutting-edge technology puts responsibilities upfront. It becomes important not only to think about what we can do with these tools but also to reflect on what we ethically should indeed do¹⁸. Since the *Maker Movement* is still growing in its reach, encompassing a very different range of actors, practices and purposes, the ethics by which it can operate is not homogeneous. We can say that the ethics of the *Maker Movement* is in the making.

¹⁸ In the specific case of 3D printing, it is already visible various implications of the technology under social-legal contexts, namely related to intellectual property (IP), product liability, gun laws, data privacy, and fundamental/constitutional rights (see Daly, 2016).

2 Methodology

The work presented in this report is based on the application of qualitative social research methodologies, which helped with getting insights and imaginaries from the *Maker Movement* communities that we could engage with. A series of in-depth interviews and three focus groups in different EU Member States were conducted. The remainder of this section describes the applied methodology.

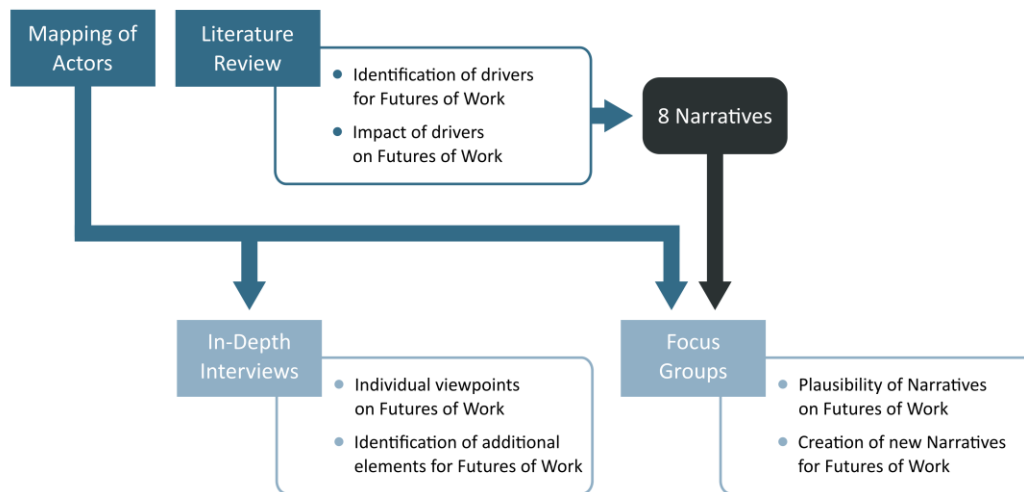


Figure 4: Research methodology.

2.1 Literature Review Methodology

In order to explore and analyse what are the diverse discourses about the futures of work, we have followed a two-step approach. We have first used the *Altmetric* search tool¹⁹ in order to understand in which discourses the debate about futures of work became prominent, followed by a literature review focusing on identifying drivers²⁰, impacts, and competences/skills in relation to the future of work in a diversity of information sources: from policy reports and briefing notes, to scientific articles, newspapers articles, non-fiction books, and institutional reports. In both instances, the searches were conducted in English. The outcomes of the literature review, which was finalised in September 2017, are summarised and synthesised in section 3, Table 2.

¹⁹ <https://www.altmetric.com/> (last access: 8 February 2018).

²⁰ The term *driver* is short for driving forces, commonly used in scenario work. It represents the key factors, trends or processes that have an effect on the situation, strategic decisions or policies and that could propel the system forward conditioning the story's outcome. In the words of Gallopín (2012) "Some of these forces are 'invariant' (e.g. they apply to all scenarios) and to a large extent predetermined. Some of the driving forces may represent 'critical uncertainties', the resolution of which can fundamentally alter the course of events. These driving forces (or drivers, for short) influence but do not completely determine the future. Thus, while the initial state of the drivers is the same in all scenarios, the trajectory of the system follows a different course in each one."

2.2 In-depth Interviews Methodology

A total of 16 in-depth semi structured interviews, averagely half an hour long each, were carried out between June 2016 and March 2018.

The contact pool of interviewees was first informed by two JRC reports on DIY science (Nascimento et al., 2014; Ravetz, Guimarães Pereira, & Nascimento, 2015) and a third one put together in 2017 that maps the *Maker Movement* in the European Union (Rosa et al., 2017) through establishing a database of over 800 spaces in Europe. Given the heterogeneity of the retrieved spaces (dimensions, interest, sustainment schemes, etc.) interviewees were selected in order to cover, as much as possible, instances of this variety. Therefore, the final list of interviews included founders, managers and members of FabLabs (5), Hackerspaces (5) and other types of Makerspaces (4), as well as entrepreneurs associated with the movement (2). People were invited to take part to our study through informal written communication addressed to the informative mailbox of the relevant makerspace. In few cases, we were redirected to third persons. The majority of interviewees had a scientific background (university students, researchers, technology experts) or previous experience in start-ups and IT related activities. Although we sought to have a gender balance at the stages of selection and communication, this proved to be impossible: from the total number of respondents, 14 were males. While the interviewed founders are typically full time employed within the space's activities, other interviewees are only part-time active and typically have other jobs and occupations.

The interview guide was divided into three phases: (i) personal experiences around the topic of work and the *Maker Movement*, (ii) how and which skills are acquired through *making* and how they are fostered by the community, (iii) implications of the *Maker Movement* in the futures of work and drivers of change. For example, interviewees were asked whether *makerspaces* provide employment, or if relationships with other job providers institutions were sought, or yet if *makerspaces* have a role on personal development in view of working and getting employed. Overall, the interviews tried to explore how the *Maker Movement* is shaping or being shaped by work trends and futures.

All interviews were transcribed and analysed by identifying recurring stances, similar themes and patterns as discussed by interviewees. Results are discussed in section 4.1.

2.3 Focus Groups Methodology

Three focus group sessions were organised and moderated by the authors in three different countries of the European Union: Italy, Belgium and Spain. The participants were selected and invited based on their connections with the *Maker Movement* and in particular, with *makerspaces* in the regions where the focus group took place (the only selection criterion applied): Milan in Italy, Brussels in Belgium and La Laguna in the Tenerife Island, Spain²¹. Even if all participants were in way or the other connected to the *Maker Movement*, not all were makers. In the case of the focus group

²¹ Other focus groups in other Member States and Switzerland were planned but unfortunately, as we write this report those meetings could not take place because of unavailability of participants.

carried out in Milan, it is remarkable that most of the participants had established professional relationships with mainstream industries.

Again in the focus groups, we tried to have a gender balance by contacting women active in makerspaces, yet very few women took part in the groups²². Participants' age was between 30 and 50 years old.

None of the participants in the focus groups contributed to the first phase of the research (*i.e.* to the in-depth interviews). The meetings lasted typically 2 hours and a half. Although we have sought to organise all focus groups in makerspaces, this was only possible in the focus group organised in La Laguna, which was organised in the FabLab of the University of La Laguna. The Brussels' focus group was held in a European Commission building, specifically at the headquarters of the Joint Research Centre; the Fondazione Bassetti hosted the Milan focus group.

The full agenda of the focus group is available in the Annex section of this report. The focus groups in Italy and in Spain were conducted in the official language of the country²³, whereas the Focus Group in Brussels was conducted in English. We have employed a mix of material and discursive methodologies to introduce or trigger conversation about the themes that we were interested to explore. Eight narratives identified beforehand (see section 3) were presented to the participants of the focus groups to gather their views on their political, social, economical, geographical and temporal plausibility and desirability. The narratives (in text format) were worked on in pairs, each pair examining two narratives. This was followed by a discussion of drivers of futures of work that are specific to the action of makerspaces or that could inspire futures of work overall. The session ended with a discussion of a possible narrative for work futures elaborated collectively by participants (see section 6).

What is a Focus Group?

Focus groups are a social research method that may be seen as a form of group interview aiming at exploring a topic of concern, as well as to ascertain participants' opinions with regards to the topics addressed, possibly understanding if those positions change with the discussions. FGs are sometimes used to identify attitudes, feelings, beliefs, experiences, and reactions that would not be possible to collect using other social research methods, such as media analysis, and in-depth interviews.

Focus groups are usually composed of six to eight participants. The criteria to select participants are established a priori.

²² The underrepresentation of women in makerspaces is a matter also documented by other scholars (Carstensen, 2013; S. Fox, Ulgado, & Rosner, 2015; Guthrie, 2014). Evidence suggests that it is an issue rooted in the wider context of similar imbalances perceived in the participation of girls and women in STEM related studies and careers. Prejudices, assumptions and bias about male and female STEM skills are paramount to perpetuating the underrepresentation, linked with direct and indirect discouragement from peers (Guthrie, 2014). Yet, in a study conducted by Bean, Farmer, & Kerr (2015), the women participating in a focus group addressing this issue, pointed out that they did not perceive gender barriers to their participation in makerspaces and felt welcome in most activities.

²³ Extracted quotes have been translated and edited by the authors.

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3 Exploring the Futures of Work

The topic *future of work* has been progressively becoming mainstream *inter alia* in intergovernmental economic discourse, in private consultancy and progressively more frequently, in the media²⁴. A similar tendency is also noticeable in policy contexts, with increasing accounts, analytics and programs centred on this issue. The special issue on the future of work of the European Political Strategy Centre (EPSC)²⁵ and the analysis of the UK's Commission for Employment and Skills²⁶ are some examples.

Relying on the *Altmetric* online search tool, which tracks a range of online outlets including mainstream media, policy documents, social and academic networks, we performed searches to assess the online interest about the topic of the *future of work*.

Figure 5 shows contextualised mentions to the *future of work* over time in policy documents while Figure 6 refers to social media, where such increase is even more evident.

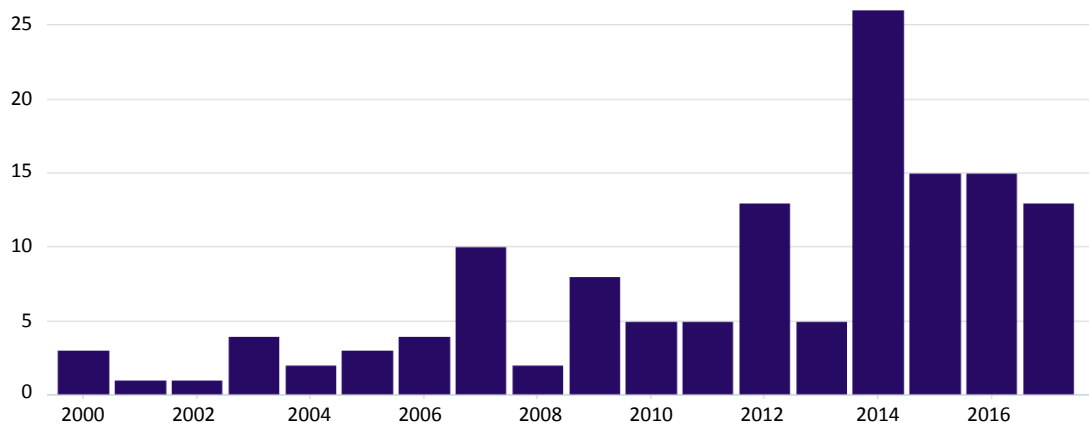


Figure 5: Number of mentions to the 'future of work' on policy documents, per year²⁷.

²⁴ For example, in 2016, The Guardian launched a dedicated series on the topic of the future of work. See: <https://www.theguardian.com/careers/series/future-of-work> (last access: 9 February 2018).

²⁵ http://ec.europa.eu/epsc/publications/strategic-notes/future-work_en (last access: 9 February 2018).

²⁶ <https://www.gov.uk/government/publications/jobs-and-skills-in-2030> (last access: 9 February 2018).

²⁷ From Altmetric.com, queries specification upon request (Retrieved on 26 January 2018).

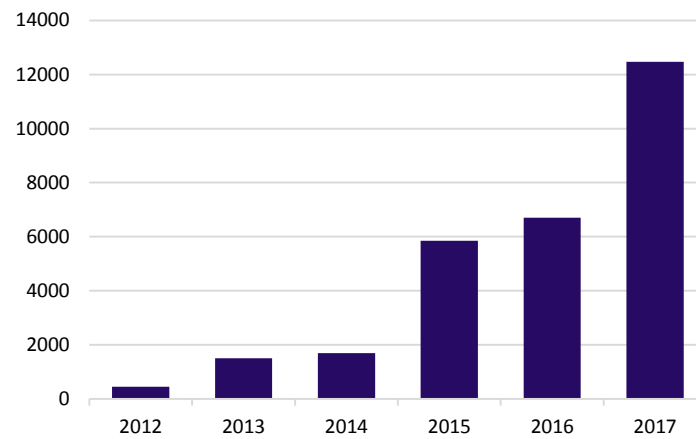


Figure 6: Number of mentions to the 'future of work' on social media, per year²⁸.

3.1 Summary of Findings from the Literature Review

In the second phase of our enquiry, we investigated closely in which terms experts in the fields of work and employment tackle the topic of the future of work. As described in section 2.1, we analysed a collection of influential accounts in media, policy, and academia by public and private institutions. Table 2 provides an overview of the main dimensions of analysis therein offered.

²⁸ From Altmetric.com, queries specification upon request (Retrieved on 26 January 2018). Authors own calculations.

Table 2: Literature review analysis.

Source:	Typology:	Drivers:	Impact in:	New competences/skills required:
World Economic Forum (World Economic Forum, 2016)	Report	<p><u>Socio-Economic Drivers</u></p> <ul style="list-style-type: none"> - Changing work environments and flexible working arrangements (e.g. remote working and co-working); - Rise of the middle class in emerging markets; - Climate change, natural resource constrains and the transition to a greener economy; - Rising geopolitical volatility; - New consumer concerns about ethical and privacy issues; - Longevity and ageing societies; - Young demographics in emerging markets; - Women's rising aspirations and economic power; - Rapid urbanisation. <p><u>Technological Drivers</u></p> <ul style="list-style-type: none"> - Mobile internet and cloud technology; - Advances in computing power and Big Data; - New energy supplies and technologies; - The Internet of Things; - Crowdsourcing, the sharing economy and peer-to-peer platforms; - Advanced robotics and autonomous transport; - Artificial intelligence and machine learning; - Advance manufacturing and 3D printing; - Advances materials, biotechnology and genomics. 	<ul style="list-style-type: none"> - Global decline in total manufacturing and production roles driven by labour-substituting technologies; - Decrease in sales and related jobs due to automation of check-out processes and smart inventory management; - Big employment decline in office and administrative roles; - Strong employment growth towards online shopping and the application of Big Data analytics to derive and act upon insights from customer data and preferences; - Strong employment growth in the computer and mathematical job family; - Sharing economy may have the potential to radically transform the way work is organised and regulated in certain job families. 	<ul style="list-style-type: none"> - Complex problem solving skills; - Social skills: <ul style="list-style-type: none"> - Coordinating with others; - Emotional intelligence; - Negotiation; - Persuasion; - Service orientation; - Training and teaching others. - Process skills: <ul style="list-style-type: none"> - Active listening; - Critical thinking; - Monitoring self and others. - System skills: <ul style="list-style-type: none"> - Judgement and decision making; - System analysis. - Cognitive abilities: <ul style="list-style-type: none"> - Cognitive flexibility; - Creativity; - Logical reasoning; - Problem sensitivity; - Mathematical reasoning; - Visualisation. <p>The Future of work will be characterised by a constant change in the skills that employees need and a shortened shelf-life of employees existing skills.</p>
Mckinsey & Company (Manyika, Chui, et al., 2017)	Report	<ul style="list-style-type: none"> - Automation (technological advances in robotics, artificial intelligence and machine learning). 	<ul style="list-style-type: none"> - Physical activities in highly structured and predictable environments; - Collection of data; - Processing of data. <p>Impact in activities related to:</p> <ul style="list-style-type: none"> - Manufacturing; - Accommodation; - Food service; - Retail trade. 	<ul style="list-style-type: none"> - Basic skills in STEM fields; - Creativity; - Critical thinking; - Systems thinking; - Logical thinking; - Problem solving; - Social and emotional capabilities. <p>The report forewarns that new education and training possibilities are required.</p>

Source:	Typology:	Drivers:	Impact in:	New competences/skills required:
Organisation for Economic Co-operation and Development (OECD, 2017)	Report	<ul style="list-style-type: none"> – Technological progress; – Demographic change; – Globalisation; – Value changes. 	<ul style="list-style-type: none"> – Automation of an increasingly number of routine and non-routine tasks traditionally performed by humans; – Relocations of labour and resources across sectors and occupations; – Shift of jobs opportunities due to offshoring and services outsourcing; – Increasing blur between work and personal life: gradual move from <i>work-life balance</i> towards <i>work-life integration</i>; – Polarisation into high-skilled/high paying jobs and low-skilled/low paying jobs, and disappearance of mid-level jobs). 	<ul style="list-style-type: none"> – <u>Soft Skills</u>: <ul style="list-style-type: none"> – Effective communication; – Team work; – Leadership; – Problem solving; – Self-organisation; – <u>Digital skills</u>: <ul style="list-style-type: none"> – Overall IT literacy. <p>Need for high-quality initial education and training, but also good skills assessment and anticipation systems, as well implementation of modern systems of lifelong learning.</p>
Organisation for Economic Co-operation and Development (OECD, 2016)	Policy Brief	<ul style="list-style-type: none"> – Digitalisation; – Globalisation; – Offshoring. 	<ul style="list-style-type: none"> – Profound change in skill profile of jobs; – Decrease in the duration of skills shelf-life. 	<ul style="list-style-type: none"> – Solid literacy, numeracy and problem solving skills; – Autonomy, co-ordination and collaborative skills; – Socio-emotional skills; – Basic ICT skills (for non-ICT specialists).
Mckinsey & Company (James Manyika, 2017)	Briefing Note	<ul style="list-style-type: none"> – Cross-border Migration; – Automation enabled by technologies (robotics and artificial intelligence); – Services on digital platforms. 	<ul style="list-style-type: none"> – Predictable physical work (<i>e.g.</i> in manufacturing, retail trade, accommodation and food services); – Data processing (<i>e.g.</i> in retail trade, finance, and insurance); – Data collection (<i>e.g.</i> in manufacturing, transport, warehousing, and utilities); – Unpredictable physical work (<i>e.g.</i> in agriculture, and construction); – Stakeholder interactions (<i>e.g.</i> accommodation and food services, retail trade, wholesale trade, finance and insurance). 	<ul style="list-style-type: none"> – Technical skills such as STEM subjects; – Soft skills such as communication, team work, and punctuality; – IT literacy: <ul style="list-style-type: none"> – IT development; – App creation; – Hardware manufacture; – IT system management; – Data analysis and statistics.

Source:	Typology:	Drivers:	Impact in:	New competences/skills required:
PWC (PWC, 2014) (Carol Stubbings, Williams, & Brown, 2017)	Briefing Note and Report	<ul style="list-style-type: none"> – Technology breakthroughs; – Resources scarcity and climate change; – Shifts in global economic power; – Demographics shifts; – Rapid urbanisation. 	<ul style="list-style-type: none"> – Need to create ever more sophisticated people measurement techniques to monitor and control performance and productivity; – Increasing importance of social capital and relationships as the drivers of business success; – The boundary between work and personal life disappear as companies assume greater responsibility for the social welfare of their employees. 	<ul style="list-style-type: none"> – STEM skills; – Emotional intelligence; – Creativity; – Persuasion; – Innovation; – Problem solving; – Empathy; – Leadership.
Research Institute of the Finnish Economy (Kauhanen, 2016)	Briefing Note	<ul style="list-style-type: none"> – Technological change (ICT and robotics); – Offshoring. 	<p><u>Tasks subject of computerisation</u></p> <ul style="list-style-type: none"> – Expert thinking (e.g. professional occupations that require creative problem solving): harder to automate but computers can increase productivity; – Complex communication (e.g. sales and management occupations): harder to automate but computers can increase productivity; – Cognitive routine tasks (e.g. simple clerical tasks): can be completely automated; – Manual routine tasks (e.g. product assembly in factories): can be completely automated; – Manual non-routine tasks (e.g. cleaning a building or driving a car): cannot be automated now but as technology progress many of these tasks will become routine manual tasks. <p><u>Tasks easily offshorable</u></p> <ul style="list-style-type: none"> – Clerical support workers; – Craft and related trade workers; – Plant and machine operators. 	<ul style="list-style-type: none"> – Demand for abstract skills will increase, especially in STEM fields; – The demand for different types of skills will evolve rapidly (the renewal of skills will be critical).
(Ford, 2015)	Book	<ul style="list-style-type: none"> – Automation/technological advances; – Advancing information technologies. <p>Also mentioned:</p> <ul style="list-style-type: none"> – Globalisation/Offshoring; – Aging population; – Climate change and resource depletion. 	<p>Impact in every industry in existence.</p> <ul style="list-style-type: none"> – Routine, predictable work; – Non-routine work; – High-skill, knowledge based work; 	<ul style="list-style-type: none"> – The acquisition of more education and skills will not necessary offer protection against job automation in the future.

Source:	Typology:	Drivers:	Impact in:	New competences/skills required:
(Frey & Osborne, 2017)	Scientific Article	<ul style="list-style-type: none"> – Computerisation/computer-controlled equipment drawing upon recent advances in robotics and machine learning (including machine vision, data mining, computational statistics and other sub-fields of artificial intelligence). 	<ul style="list-style-type: none"> – Routine manufacturing tasks (results in shift of middle-income manufacturing jobs to low-income service occupations); – Non-routine cognitive tasks (development of algorithms that allow the processing and analysis of larger amounts of information in the health care, legal or financial sector; or in occupations that require judgment, as the unbiased decision making of an algorithm represents a comparative advantage over a human operator); – Non-routine manual tasks (e.g. automation of transports and logistics (autonomous driverless cars)). 	<ul style="list-style-type: none"> – Creative intelligence; – Social intelligence.
(Basmer et al., 2015)	Scientific Article	<ul style="list-style-type: none"> – Information and Communication Technologies; – Manufacturing Technologies. 	<ul style="list-style-type: none"> – Manufacture and production of goods: <ul style="list-style-type: none"> – <u>Open Production</u>: Democratisation of production through the implementation of open source hardware, open source design and open source software. Companies open their value creation processes, structures and artefacts. The value creation process is cooperative (among many different stakeholders), decentralised and self-organised. Stakeholders are able to become producers (prosumers); – <u>Micro-Factories</u> (e.g. FabLabs): Enable anyone to manufacture almost anything as they represent small production systems. 	
(Rakowska & Cichorzewska, 2016)	Scientific Article	<ul style="list-style-type: none"> – Globalisation; – Development of advanced technologies (mainly ICT); – Migrations; – Cultural changes (e.g. values). 		<ul style="list-style-type: none"> – Sense-making; – Social intelligence; – Novel and adaptive thinking; – Cross-cultural competency; – Computational thinking; – New-media literacy; – Transdisciplinarity; – Design mindset; – Cognitive load management; – Virtual collaboration.

Source:	Typology:	Drivers:	Impact in:	New competences/skills required:
Deloitte (Hagel, Schwartz, & Bersin, 2017)	Article	<ul style="list-style-type: none"> – <u>Technological advances</u> in the areas of robotics, artificial intelligence, sensors and data; – <u>Demographic shifts</u> in the global workforce; – <u>“The power of pull”</u>, i.e. the ability to find and access people and resources when and as needed (rise of global talent markets). 	<ul style="list-style-type: none"> – Advances in digital technologies are remaking not just manufacturing and low-skilled labour but every sector of the economy and society: routine tasks will be increasingly automated, while technology-aided creative work expands; – Intensification of the intergenerational competition for jobs: enhanced longevity results in older generations working for longer periods, thus affecting the pace at which younger talent and ideas renew organisations; – Growing fragmentation of product and service businesses, with small companies employing more of the overall labour force. 	<ul style="list-style-type: none"> – Reconfiguration of jobs to leverage uniquely human skills: <ul style="list-style-type: none"> – Empathy; – Social and emotional intelligence; – Ability to set context and define business problems. – Need for individuals to continually learn new skills to remain employable (lifelong learning).
The Guardian (K. Fox & O’Connor, 2015)	News article	<ul style="list-style-type: none"> – Collaborative work environments; – Technological advances in the fields of automation, artificial intelligence, and machine learning; – Gig economy. 	<ul style="list-style-type: none"> – <u>Collapse of the corporate ladder</u>: Several layers of management will be lost in favour of a more grid-like structure, where ideas flow along multiple paths (more collaborative and flexible work environment). – <u>Automation in the workplace</u>: Robots and intelligent computer systems are going to absorb all routine aspects of jobs. Furthermore, the current availability of data of all kinds along with the growing ability to interpret it is going to enable a lot of things that were not able before. – <u>Human cloud</u>: Global pool of freelancers available to work on demand from remote locations (freelancers are invited to bid for work). – <u>Workplace monitoring</u>: Companies will increasingly monitor their employees, where they are but also how they are feeling. – <u>End of retirement</u>: People will work longer, and will stop work gradually rather than abruptly upon reaching retirement age. 	

Table 2 literature review was finalised by September 2017.

3.2 Eight Narratives on the Futures of Work

We coded and extracted the main recurring themes as they emerge in the various contributions, deriving a subset of eight thematic streams, which we hereon refer to as *narratives* (summarised in Table 3). The narratives were used in our social research enquiry in order to explore their desirability and plausibility as well as, how the maker community sees their relevance in their perspectives about futures of work. The next sections examine these narratives from the makers’ perspectives.

What is a Narrative?

In policy, a narrative can be conceptualised as the perspective of a certain narrator, and it is therefore made of certain temporal and spatial structures where actors and subjects exist along particular rationales, in most cases in the context of an established causal relationship problem-solution (Mosher, Bal, & van Boheemen, 1987). Therefore, a narrative does not exclusively coincide with a specific socioeconomic phenomenon, but also provides a framework for actual action and, therefore, policy implementation. Dominant narratives often influence the selection of policy alternatives against others. We extensively reported on this subject in a former report entitled “New narratives for innovation” (Guimarães Pereira, Saltelli, & Tarantola, 2015).

Table 3: List of Narratives discussed in the Focus Groups.

Narrative 1	<p>Automation</p> <p><i>The continuous advances in robotics and machine learning/artificial intelligence fields lead to the complete automation of all routine manufacturing tasks in production occupations and to quasi-complete automation of non-routine manual tasks in transports and logistics, and of non-routine cognitive tasks in health care, legal and financial sectors. The increased automation maintains productivity levels high but employment levels low.</i></p>
Narrative 2	<p>Globalisation</p> <p><i>Globalisation further impacts the work environment, leading to the widespread implementation of alternative work arrangements like remote freelancing and on-demand work. As a result, available work is reconfigured to task-based formats and short-term projects. This non-traditional type of work provides less schedule certainty but noticeably more flexibility than traditional, full-time, fix schedule jobs. A global pool of freelancers will earn their income through a series of temporary gigs, available in digital platforms, based on their bid for the work.</i></p>
Narrative 3	<p>Micro-Factories</p> <p><i>The widespread of Micro-Factories such as FabLabs, leads to the democratisation of innovation and production. These small production systems allow anyone to manufacture almost anything: new products and startups are easily created based on open source hardware, open source design and open source software principles. Consumers also become producers (prosumers).</i></p>

Narrative 4

Sharing Economy

The spread of sharing platforms like Uber, Airbnb, and 3D Hubs drastically expands the access to products, services and talent beyond one-to-one or singular ownership, giving people the opportunity to make a market from their under-utilised skills. Jobs multiply as new and novel platforms are invented on which people define their own work and careers based on acquired reputation.

Narrative 5

New Skills

The impact of technology and innovation on employment creates a paradox on job requirements and crucial skills. The rapid progress witness in the work environment means that employees are required to adapt their skills set. There is not only a demand for different types of skills that evolves rapidly but also employees existing skills shelf-life is drastically shortened. In addition, there is a growing separation between the necessary skills for a specific job and the ones taught in schools and universities. There is a lack of technical skills such as STEAM subjects, leading to problems in hiring qualified staff.

Narrative 6

Green Economy

The increasing effects of Climate Change and the depletion of natural resources ultimately lead to the transition to a greener economy. Social responsibility dominates the agenda and the economic process is restructured towards a circular model in which resources are reused repeatedly. Moreover, waste materials or unwanted products are transformed into new materials or products of better quality or of better environmental value. Novel jobs aimed at bringing materials from the waste stream back into the mainstream with an added economic value flourish and boost the economy.

Narrative 7

Ageing

Advances in medicine increase the life expectancy of people, creating a pressing burden in governments in maintaining and affording the pensions of the longer-living population. As a consequence, the compulsory retirement age is abolished and people no longer have a fix retirement age. Elderly people will continue to work in a variety of different work arrangements and patterns, and will stop working gradually, rather than abruptly. On the other hand, younger people face an additional challenge when finding a job as the job market cannot accommodate them.

Narrative 8

Migration

Migration will play a major role in wage distribution: the number of low paid workers will increase, saturating the supply of less paid labour. The gap between under- and over-paid workers further increases and inequality further widens.

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4 Insights and Perspectives from *Makers'* Imaginaries

4.1 Perspectives from the In-depth Interviews

[Interviewer]: “Do you think that makerspaces might offer opportunities for job creation?”

[Interviewee]: “Well, how long is my answer allowed to be? First of all you would have to define what you mean by job creation! I feel that the understanding of what work itself is and how it can be structured is slightly different in communities like ours.”

-- Interviewee 7; April 2017

In this section we analyse the perspectives gathered through the in-depth interviews. All respondents demonstrated great openness and willingness to share their views, somehow confirming their closeness with and interest about debating possible futures of work. Interviewees, however, would not take for granted received meanings of the issues being discussed, including the meaning of *work* as illustrated by the quote above.

Although the vast majority of interviewees see some opportunities for entrepreneurial development within makerspaces, only in few cases, work, jobs and employment and their possible developments in the future are actual concerns or aspirations for the members of the *Maker Movement* that we have interviewed. In fact, throughout the interviews we noticed how participation in the *Maker Movement* is seen as a free time activity. Makerspaces are, as described by our interviewees, places where people gather to cultivate their hobbies and spend time together. For example, some interviewees mention that these spaces are created more “*for your free time and leisure time*” (Interviewee 2). The importance of the hobby side of the spaces is quite evident on the German Hackerspace culture, where the commercial value is even unwanted/refused:

“I know a lot of people who would like to hire the [name of the makerspace], if the [name of the makerspace] would be for hire, but it is not so, it is out of discussion (...) for me and the core group that is active there, it is mainly a hobby”.

-- Interviewee 2; May 2017

The *members of hackerspaces* that we interviewed made a clear demarcation between those spaces and *makerspaces* as the latter are seen as commercial versions of hackerspaces (in the words of a participant, a “*space where they can start their companies*” (Interviewee 2). However, interviewees would agree that even if the goal of *making* is not to drive futures of work, the movement could have some influence on how futures unfold because of their social and cultural underpinnings.

“[Impacting work] is the case, but not the goal, at least for most people here. For the most, it's learning things that are fun or interesting to learn. Developing skills that help you in the future, with your job is probably not the main goal for people here, I would say.”

-- Interviewee 7; April 2017

This and similar quotes suggest that cultural aspects embedded within the *Maker Movement* drive their organisation, practices and aspirations. Some participants are convinced that the maker culture can, in some ways, provide a transformative space in which a series of dimensions that interest the futures of work, are or can actually be experimented.

"We do not believe in employment as a way for the future, but what's interesting is that we deliver the development of skills that could lead people [towards] employment!"

– Interviewee 5; October 2017

Hence, two main narratives are typically articulated by our respondents: on the one hand, makers are mainly seen as carrying out spare time activities, whose implications in the context of work go beyond the scope of the movement itself; jobs related issues are left to the individual. On the other hand, the interviewees claim that skills do form through *making* and members are very likely to be employed professionally. Makerspaces are usually heralded as relevant for social support, thematic exploration, access to technology, individual empowerment and self-efficacy (Taylor, Hurley, & Connolly, 2016).

Two interviewees expressed substantially divergent opinions, highlighting the existence of a substantial overstatement (by institutions and the media) about the potential of the *Maker Movement* to impact social life. These respondents were members of hackerspaces also active in online digital communities, and throughout the interview tended to focus on the cultural aspects of the *Maker Movement*. In their view, society is undergoing radical changes at various levels and the futures of work are looked at as a dimension bound to change in its more fundamental nature, referring to current terms, such as the collaborative, sharing and gift economies²⁹, which entail different organisations of work.

Beyond different views about the ultimate goal of makerspaces, several dimensions were discussed during the interviews, which we coded and summarise below, illustrating with quotes extracted from the interviews recurring arguments that can interest the debate about futures of work, such as *skills*, *entrepreneurship*, and *making as business model*.

4.1.1 Skills

For all interviewees, *making* favours the development of strategic skills that range from material and *hands-on* approaches, and programming, to the capacity of producing new products and services, possibly (but not necessarily) proposing them as marketable innovations. Many interviewees mention that makerspaces are places to *upgrade* one's knowledge and acquire new skills, e.g. "*developing skills that can help you in the future... [and] lead into employment*" (Interviewee 4); and "*we are offering our knowledge for young people*" (Interviewee 7).

Makers frequently describe their activities as *crafting*, *repairing*, *fiddling around* and, *hacking*³⁰. This much reminds about the experiential aspects of the various activities inside makerspaces. Learning

²⁹ Expressions such as *sharing economy*, *gift economy*, *gig economy*, and *collaborative economy* can be referred to with a range of meanings, but in most cases describe economic and social activities and transactions taking place across open-source communities. For a complete account see (Selloni, 2017).

³⁰ The term *hacking* is referred here in its positive connotation, i.e. to engage in activities commonly associated with technology in a spirit of playfulness, tinkering and exploration with the aim to achieve something novel and purposeful.

processes are often based on the *trial and error* mode, whereby the progress and success of specific tasks are socially validated, and above all, fully project based. As one interviewee put it:

"We don't exclusively communicate the success of a project, but even when it's a failure. It can be helpful for others not to make the same mistakes!"

-- Interviewee 7; April 2017

Accessibility to knowledge and community support is seen as an opportunity that emerges as the result of social interaction and open participatory systems. Participants learn how to develop skills and flexibility to face everyday problems:

"Everyone knows something, has some skills that can add to the space. I think this is something very valuable, and I see a lot of opportunities for these kinds of relationships here. I think it has to come from the people themselves."

-- Interviewee 2; May 2017

"(...) in the Fab Lab you will acquire fast adaptiveness to problem solving."

-- Interviewee 4; April 2017

Overall, focus is given more to the educational *project* of many of these spaces. Interviewees widely agreed that makerspaces, together with their experiential potential and their offered social setting, are way more effective than traditional approaches to learning. This is in vein with relevant literature on the topic (see for instance, Bevan, 2017; Kurti et al., 2014; Litts, 2015). The majority of our interviewees are convinced that the skills informally developed through *making* are likely to be applied professionally by individuals:

"It's interesting that that we deliver the development of skills that people could deploy into employment"

-- Interviewee 6; September 2017

4.1.2 Entrepreneurship

While nearly all respondents agree that personal skills develop through *making*, entrepreneurship is not one in which many of the respondents focused. According to the respondents, entrepreneurship is not a stabilised objective for the spaces where they come from. The focus on entrepreneurship seems to depend on the scope of the space. On the one hand, some profess the spread of start-ups and real business inside the community. In this sense, makerspaces are heralded as places for innovation, which can lead to create new products and the development of start-ups. In this way help (indirectly) with creating new jobs (or as an interviewee has put it, to "*help people find their niches*").

"It's possible that inside a Fab Lab a new product, a new idea is developed and then become a real product. So, basically we dedicate some space to incubate start-ups or entrepreneurship"

-- Interviewee 4; April 2017

On the other hand, some other interviewees are convinced that entrepreneurship is quite a separated issue, and that the connection between prototyping and eventual market success is not to be taken from granted:

"(...) it's a long process to prototype and, you know, it's a long process and it's a devious process to penetrate and succeed on a market."

-- Interviewee 1; March 2017

Examples exist about business projects that started in makerspaces and successfully made it to the market, offering job opportunities for their creators:

"So, for example we had some people who were using our machinery back in 2013 and they had in mind a toy company, what they said was that children are the real toy creators. So they made an easy to use Web tool where young kids could go, use simple geometric models to create 3D models. The company, [name of the company] would print those toys on their 3D printers, which the kids themselves designed. It turned out quite as a success!"

-- Interviewee 7; April 2017

4.1.3 Making as a Business Model

Besides favouring personal development and enjoyment, *making* is more and more often adopted by professional companies as a new business model to streamline productive processes. Such trend is acknowledged by our interviewees, who are not new to partnerships with private companies; for example, by outsourcing specific products and services (e.g. consultancy on 3D printing and app development):

"We notice the commercial value of our space, when some companies are trying to get a certificate like "the [name of their organisation] approved" or "the [name of their organisation] has audited our source code"...we reject these requests all times."

-- Interviewee 9; September 2017

"I could give you a couple of examples of companies that we've helped with more than an effort to accomplish their goals."

-- Interviewee 4; April 2017

Due to their characteristics, some sectors more than others are deemed more likely to have collaborations with makerspaces. This is the case of architecture, design and art, which can benefit from the flexibility and velocity of 3D printing to speed up and simplify the prototyping of products and artefacts:

"There's also the community of architects we try to collaborate with. They have certain projects for which they look for places where they can fabricate different stuff, mainly models and prototypes."

-- Interviewee 10; April 2017

In certain contexts, FabLabs are more and more often adopted as companies' spin offs. In most cases they are conceptualised as *innovation laboratories* or *hubs* where people can operate in an open and transdisciplinary environment (see, Passebon, 2014).

As for personal fabrication, what emerges throughout our interviews is quite aligned with what is presented by the media and the scientific literature: personal fabrication is often seen as a promising technology and novel way of democratising the process of manufacture. Such trend could offer the basis for a new wave of industrial revolution to come (Anderson, 2012; Mota, 2011). According to this study, however, we may add that certain sectors (such as design, architecture and prototyping) are considered more likely to be touched upon by such change than others.

Finally, in relation to employment and jobs as arrangements to perform work, interviewees suggested that *employment* might not be the way for the future, as exemplified in these quotes, “*we do not believe in employment as a way for the future*” (Interviewee 1); “*we have to imagine other ways to be useful to society*” (Interviewee 10) and “*people must be able to create their own business*” (Interviewee 12). Yet, in most cases makerspaces do not offer direct jobs, even though, as one interviewee notices: “*I actually found this job here [and] more and more FabLabs are spreading around the world*” (Interviewee 3).

4.2 Perspectives from the Focus Groups

In this section, we are presenting main findings in relation to our research questions explored with participants of the focus groups. The research material obtained from the focus groups is substantially different in nature from the one of the interviews, due to both the richness of individual insights and the discussions among participants. As in any focus group, it becomes a challenge to analyse the outcomes. Therefore, what we choose to analyse here is focused on the following lines from a *makers'* point of view:

1. Plausibility of current narratives of work futures embedded in futures of work debates and discourses;
2. Drivers, values and key elements of imagined work futures; and finally
3. The specific role of *making*, *makers* and *makerspaces* in imagining and performing futures of work.

The analysis of the focus groups will start by examining the commentary of participants in the focus groups organised in Milan (*FG_MIL*), Brussels (*FG_BXL*), and La Laguna (*FG_LL*) to the narratives identified earlier. Two of the narratives – Narrative 7: *Ageing*; and Narrative 8: *Migration* – were not selected in any of the focus groups by the participants and thus cannot be analysed.

The immediate reaction of participants upon reading the narratives is that uncertainty is too high to anticipate next transitions. Reflecting on the present challenges seemed to them to be more adequate; below reflections about the narratives are offered, illustrated with quotes from the participants. The quotes in this section are often by themselves self-explanatory, and thus used in full.

4.2.1 Automation

Narrative 1

Automation

The continuous advances in robotics and machine learning/artificial intelligence fields lead to the complete automation of all routine manufacturing tasks in production occupations and to quasi-complete automation of non-routine manual tasks in transports and logistics, and of non-routine cognitive tasks in health care, legal and financial sectors. The increased automation maintains productivity levels high but employment levels low.

The quotes below express that participants do not see automation as a specific narrative of our times even if they consider it being put forward because of the idea that automation is precisely changing the nature of work and also possibly taking many current jobs away in a job hungry society. Some participants suggest that the current effects of automation are mostly visible on the service sector. However, for different participants, the effects of automation on the future of work are constantly in the making, and there seems to be no stable anticipatory ideas on this. Automation is not primarily about physical activities but rather, more significantly today, about intangible services.

"Automation is a reality that has been developing with different names over the last at least 300 years, since the starting of economic theories, those we know now (...). So, I see it as a reality, but I don't see it as something that emerged specifically and concretely from robotics; this has been going on since the industrial revolution."

"[L]a automatización es una realidad que se viene produciendo con diferentes nombres en los últimos, como mínimo 300 años, desde que existen las teorías económicas, las que conocemos con la actualidad, lo único es una redistribución con las personas...Por lo tanto lo veo una realidad, pero no lo veo algo que surge específica o concretamente derivado de la robótica, ha pasado con la revolución industrial"

-- Participant D, FG_LL

"(...) there is a great deal of controversial positions [about automation]; some say that it will generate new jobs, others say that the percentage of new jobs is of different nature and anyway much smaller than all jobs that get lost. Hence, in reality, this is an open issue."

"(...) ci sono molte posizioni controverse; qualcuno dice che si generano nuovi lavori, qualcuno dice che la percentuale di nuovi lavori che si generano è comunque di natura diversa e comunque in misura drasticamente inferiore a tutti i lavori che si perdono. Quindi in realtà è una open issue questa cosa qua."

-- Participant D, FG_MIL

Furthermore, what gets to be automated is also a subject of discussion;

"The impact of automation is not on the robotics side, in the physical world; it is in the intangible part, in the service world; the impact on unemployment is not for the workers at the assembly line yet. It also depends on banks or insurance companies or on those who do financial transactions. In my opinion we should start considering services as an essential part of the impact of automation."

"l'impatto dell'automazione non sta nella parte della robotica, quindi nel mondo fisico, sta nella parte intangibile, nel mondo dei servizi, l'impatto sulla disoccupazione non è dei lavoratori alla linea di montaggio ancora, dipende anche dalle banche o dalle assicurazioni o da quelli che fanno transazioni finanziarie. Secondo me dovremmo cominciare a considerare i servizi come una parte essenziale dell'impatto dell'automazione"

-- Participant D, FG_MIL

activities that involve skills related to creativity and problem finding are not straightforward automatable human activities. For example, in this quote concerning creativity:

"(...) the last thing that will be conquered by automation will be creativity."

"(...) el último que será conquistado por la automatización será precisamente la creatividad."

-- Participant D, FG_LL

or the following concerning problem finding:

"Attention though, problem finding is very difficult to do with machine learning approaches. In the universe of machine learning there are undefined problems."

"Attenzione però, per il problem finding con il machine learning si fa fatica a farlo, l'universo del machine learning ha comunque dei problemi che non vengono definiti."

-- Participant D, FG_MIL

The importance of collaboration between humans and technology is acknowledged as a more plausible paradigm than that of substitution:

"Introducing technology doesn't mean work replacement, rather, so to say, a collaborative dynamic between man and technology which demands for a growth of the competences, qualities and skills of those involved in the productive processes."

"l'introduzione della tecnologia non è sostituzione del lavoro ma, anzi, come dire, una dinamica collaborativa tra tecnologia e uomo che chiede crescita delle competenze, delle qualità e delle skills delle persone impegnate nei processi produttivi."

-- Participant B, FG_MIL

4.2.2 Globalisation

Narrative 2

Globalisation

Globalisation further impacts the work environment, leading to the widespread implementation of alternative work arrangements like remote freelancing and on-demand work. As a result, available work is reconfigured to task-based formats and short-term projects. This non-traditional type of work provides less schedule certainty but noticeably more flexibility than traditional, full-time, fix schedule jobs. A global pool of freelancers will earn their income through a series of temporary gigs, available in digital platforms, based on their bid for the work.

The narrative of globalisation permeates all human action these days. It is one of the strongest narratives in the discourses about current and future work patterns and it has been there for quite a long time now. The participants examined this narrative also at the light of their own experience and expectations with regards to makerspaces. They suggest that globalisation has paved the way to many transformations, such as redefinition of market players, and privileging existing large companies; yet, the enhanced possibility of sharing practices and politics through global connectivity could paradoxically, enhance processes of local production. This latter idea seems to be very inherent to makerspaces operation and culture.

“Lots of people really think that globalisation and Artificial Intelligence gets to a level that (...) a lot of work will disappear; (...) that there will be less jobs; less work in the future. [This] doesn't have to be a problem.”

-- Participant B, FG_BXL

“In terms of globalisation and specifically in Fab Labs you have a model that is called global connectivity and local productivity, or local fabrication. So, that is the idea that sharing a lot of knowledge, that you could go to a model of self-sustainable cities and they call this model Data In, Data Out. Now you have the model PITO, Product In, Trash Out, because you have a lot these streams of materials of fabricated products. But you could go to DIDO, Data In, Data Out, where you still have the materials, of course, but now the finished products can be made Just-in-time, based on what the local need is. So, you have way less trash, for example, way less material streams (...) [Also] this year the FabTextiles started, which is like a network or a few FabLabs, Barcelona, Amsterdam, and some others, that are teaching people how to create their own textiles, shoes, clothes, etc., based on digital fabrication technologies. So, making use of the tools and the knowledge that is available in FabLabs. So, this is just one example, but I think it is a very interesting example, because consumers hopefully will become more aware of the bad conditions in which textiles, shoes, etc., are created. So, that could be an extra trivia, to revalue this kind of things and to even try to make your own stuff.”

-- Participant B, FG_BXL

“Another consideration was, in the discussion on globalisation, whether it's not a danger that companies become too big, or too influential. You could say too big to fail, like in 2008 for the banking industry. The good thing about democracies is that if it's not functioning well you can vote out politicians, but you cannot do the same with companies. So, in terms of globalisation and the impact that very big companies have on innovation, it's not always positive. There are numerous examples of start-ups that were bought by Apple, Google, Facebook, and that were then just shut down, just to make sure that there was no competition.”

-- Participant B, FG_BXL

4.2.3 Micro-Factories

Narrative 3

Micro-Factories

The widespread of Micro-Factories such as FabLabs, leads to the democratisation of innovation and production. These small production systems allow anyone to manufacture almost anything: new products and startups are easily created based on open source hardware, open source design and open source software principles. Consumers also become producers (prosumers).

Some participants do not see micro-factories as a plausible trend, being very cautious with regards to thinking that micro-factories could counteract in Europe the impacts of capitalistic models and delocalised production (prevalent in countries like China, for example).

“The belief that we are going to change the hegemonic model of capitalism, globalisation, delocalised manufacturing, proposing micro-factories seems dangerous only for a reason, simply because it is not going to be true; then of course all efforts, all ambitions of these people can be frustrated and when people are frustrated and people get angry and anti-system, or they disappear. I think we should explain all this as a process of adaptation, of distribution, of complementarity that could end up modifying the [economic] model. Changing the

economic model needs the drivers with which the economic model was built. So, a micro-factory will never have as much power as Ford has; but it can activate and function as a catalyst for new models, though they will need [powers similar to those of] Ford"

"creer que nos van a cambiar el modelo hegemónico del capitalismo, de la globalización, de la fabricación deslocalizada, proponiendo microfábricas me parece peligroso solamente por una razón, simplemente porque no va a ser cierto entonces claro todos los esfuerzos, toda ambición de esa gente puede verse frustrada y cuando frustran a la gente ya le gente te rebota, se hace anti sistema, desaparece y tal, yo creo que habría que habría que explicar todo esto como un proceso de adaptación de reparto de complementación que pueda acabar modificando el modelo pero junto con las fuerzas del modelo, o sea cambiar el modelo económico necesita las fuerzas con las que se construyó el modelo económico. Entonces una micro fábrica nunca va a tener tantos caballos de fuerza como tiene la Ford, sí puede activarse y funcionar como catalizador de nuevos modelos pero que van a necesitar de las fuerzas de la Ford"

-- Participant B, FG_LL

"If people don't understand why it's important to pay a little bit more for a product we cannot work at a micro factory. (...) We need to try and fund these, a Fab Lab, for example, and show it's possible at some point, and maybe create a big network and decentralize. So, if we have a lot of micro factories, at some point, yeah, like you said, we will just ship all the materials and it will cost less than all the wood we can grow here in Belgium and then send it to China to create the toys, which came back."

-- Participant C, FG_BXL

Also, the idea expressed in the micro-factories narrative that FabLabs are micro-factories, is not shared by some participants. This quote illustrates a different role for FabLabs than those of production; it suggests that these types of spaces are learning opportunities that can be transformed on manufacturing projects of specialised and differentiated production: *manufacturers of ideas*.

"I do not agree with 'microfactories such as the FabLabs'; a FabLab is not a micro-factory because the objective of FabLabs is not production but to disseminate those modes of production, to teach, to encourage; maybe because we are university students, I see it more like a micro-factory school rather than as a micro-factory, and in fact we have had examples of people who leave here thinking about doing their small production, like the guy that produced of glasses; that guy has a micro factory which arises in a context, this is micro factory school would be a FabLab. (...) I see a great obstacle to (...) this hypothesis of generating economies through micro factories; the first thing that it stumbles with is the mass production of China: the delocalised manufacturing at prices that come from a non-democratic social structure where salaries are, well, I do not know... what we teach in our micro factory school is that you can manufacture it in a FabLab, in a micro factory business model, you have to carry a surplus value, because if you are going to make a ring; we were discussing it with Pilar, Pilar is a jeweller, Pilar can never compete in silver rings because for 3 euros you have a silver ring. She has to sell it at 60 euros. Then one has to ask, where is the added value? Of course in creativity, originality, uniqueness, limited circulation, and authorship ... micro factories are only possible if they sell a product that carries added value of personalisation, creativity, originality, authorship, etc. If not, they are doomed to failure because no matter how democratic the means of production are, the micro-factory will always manufacture more expensively."

"yo no estoy de acuerdo con que 'las microfábricas tales como los FabLabs'; FabLab no es una micro fábrica porque el objetivo de FabLab no es la producción sino divulgar esos modos de producción, enseñar, fomentar, entonces será que como somos universitarios, lo veo más como una escuela de micro fábrica que como una propia micro fábrica, y de hecho hemos tenidos ejemplo de gente que sale de aquí pensando en hacer su pequeña producción, como el tipo de las gafas, el tipo de las gafas es una micro fábrica pero eso surge en un contexto, esto es escuela de micro fábrica sería un FabLab. Yo creo que en parte sí, y veo un gran impedimento a todo esto, esta hipótesis de generar economías a través de micro fábricas con lo primero que se tropieza es con la producción en masa de China, o sea con la

fabricación deslocalizada, a precios que provienen de una estructura social no democráticas donde los salarios son, en fin, vale no sé... lo que nosotros enseñamos en nuestra escuela de micro fábrica es que todo lo que se puede fabricar en un FabLab, en un modelo de negocio de micro fábrica, tiene que llevar una plusvalía, porque si vas a hacer un anillo, lo discutíamos con Pilar, Pilar es joyera, Pilar nunca puede competir en anillitos de plata porque por 3 euros tienes un anillo de plata. Ellos tienen que venderlo en 60 euros. Entonces dice ¿Dónde está la plusvalía? Pues en la creatividad, en la originalidad, en la singularidad, la tirada limitada, y la autoría...las micro fábricas solo son posibles si venden un producto que lleve una plusvalía de personalización, de creatividad, de originalidad, de autoría, etc. Si no están abocadas al fracaso porque por muy democráticos que sean los medios de producción siempre vamos a fabricar más caros."

-- Participant A, FG_LL

The idea that micro-factories are part of the futures of work narratives needs interrogation. As the same participant seems to suggest, micro-factories cannot promise the same types of products that are manufactured by economies such as that of China. In other words, the modes of production need necessarily to be different and the participant argued that uniqueness, creativity and collaborative work are key distinguishable features.

"We do everything here, we work on marketing, now we are in the marketing of [name of the company], from the design of the product, from the way of manufacturing the product to be optimal, to merchandising it and because we are in a context with engineers, with artists and designers, we can also teach that creative added value. I believe that talking about this added value is necessary for a micro-factory model to be profitable, to be sustainable."

"Nosotros aquí hacemos todo, trabajamos sobre el marketing, ahora estamos en el marketing del [nombre de la empresa], desde el diseño del producto, desde el modo de fabricar el producto para que sea óptimo, hasta el merchandising y como estamos en un contexto con ingenieros, con artistas y diseñadores, esa plusvalía creativa también la podemos enseñar. Yo creo que hablar de esa plusvalía es necesario para que ese modelo de micro fábrica sea rentable, sea sostenible."

-- Participant A, FG_LL

Similar views are shared by participants in another focus group.

"[In FabLabs] production is possible, but not production in the traditional sense of mass manufacture. It is production on a make scale, not on a mass scale."

-- Participant E, FG_BXL

"There is a very big difference between making especially a physical prototype and scaling that up into a product that can be mass produced."

-- Participant B, FG_BXL

Another issue raised by a different participant deals with the real cost of manufacturing. If makerspaces are to be seen as economically competitive micro-factories, the cost of products from other sources must reflect the actual human and environmental costs with which they are manufactured.

"Consumers (...) mostly look to the cost of something and that's also one of the drivers of our economy and of the trade agreements that are being made between big regions. If in trade agreements we would also say the conditions, the human conditions, the ecological conditions in which products and services are created to be of the same quality level and the same standards as, for example, we have here [at makerspaces], that would already change some parts of the economy for a better way."

-- Participant B, FG_BXL

(...) What needs to happen with the free trade policies is actually that the product needs to reflect the actual cost. (...) If that is reflected, then all of a sudden, making/ manufacturing (...) locally becomes a lot more interesting. So, it is about those hidden costs where I think there needs to be a more realistic perception of. And then, it will make it more interesting to look at local manufacture. [Otherwise] it would be more expensive even if you made it yourself."

-- Participant B, FG_BXL

4.2.4 Sharing Economy

Narrative 4

Sharing Economy

The spread of sharing platforms like Uber, Airbnb, and 3D Hubs drastically expands the access to products, services and talent beyond one-to-one or singular ownership, giving people the opportunity to make a market from their under-utilised skills. Jobs multiply as new and novel platforms are invented on which people define their own work and careers based on acquired reputation.

Participants argued that the emergence of a *sharing economy* is originally a response to the organisation of work and jobs that has been progressively put in the hands of large corporations. However, they reckon that progressively these ideas have been at jeopardy because of conflict of interest, lack of regulation and also because anyway those who own the IT platforms do not act differently from large corporations in the long run, in the sense that they look for profits as any other company. The following quotes illustrate these points:

"(...) if there is more and more differences between rich and poor and increasingly more large companies form; the larger the company is, the smaller the number of workers; then, companies tend to join to become very large to save on hiring workers. It is clear that if the population - because there is more and more population - cannot access wealth through the business structure, other structures will have to be created where the worker or the citizen can acquire the wealth, (...) then of course I have the grandmother's apartment..."

"(...) lo que está claro es que si cada vez hay más diferencia entre rico y pobre y cada vez haya empresas más grandes, cuanto mayor es la empresa menor trabajadores tiene, entonces cada vez las empresas tienden a unirse a hacerse muy grandes para ahorrarse trabajadores, entonces está claro que si la población, porque cada vez hay más población, no puede acceder a la riqueza a través de la estructura empresarial, tendrán que crearse otras estructuras donde el trabajador o la ciudadanía pueda adquirir la riqueza, la riqueza para esa clase media, entonces claro pues tengo el pisito de la abuela..."

-- Participant D, FG_LL

"the collaborative economy can be a mechanism, but if later it goes against regulation, then it is a political question, of power, it is necessary to enable the mechanisms to make more decisions about the sharing economy..."

"la economía colaborativa puede ser un mecanismo, pero si después se topa con la regulación, entonces es una cuestión política, de poder, hay que habilitar los mecanismos de poder para tomar decisiones sobre la economía colaborativa"

-- Participant A, FG_LL

"What I think is that, I share the need for regulation, but regulation will have to be done so that minorities have access to resources and wealth, at the expense of the greater profit margins that a company makes. (...) Because when until recently we talked in Marxist terms about the distribution of wealth, it was still believed that it meant to go to the bank and distribute the money; not anymore: this is about distributing resources and access to the sources; then the problem is that you have to make a regulation that allows you to exploit your apartment [referring to Airbnb type of activity]. (...) the problem of regulation, and I am pro-regulation - I am Keynesian as an economist - the problem of regulation is who determines what type of regulation needs to be done..."

"Yo lo que creo es que, yo soy partidador de la regulación, pero la regulación tendrá que hacerse para que las minorías accedan a los recursos y a la riqueza, a costa del mayor margen de beneficio que gana una empresa, (...) porque cuando se hablaba hasta el otro día en términos marxista del reparto de la riqueza todavía se creía que trata de coger (...) al banco y repartir el dinero; no, no ahora se trata de repartir los recursos y el acceso a las fuentes; entonces el problema es que hay que hacer una normativa que te permita explotar tu apartamento. (...) el problema de la regulación, y yo soy pro regulación, soy keynesiano como como economista, el problema de la regulación es quien determina qué tipo de regulación tiene que estar..."

-- Participant D, FG_LL

"Well, but they [sharing economy platforms] are forms of adaptation, there are different conditions, they are outsider of the system, later they become part of the system obviously when they reach a certain level they come together..."

"Buono, pero son formas de adaptación, son condiciones diferentes, son outsider propios del sistema, después se convierten en propios del sistema obviamente cuando llegan a cierto nivel se juntan..."

-- Participant B, FG_LL

"The sharing economy starts from values belonging to two different worlds, one is sharing, the desire to share, which is a social value, and the other is economic, making a living. It is very difficult to prevent competition among competitors."

"la sharing economy parte da certi valori in due mondi diversi, uno è sharing, il desiderio di condividere che è un valore sociale e l'altro è economy, quindi il fatto di campare. È molto difficile disinnescare la competizione tra competitors."

-- Participant G, FG_MIL

"The world doesn't work for 'the good', otherwise we tell tales, because there is competition on resources, there is conflict and there are scenarios that are (...) catastrophic. Thinking that everything boils down to a composition and not to a choice, that there is absolute harmony of everything... I think it is unrealistic."

"il mondo non lavora 'for the good', altrimenti dipingiamo delle favole perché c'è competizione sulle risorse, c'è conflitto e ci sono scenari di cambiamento che sono (...) catastrofici e pensare che tutto si riduca a una composizione e non a una scelta, che ci sia una convivenza assolutamente di tutto... Credo che sia irrealistico."

-- Participant D, FG_MIL

4.2.5 New Skills

Narrative 5

New Skills

The impact of technology and innovation on employment creates a paradox on job requirements and crucial skills. The rapid progress witness in the work environment means that employees are required to adapt their skills set. There is not only a demand for different types of skills that evolves rapidly but also employees existing skills shelf-life is drastically shortened. In addition, there is a growing separation between the necessary skills for a specific job and the ones taught in schools and universities. There is a lack of technical skills such as STEAM subjects, leading to problems in hiring qualified staff.

As already seen through the in-depth interviews, skills and skills development are core to the discourse and imaginary of work futures of members of the *Maker Movement*. In that sense, skills development is seen as a core business of makerspaces for many participants. Attention must be given nonetheless to social minorities which might perceive these spaces as inaccessible.

However, one of the participants notes that it is not skills that make a difference on solving a problem, but the awareness that such problem exists and that one cannot delegate their resolution to *others* or that one has a part on resolving those problems; skills then become the means through which some of these problems can be addressed by individuals or a community.

“My primary thought on this is that actually the skill is superseded by the awareness that a citizen can make his or her own impact. Which means, at this point everybody looks at, you know, somebody will solve the garbage problem. No, not somebody will solve, you will solve your own garbage problem. And that's a pivotal societal shift that will make STEM skills, technical skills, (...) far more relevant. But the thing is, at this point, the sense of enablement that people can be their own actors of change. (...) That is the approach you can change something [and] it is not only the belief, it's also showing that these few people can actually make a thing possible. But again, to get these people from realisation to actually doing it, require that, again, they need to be paid in some way or another. So, it's all, kind of mixed up together. The skills themselves, I think it's very much a matter of access to information. (...) We need to be able to go to a system where (...) certain courses are available online for standard payment, instead of having to inscribe yourself at a university for a certain course (...). We have a lot of work to do in, I would say, access to information and, kind of, building a new platform for skills training.”

– Participant E, FG_BXL

Participants suggest that formal systems of education are unable to provide the necessary skills for the work of the future, a recurring theme in the focus groups. An interesting point was that makerspaces can have a prominent role in teaching people to be flexible. The recognition of skills acquired in the informal environment of makerspaces by peers was also discussed, with *reputation* having a strong role. A type of *badge system* that would attest ones' skills was proposed.

“The schools system, if you look from an historical point of view, is a system that we have because it was pushed by the industrial revolution. At a certain point, we need a lot of people with certain skills, so we had to make this system. (...) [Now] those skills are maybe not the ones that the recruiters in the end of the day will check upon. (...) Even if schools are the ones certifying [who] you are.”

"I think that flexibility is something that you don't really learn at school. That's why I think makerspaces and Fab Labs are very important, because there you learn to be flexible, to change."

-- Participant D, FG_BXL

"Reputation within the Maker Movement is connected to what one is capable of doing. (...) We cannot afford to become fakers³¹, on the one hand because the movement punishes you, I mean, given that you gained that reputation doing things, if you then act as the one who speaks without doing, people begin to ask you: "[Let's see] what you have done. (...) You either explain me, or you end up in the papers, you make an article that tells about you, but it is clear that there is nothing real behind."

"la reputation all'interno del movimento maker è molto legata a quanto si è capaci di fare. (...) noi non possiamo permetterci di scivolare nei fakers, da un lato perché il movimento ti punisce, cioè, visto che la tua reputation te la sei guadagnata facendo delle cose, se poi scivoli sempre di più in quello che dice ma non fa, piano piano la gente comincia a dirti: 'quello che hai fatto tu. (...) O mi spieghi perché, oppure finisci sui giornali, fai articolo in cui si parla di te, ma è chiaro che poi di sotto non c'è niente.'"

-- Participant G, FG_MIL

"I'm trying to use and create a system like a scout with badge. And each time you are able to do something you get a badge³². (...) So, you can create your own course, because each time you do something you receive some kind of acknowledgement (...). We want to use the same logic and start with children to earn badges because it's fun and it's rewarding. And the badges could directly be valid [for] the adult[s]."

"Portfolio becomes increasingly important. But of course, I still believe in university because (...) instruction is important. I also believe knowledge should be given [to] us freely".

-- Participant C, FG_BXL

4.2.6 Green Economy

Narrative 6

Green Economy

The increasing effects of Climate Change and the depletion of natural resources ultimately lead to the transition to a greener economy. Social responsibility dominates the agenda and the economic process is restructured towards a circular model in which resources are reused repeatedly. Moreover, waste materials or unwanted products are transformed into new materials or products of better quality or of better environmental value. Novel jobs aimed at bringing materials from the waste stream back into the mainstream with an added economic value flourish and boost the economy.

In relation to this narrative, ideas of care, of passion, and of ownership are suggested as the key dimensions for such narrative to be plausible and to have a stand on its own; otherwise these ideas risk being appropriated as a rhetorical device of existing economies disguised into slogans such as 'social responsibility'. Also, as with any narrative, it is policies and practices dictated by political choice, that will ultimately make these narratives plausible and implementable.

³¹ The term *fakers* is used here to refer to individuals who talk about the Maker Movement and making but do not really engage in DIY activities themselves, opposed to those who really do and make *stuff* (i.e. *Makers VS Fakers*).

³² The example given of a similar system was Open Badges <https://openbadges.org/>.

"If you want to change the world, let's say, you need scalability. And the way you can have scalability is by being profitable, because at the end of the day, what people are most interested about having, (...) what they need, is money. And that's why people work, right, because they need money. But if you have passion, is passion not enough to scale something? (...) If you can have people that are passionate and transferring that passion into something useful."

-- Participant A, FG_BXL

"If you give people ownership of what they are doing, then we start also to care for what's around. So then we go to the green economy. These two things are linked." (...) "If you have ownership you take care of what's yours, and if you can make it profitable you can survive with it and it's also a good thing. So, then we came to the conclusion that actually you need a kind of a system, and it's the kind of, I don't know, a cross-system between what you have in the United States, where people are very free, very liberal, they can go for the American dream. You can start your own things. But here [Europe], we have a very good social system. Actually, you kind of need to merge [the two systems]."

-- Participant D, FG_BXL

"I was thinking it is simple to collect plastic bags or collect bottle. It is like the right thing to do. (...) But we earn nothing from that (...). [Thus] There are a lot of people who don't care. (...) How can you convince them that they should do it, without telling them?"

-- Participant C, FG_BXL

"Models of this kind have a dimension that is not only of passion and values, but of interests, the narrative will impact on this thing, i.e. if I put resources on economic activities, if I build policies that put economic resources on certain activities that favour the dimensions of circularity, or of technology, of low-impact manufacturing, with substantial deployment of technologies focusing on those activities instead of others that do not have this kind of attention, I am changing political dimensions as well."

"Modelli di questo genere hanno una dimensione che non è solo di passione e di valori, ma di interessi, la narrazione va a impattare su questa cosa, cioè se metto risorse banalmente su attività economiche, se costruisco delle policy che mettono delle risorse economiche su determinate attività che privilegiano l'uso delle caratteristiche della circolarità, oppure della tecnologia, della manifattura a basso impatto, e con uso sostanziale delle tecnologie e mi metto su quelle attività e non le metto su altre che invece non hanno questo tipo di attenzione, spostato degli equilibri anche politici."

-- Participant B, FG_MIL

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5 Drivers and Values in Futures of Work: Inspiration from the *Maker Movement*

We will now address one of the main questions of this research, ***what does ‘making’ have to do with futures of work?*** The question is bluntly made to explore to what extent the *Maker Movement* is influencing and/or is influenced by possible futures of *work*. Makerspaces have been emerging with multiple objectives, and our enquiry seems to suggest that the connection between *making* and jobs creation is neither often desirable, nor is it an objective of the *Maker Movement*. Yet, with and through the *Maker Movement*, a number of transformative ideas and concepts could already be changing or re-enacting lost meanings of work. Such ideas could form a different, but not necessarily new, narrative for work futures.

Hence, in the remainder of this section we look into drivers and values that permeate the discourse of makers in the discussions that were promoted both through the in-depth interviews and the focus groups.

5.1 Drivers

In this section we examine key drivers that from the point of view of the maker community that participated in the three focus groups discussions are or could boost work futures. Whilst some of the identified drivers seem to be embedded in the narratives of our times, some others are somehow not so much articulated in the discourses of policy, business and media accounts; others seem to be relinquished to a second plan, whereas indeed their disappearance could be a stronger driver than existing or emerging technology. In the discourse of the participants we could identify (i) skills (21st century, social and manual) and their maintenance, rediscovery or redeployment as a driver of different futures of work; (ii) creativity and fantasy; (iii) ethics and values, such as care, sharing, openness, new forms of solidarity; (iv) collaboration as opposed to competition; and (v) other meanings for work beyond employment as key drivers of work futures, mostly identifiable and constitutive of the *Maker Movement*. Indeed, these are simultaneously makers’ inspired drivers but also constitutive promises of the discourses of this movement.

5.1.1 Innovation(s)

Innovation can be considered as both a narrative and a driver. For the purpose of this study, we will just concentrate on the latter perspective, *i.e.* what types of innovation are makerspaces engaged with that could change or influence work futures. We came across a number of innovations, not only technological but also at social and governance levels. The dimensions span from who uses the spaces and with what objectives, the ways in which these spaces connect to other established infrastructures, as well as to how these spaces create collectives.

The innovation focus of these types of spaces depends very much on the origins of the space. So, the discourse of the interviewees and focus groups' participants is quite diverse showing the richness of purpose of makerspaces. In all discussions it emerged that these spaces are *de facto* bridging different communities which relate and operate with very different but potentially converging objectives. The FabLab of La Laguna, situated in the university campus, attracts not only people from the university but also many other people outside the educational system, including young people, that are not university students, engineers, people that have small artisanal companies, and designers. Many of the participants in the focus group in Brussels had strong connection to the educational system, as well. In other spaces, the connection to big companies was not only sought but also described as desirable by the companies themselves:

"Big companies listen to us more than small ones. It is easier to get in touch with them, in the sense that the craft population is over framed; they have a lot of trouble to solve"

"Ci ascoltano di più le grandi imprese, rispetto a quelle piccole. È più facile entrare in contatto con loro, nel senso che la popolazione dell'artigianato è iperframmentata, hanno un sacco di casini loro da risolvere"

-- Participant G, FG_MIL

The idea of *third place*³³ (Moilanen, 2012; Oldenburg, 2001) is aired in the discussions, *i.e.* a supplement to the two traditional social environments of home (*first place*) and workplace (*second place*). A participant explores this idea, adding that makerspaces are being created because:

"(...) we are convinced, that everything that is related to science and technology, and arts, and engineering, mathematics, is very important for our economy."

-- Participant B, FG_BXL

And because there is money available, even if according to this participant, the innovation rhetoric within the promises of makerspaces, is in need of undisputable credibility:

"(...) a critical role that now needs to be filled, which is you have this infrastructure, now, let's embed it with some religion, or with some purpose, because, otherwise these things will not keep working."

-- Participant E, FG_BXL

During the interviews and focus groups discussions, the capability of makerspaces as centres of innovation where new products and services can be designed and experimented was widely debated. Indeed, the idea that makerspaces are places for *manufacturing ideas* is widely recognised already and it is part of the promises and expectations about the movement itself. In the discourse of participants, this is narrowed down to the ideation and prototyping phases (makerspaces are not suitable for mass-manufacture, as discussed earlier).

"(...) in the Canary Islands there is no product design, but people who are starting to make small industrial products that are not very complex need to prototype the idea, need to visualize the idea, to make it in 3D. Now we are printing a job for a small company (...) [with] two guys, who have developed a device to place humidity sensor in plant pots (...) and then

³³ Makerspaces can be seen as *third places* referring to social settings which differ from *first place* (home and other similar settings) and *second place* (workplace). The third places are expected to be anchors of community life that facilitate reconnection of individuals and strengthen community ties (Oldenburg, 2001).

they want to put the sensor inside a house with a very flirty design to sell that product; they are prototyping that product and we designing the house, for example."

"(...) en canarias no hay diseño del producto, pero están empezando a venir gente que está empezando a hacer pequeños productos de carácter industrial que no son muy complejos, pero necesitan prototipar la idea, necesitan visualizar la idea, hacerla en 3D. Ahora estamos imprimiéndole un trabajo [para] una pequeña empresa [con] dos chicos [que] han desarrollado un dispositivo para colocar sensor de humedad en las macetas, (...) y entonces quieren meter el sensor dentro de una casita con una forma muy coqueta para vender ese producto y lo están prototipando ese producto y nosotros les estamos haciendo ahora el diseño de la casa, por ejemplo."

-- Participant A, FG_LL

"FabLabs are very, very useful. But indeed, in the early stage, in the ideation and prototyping."

-- Participant A, FG_BXL

"Pilar Cote who is a jeweller, makes jewellery design and pieces in ceramics and when she saw the possibilities of technology, she changed (...) and she has done it since she knows this FabLab and she does not really execute them but she resorts to us ... we are her operators. Hence, creativity can change only by knowing these tools, they change creativity, they change iconography, (...) they can change business models, or promote new business."

"Pilar Cote que es joyera, ella hace diseño de joyería y piezas en cerámica y ella cuando ha visto las posibilidades de la tecnología ha cambiado, ella ha cambiado... (...)y lo ha hecho desde que conoce el FabLab y realmente no los ejecuta ella sino ella recurre a nosotros... nosotros somos su operarios; entonces la creatividad puede cambiar solamente por conocer estas herramientas, cambia la creatividad, cambia la iconografía, (...) puede cambiar en los modelos de negocios, en aparecer nuevos negocios, lo que estábamos hablando"

-- Participant A, FG_LL

Yet, the twist is that those spaces can be experimental with a right to fail.

"what we are doing is experimenting, and experimenting is very difficult in very regulated spaces because they do not allow you; often university project spaces are like as if everything is tied up; a place where failure doesn't bother, doesn't exist. In this space we do have that philosophy and when something goes wrong, we take a coffee"

"lo que estamos haciendo es probar y probar es muy difícil en espacios muy reglados porque no te dejan; los espacios muchas veces universitarios para proyectos, parece que está todo como más amarrado.. y un sitio donde el fracaso sea una cosa que no moleste pues no hay, en este espacio sí que tenemos esa filosofía que cuando hacemos algo y nos sale todo mal, pues nos tomamos un café..."

-- Participant B, FG_LL

"(...) it's not fail, even if you cannot do it, don't worry, just try. And if you cannot, ask questions, or copy what somebody else is doing. Really act, observe, and do and adopt and this way you really develop a kind of thinking that will help you in life (...)"

-- Participant D, FG_BXL

Participants of our social research claim that makerspaces not only offer an opportunity to produce new knowledge but also to explore innovative ways to relate to existing institutions. Indeed, some participants sustain the idea that makerspaces do not conform to *taken for granted* models of governance, innovation and knowledge production. As the quote illustrates, their activity and operation cannot be categorised in known models and that is often problematic:

"Transfer to models that do not exist, to businesses that do not exist or that could exist. So in spaces like this, in the Make spaces, in the FabLabs ... they are spaces that, I think, are more predisposed to generate new drawers, than to adapt to existing drawers, because companies already have their own laboratories their own centres of development to grow their profits; hence, these spaces should take time to go outside to look for new spaces, new paradigms, new investments (...)"

"Transferir a modelos que no existen, a negocios que no existen o que pudieran existir. Entonces en los espacios como este, en los espacios Make, en los FabLabs...son espacios que yo creo que están más predisuestos a generar esos nuevos cajones, que adaptarse a cajones que ya existen, porque ya las empresas tienen sus propios laboratorios sus propios centros de desarrollo para hacer crecer su caja, entonces estos espacios deberían dedicar tiempo a salirse a la calle a buscar espacios nuevos, paradigmas nuevos inversiones nuevas (...)"

-- Participant A, FG_LL

The participants claimed that a different relationship with mainstream institutions is needed for the full usability of these types of spaces, and their innovation potential and social role to be fulfilled. These quotes illustrate how these spaces challenge existing administrative arrangements to deal with funding and resources. This type of reflection interests directly futures of work, futures of resources management.

"the administration should find mechanisms that do not work vertically, but should be institutional mechanisms that from the start work in a transversal manner, this does not mean that they are not audited, that there is no audit because the administration is always afraid that when a thing is transverse the money is lost, it is stolen, there is no control, it disappears ... then generally the mechanisms are vertical, but the vertical mechanisms are not operative and are not operative thinking about the future, they are not adaptable, they are not flexible, then a transverse mechanism that works in the horizontality as the FabLab has shown that it can work alone (...)"

"la administración debería encontrar mecanismos que no funcionaran de manera vertical, sino tendrían que ser mecanismos institucionales pero que del principio funcionaran de manera trasversal, esto no significa que no sean auditados, que no hubiera auditoria porque la administración siempre tiene miedo que cuando una cosa es trasversal se pierde el dinero, se roba, no hay control, desaparece... entonces generalmente los mecanismos son verticales, pero los mecanismos verticales no son operativos y no son operativos pensando en el futuro, no son adaptables, no son flexibles, entonces un mecanismo trasversal que trabaje en la horizontalidad como el FabLab ha demostrado que puede funcionar solo(...)"

-- Participant A, FG_LL

"Probably the problem we would have with the Crowdfunding is to adapt it to the administrative system of the university, because once we spoke about it in the [university], the structure that manages money, I told him about the Crowdfunding, he replied, well, how does that work?"

"probablemente el problema que tendríamos con el Crowdfunding es adaptarlo al sistema administrativo de la universidad, porque ya una vez lo hablamos en la CULL, que es que lleva la estructura del dinero, yo le comente lo del Crowdfunding, y bueno ¿Eso cómo funciona?"

-- Participant D, FG_LL

5.1.2 Skills

Earlier we presented *new skills* as a strong narrative in futures of work. In most accounts from policy, consultancy and the academic literature the debate about futures of work is tackled from perspectives on the development, consolidation, recognition and transfer of skills (see Table 2 for

some examples). While skills are normally qualified by educational systems in the form of titles and awards based on curricular activities, the *Maker Movement* offers vocational paths to learning. A growing body of research is dealing with the impact of non-academic and social skills (e.g. self-regulation, problem-solving, social awareness, problem adaptation). These sets of skills have been called as supplemental, non-conventional, non-cognitive, non-academic (Finn et al., 2014).

In the discourse of the participants and interviewees skills appear as a strong driving force of different work futures, in which participants reckon that makerspaces have a steering role. Whilst many speak about the *21st century skills* (see below), technologically based, others talk about disappearing skills that often are exactly rediscovered and taught at makerspaces. The quotes below illustrate the ways in which skills as *driver* are articulated in the participants' discourse: the *hands-on* philosophy of makerspaces, learning by doing education, manual skills, social and relational skills, collaborative skills, and other skills.

"My partner will always have more job offers than me; she is a fashion designer. (...) She has experience and manual skills that are increasingly rare, and required, because everyone wants to be creative but no one wants to do it (...)"

"La mia compagna avrà sempre più offerte di lavoro rispetto a me e fa la modellista. (...) Ha un'esperienza e delle skills manuali che sono sempre più rare, e richieste, perché tutti vogliono essere creativi ma nessuno vuole fare fatica per realizzare (...)"

-- Participant G, FG_MIL

[Interviewer]: *"Is there a competence that according to you will remain stable and cannot be influenced by technology?"*

"C'è una competenza che secondo me rimane stabile, non è influenzata dal cambiamento tecnologico?"

[Interviewee]: *"The whole range of social skills, the capacity to build empathy, the relationship in communication that in fact is still a purely human trait. (...) where there is automation it is not always completely replaceable."*

"Tutta la parte dei social skills, la capacità di costruzione dell'empatia, la relazione nella comunicazione che di fatto è comunque ancora una caratteristica prettamente umana. (...) dove c'è automazione non è sempre tutta sostituibile."

-- Participant D, FG_MIL

"When you make things with your hands, actually your brain works better. You remember things better."

-- Participant D, FG_BXL

In relation to skills, the following quote suggests a deeper meaning for collaborative skills, beyond human collaborations, *i.e.* the human-machine *collaboration*:

"If we imagine that the introduction of technology is not a substitution of work but, rather, how to say, a collaborative dynamic between technology and man who asks for the growth of skills, qualities and skills of people involved in production processes, [the narrative on automation] does not hold this kind of representation."

"Se immaginiamo che l'introduzione della tecnologia non è sostituzione del lavoro ma, anzi, come dire, una dinamica collaborativa tra tecnologia e uomo che chiede crescita delle competenze, delle qualità e delle skills delle persone impegnate nei processi produttivi, [la narrativa su automation] non tiene questo tipo di rappresentazione."

-- Participant B, FG_MIL

Other types of skills are connected to a broader expectation about these types of spaces, also encountered in the literature (Barrett et al., 2015; Hui & Gerber, 2017), *i.e.* a role on entrepreneurship and innovation. For example, this quote:

“(...) *the skill of being entrepreneurial, not necessarily in the sense of starting a business, but just looking around, seeing opportunities and trying to solve this by means of technology.*”

-- Participant B, FG_BXL

The issue of alternative skills is recently entering the broader debate on education: *Partnership for 21st Century Learning (P21)*³⁴, founded as a non-profit organisation by members of the national business community, education leaders and policymakers enlist among the *four Cs* - collaboration, communication, critical thinking and creativity - skills widely recognised as provided in maker environments. Private institutions, such as École 42 in Paris³⁵, do not have any professors nor issue diploma or degrees. The school, now enjoying international prestige, is inspired by new modern ways of teaching that include peer-to-peer pedagogy and project-based learning.

On the institutional scale, Finland is an example of European forefront in considering alternative teaching methods and inclusion of digital tools. New educational models promote discussions on real world contexts and focus on developing skills such as critical thinking, collaboration and creativity placing the future of soft skills in focus (see OECD, 2013). Another matter is finding ways for accrediting informal skills and skills that have been gained outside of the formal education: on their side, makerspaces are acquainted with such issue and have developed ideas on how to develop systems (*e.g.* badges) to recognize and certify on skills gained through participation (Provenzano, 2017).

5.1.3 Open Everything

The concept of open source³⁶ is foundational to the *Maker Movement*, being often heralded as a way to foster innovation. The Arduino prototyping platform is given as an example:

“*It really empowers a lot of people worldwide to create fantastic devices, fantastic things. (...) it has been a dramatically strong inspirator and innovator worldwide. (...) the tools became so powerful and easy to use.*”

-- Participant B, FG_BXL

³⁴ <http://www.p21.org> (last access: 14 February 2018).

³⁵ <http://www.42.fr> (last access: 15 February 2018). This issue was discussed in the focus group in Brussels.

³⁶ In 2012, Steele (2012) wrote a manifesto that pleaded an *Open Source Everything* paradigm, which, as the author explained, with a broader community of actors that produce, preserve and deploy knowledge, many areas of societal development cannot be guaranteed by elites' deeds and decisions. His departing point was the operation of 'Intelligence' and national security in the USA. In an interview he conceded to the newspaper *The Guardian* in 2014, he stated: “*We have over 5 billion human brains that are the one infinite resource available to us going forward. Crowd-sourcing and cognitive surplus are two terms of art for the changing power dynamic between those at the top that are ignorant and corrupt, and those across the bottom that are attentive and ethical. The open source ecology is made up of a wide range of opens – open farm technology, open source software, open hardware, open networks, open money, open small business technology, open patents – to name just a few. The key point is that they must all develop together, otherwise the existing system will isolate them into ineffectiveness. Open data is largely worthless unless you have open hardware and open software. Open government demands open cloud and open spectrum, or money will dominate feeds and speeds.*” (In: Ahmed, 2014).

Yet, the same participant also notes that,

"It can also be difficult for starting companies to start with open sourcing their things, their products, their services, in order to survive."

-- Participant B, FG_BXL

because for investors open source is not an appealing feature:

"If you talk to investors at a level at which you need to do for growing further, open source simply becomes a liability."

-- Participant E, FG_BXL

In other words, the open source paradigm is in need of another business regime and expectations from innovators and developers in order to be a driving force. But in Steele's (2012) own words, open source everything is *"a transition from top-down secret command and control to a world of bottom-up, consensual, collective decision-making as a means to solve the major crises facing our world today"*. The implications for futures of work could be staggering.

5.1.4 Sharing

Unlike open source, sharing in multiple forms is seen both, as a foundational pillar of the *Maker Movement*, as well as a fundamental driver of futures of work by participants. Sharing can come in multiple facets, from connecting people, their knowledge, to tools and spaces.

"Because in a FabLab or in a Makerspace, they [the users] have access to tools that they cannot afford themselves. You are never going to buy for yourself a laser cutter of ten thousand euros, to make use of it. So, in that case, you can compare Makerspaces and FabLabs, [even if] they are a bit different, you can compare them to libraries. They innovate, they democratise the access to knowledge, to expertise and, because of, let's say because of the FabLab charter, that really emphasizes on learning, playing, but especially on sharing knowledge."

-- Participant B, FG_BXL

"What is manufactured [here] are ideas, but all this technology that was previously in the industry has been made accessible and the people who access it, use it, in most cases, with more social value, giving it new possibilities (...) what is certain is that new ways of doing things are being created through, above all, transdisciplinary, people from different places give a technology a usage that they find adequate (...) one of the things that, is a given in these spaces, is the documenting what is done."

"Lo que se fabrica son ideas, pero toda esta tecnología que antes estaba en la industria se ha hecho accesible y la gente que accede a ella le da un uso, en mucho caso, más social y le da posibilidades nuevas (...) lo que si es cierto es que se están creando nuevas formas de hacer a través de, sobre todo, lo transdisciplinar, que gente de distintos sitios vean una tecnología y cada uno le dé el uso que le venga (...) y una de las cosas que, es fijo en estos espacios, la vocación por documentar lo que se hace."

-- Participant B, FG_LL

5.1.5 Fantasy

Creativity, expressed by a participant as the use of fantasy, is for many participants a key driver of futures of work. Makerspaces are illustrated as safe spaces where fantasy can be experimented with, it being a source of inspiration in the thinking about futures of work, *i.e.* that those opportunities of experimenting without a fear of failure could become part of workplaces and the organisation of work.

"I think that without a doubt it is the contribution of creativity and ... getting away from the rules ... as regards ... a heuristic approach to the issue, I think it is becoming increasingly valuable, in fact, according to studies, creativity, companies, is one of the values that most seek in their workers, then I think that without a doubt ... the pure and hard reason is fine, but I think it has to go hand in hand a bit of imagination too, right? A more artistic approach to the thing"

"yo creo que sin duda alguna sea la aportación de creatividad y... salirse un poco de las normas... un enfoque heurístico de la cuestión, creo que cada vez está teniendo más valor, de hecho, según estudios la creatividad, las empresas, es uno de los valores que más buscan en sus trabajadores, entonces creo que sí que sin duda alguna... o sea la razón pura y dura está bien, pero creo que tiene que ir de mano un poco de la imaginación también ¿No? Un enfoque más artístico de la cosa (...)"

-- Participant B, FG_LL

It is also the reason why many makers come to these places:

"[what brings me to the makerspace] Creativity, of course. That this is not just mechanised, a technology, a computer program, but [that we can] solve problems in another way, in a collaborative way, that's what this brings to me (...)"

"[porque vengo al makerspace] Creatividad, claro. Que no solo sea un mecanizado, una tecnología, un programa informático, sino resolver problemas de otra manera, de manera colaborativa, eso es lo que me lleva a mí esto (...)"

-- Participant C, FG_LL

"if in the school of architecture, to give an example, there was a space like this open to the students, maybe they bring you the drawing and it is printed; (...) it would be cool because you can do things that are otherwise impossible to do, and that helps you to create, to open your mind and see what is being done outside on a small scale, but I am now hallucinating because one can do amazing things (...)"

"si en la escuela de arquitectura, por poner un ejemplo, hubiera un espacio como este abierto a los alumnos, a lo mejor pues ellos te dan el diseño y ahí se imprime, (...) sería una pasada porque se pueden hacer cosas que de otra manera es imposible hacerlo, y eso te ayuda a crear, a abrir la mente y ver lo que se está haciendo fuera también a pequeña escala, pero yo con esto ahora estoy alucinando porque se pueden hacer cosas increíbles (...)"

-- Participant C, FG_LL

Yet, the idea that makerspaces can help with unique solutions and need to get away from mass production paradigms is key for some participants. While engaging critically with the idea of makerspaces as micro-factories, the participants suggested that if anything, makerspaces need to respond to a very different model of production that they have called the *personalisation of creativity*.

"We are living a change of model, we are going to do things that are not worth doing in China, that is, a very exclusive thing. So, we told her, if you want a lead soldier go to China; now if you want a lead soldier that has an arm like this and instead of the crown it has the logo of your company, if you want it customised then you have to come here and then we have the micro-factory! I do not compete with China anymore because in China they are not going to make you one, they're going to make soldiers (...) hence, the issue of personalisation of the creativity I think is key to the micro-factory role... to generate economies here. That's why what [Participant C] said, you have to put the A of Art or the C of creativity, you have to put creativity because if not ... we will compete with China."

"Estamos viviendo un cambio de modelo, vamos a hacer cosas que no merezca la pena pedirse en China, que sea una cosa muy exclusiva, entonces nosotros le dijimos claro si tú quieres un soldado de plomo tal cual vete a China, ahora si quieres un soldado de plomo que tenga un brazo así que ponga aquí que en vez de la corona ponga el logo de tu empresa si lo quieres personalizado entonces ya tienes que venir y ya tenemos microfábrica! Ya no compito con China porque en China no te van a hacer uno, te van a hacer soldados (...) entonces el tema de la personalización de la creatividad yo creo que es clave para este rollo de micro fábricas... para generar aquí economía. Por eso lo que decía [Participant C], hay que meter la A de Art o la C de creatividad, hay que meter la creatividad porque si no...vamos a competir con China."

-- Participant D, FG_LL

5.1.6 Collaboration

Collaboration was repeatedly heralded as a key driver of futures of work. Indeed it is presented as a condition *sine qua no* for the organisation of work already today. The participants claim that such collaborative *attitude* is clearly fostered in makerspaces. Moreover, these types of spaces which are most of the times community based, do not embed the visions and aims of mainstream institutions with which sometimes they are associated – in the particular case of the FabLab of La Laguna and others in Milan, there are clear associations with universities, but still they claim some sort of independency from the institutions they might be associated with. A more fundamental question would be whether these places are somehow revitalising or reinforcing past or existing ideas of organisation of work, when they foster a collaborative model. Are values of care and solidarity entrenched in the collaboration driving force?

"I think that nowadays, you cannot think that a single person does all the work; beforehand the artisans began and finished a job, but nowadays there is a demand, I think, [that makes collaboration] almost obligatory, that everyone collaborates, that everyone contributes a little of what they know in order to have a better product, to meet the needs that each one needs you have."

"yo creo que hoy en día no creo que se pueda pensar que una sola persona abarque todo el trabajo, antes con los artesanos pues, el mismo empezaba y terminaba un trabajo pero hoy en día lo que la gente demanda creo que es casi obligatorio que todo el mundo colabore, que todo el mundo aporte un poco de lo que sabe para poder tener un producto mejor, acordar las necesidades que cada uno necesite."

-- Participant C, FG_LL

"With the global reality the problems cannot be solved with unique visions or unique elements, because people do not have enough knowledge to deal with the whole. And these spaces, what they give you is that element, they justify that people get together."

"los problemas y con la realidad global y esa no se puede resolver con visiones únicas o elementos únicos, porque no tienen los conocimientos suficientes para tratar todo el conjunto. Y estos espacios, lo que te dan es ese elemento, te justifican que la gente se junta."

-- Participant B, FG_LL

"That idea of collaboration started from scratch; it was not a decision made by the administration, that is, the FabLab was not a top down decision, but a bottom up one; so until we united and looked for a link, some affinities, we could not start the FabLab, it is consubstantial, that is, for us to be a collaborative space is fundamental."

"esa idea de colaboración porque nosotros como empezamos de cero no fue una decisión que tomó la administración, o sea el FabLab no fue una decisión de arriba hacia abajo, sino de abajo hacia arriba, entonces hasta que no nos unimos y no buscamos un nexo, unas afinidades, no pudimos empezar el FabLab, es consustancial, o sea para nosotros que sea un espacio colaborativo es fundamental"

-- Participant A, FG_LL

The collaborative driver could also foster new forms of administrative organisation:

"[you need] to make visible that you are better in the FabLab than outside FabLab, (...) it suits us to be in a group. I was telling you ... a guy came to give an Arduino course, he made money, the CULL paid him, and the students got their training certified, but we avoid the whole structure. The guy who gave the course won, the students won and everyone was happy. Anyway, I suppose that is very difficult... to handle this in La Laguna is complicated, imagine in Europe."

"hay que hacer visible a la gente como tu estas mejor en el FabLab que fuera de FabLab, (...) nos conviene estar en grupo. (...) lo que os he dicho...vino un chico a dar un curso de Arduino, él ganó dinero, le pagó la CULL al chico, y los alumnos, se certificó su formación, pero evitamos toda la estructura. El chico que dio el curso ganó, cobró de la CULL, los chicos cobraron y todos contentos. En fin, yo supongo que eso es muy difícil...manejar esto ya en la Laguna es complicado imagínate en Europa."

-- Participant A, FG_LL

5.1.7 Education

Education, and indeed new models of education that are proposed to be experiential, hands-on, experimental, is also described as a pivotal driver on work futures. The concept of learning by doing and peer-to-peer learning processes as opposed to formal modes of learning (Kostakis, Niaros, & Giotitsas, 2015) or in the words of Ângelo (In: (Ravetz et al., 2015)), hackerspaces provide *"alternative curricula"*.

"Most of them were generally interested and really tried their best to make that possible, because they saw that this is not just something to try out, it's something that already proved itself at a lot places in the world. So, in a lot of cases, people are not doing it for profit, because most of the Fab Labs are just non-profit organisations. A lot of them are makers or people that are interested in this kind of culture, or they are educators and they just see and feel and experience every day the big potential that these kinds of spaces have for general development of people, like the 21st century skills."

-- Participant B, FG_BXL

However, some participants argued that besides learning about different technologies or design methods to more experiential events, also other aspects of education need to be addressed. For example, learning to be collaborative as opposed to be competitive, or learning about the opportunities of creativity that spaces like makerspaces can give needs to be part of the educational model itself.

"Well I think that, generating collaboration, but from below, I'm not going to Education, the schools themselves should learn to work in a group, that each one contributes something, (...) to teach in another way, maybe, I do not know ..."

"Pues yo creo que, generando la colaboración, pero desde abajo, no se me voy a Educación, los propios colegios que aprendan a trabajar en grupo, que cada uno aporte algo, (...), enseñar de otra manera, quizás, no sé..."

-- Participant C, FG_LL

"We tell the kids, this is not the future, this is the present! It is interesting, the door is always open, and it is true that some people approach, but it costs more than we think. I thought that when you opened the box everyone would throw themselves in the candy, no! You have to say look, take, try it, it's good; something is failing there, it's not so immediate."

"Nosotros a los chicos les decimos, esto no es el futuro esto es el presente, es interesante, está la puerta abierta siempre, y verdad que algunos se acercan, pero cuesta más de lo que pensemos. Yo pensé que cuando tu abrías la caja todo el mundo se tiraría a los caramelos, no. Tienes que decirle mira, toma, pruébelo, que es bueno; algo está fallando ahí, no es tan inmediato."

-- Participant A, FG_LL

"A very important task is therefore universities (...) for example at the Erasmus university college [in Brussels], actually this year they are starting into the professional Bachelor degree, a sort of entrepreneurship trajectory. So, very enthusiast, and capable and passionate people, students, they can get rid of some of the courses they normally have to follow and get space and time and coaching of the lecturers to start their own business, during their education. So, I think that really impacts the potential of starting new small businesses."

-- Participant B, FG_BXL

"I have had students who criticised the Fab Academy because they were expecting you to hold their hands and give a teacher-to-student class, with an exercise assigned. They would look at it and replicate it. However it is a slow process, which also departs from the assumption that I, as a teacher, own the solution."

"Io ho avuto degli studenti che criticavano la Fab Accademy perché si aspettavano che tu li prendessi per mano e facessi la lezione frontale in cui c'era l'assegnazione dell' esercizio, loro vedevano come era fatto l'esercizio e replicavano, che però è un processo molto lento e poi parte dal presupposto che io ti dia la soluzione."

-- Participant G, FG_MIL

"We must strengthen some mechanism beyond [mainstream] education. For example, we have an educational offer, we are inside the university, but the educational offer that we do is not part of the university; the university has a study plan approved by Bologna, it is a very heavy structure, you know it, and suddenly we make a formative offer that we decided, and because we decided it, because we know people around that wants to learn something or they are interested, or someone makes a suggestion, (...) or there is a person who knows Physical Computing, knows Arduino... and do you know Arduino? Let's teach it!"

"Entonces habrá que potenciar algún mecanismo así y que fuera educativo. Nosotros por ejemplo, tenemos una oferta educativa, estamos dentro de la universidad, pero la oferta educativa que nosotros hacemos es a parte de la universidad, la universidad tiene un plan de estudio homologado con Bolonia, es una estructura muy pesada, tú la conoces, y de repente nosotros hacemos una oferta formativa que la decidimos, y porque la decidimos, porque conocemos a gente de entorno y que quiere aprender algo o que están interesados o alguien te hace una sugerencia, (...) o hay una persona que sabe Physical Computing, sabe Arduino y ¿A tú sabes Arduino? ¡Vamos a enseñarlo!"

-- Participant A, FG_LL

It is also suggested that it is necessary to change the mind-set of teachers.

"Such an approach disorients the teachers as they feel responsible for transferring content rather than a modus operandi. It is therefore difficult to intervene. Only the more open minded and 'enlightened' walk that road."

"In questo modo di lavorare gli insegnanti si trovano spiazzati normalmente perché loro si sentono responsabili di trasferire un contenuto non tanto un modo di operare, e quindi è difficile intervenire. Sono quelli più illuminati e aperti che prendono questa strada."

-- Participant D, FG_MIL

The 3D printing technology – significantly featured in makerspaces – is also facilitating not only experimentation but also representation of complex issues, namely in the teaching of science, facilitating the realisation of projects at the university or cooperation between universities and other organisations. Yet again, the educational opportunity viz. à viz. the futures of work, lies in a transversal and interdisciplinary paradigm facilitated by the existence of these types of spaces; a member of the FabLab of La Laguna articulated this as an issue of authority.

"the importance of transversal and multidisciplinary [nature of the makerspaces] has been very fundamental because I could never have done my work... I would not have been able to do it, if I had not had a scientist, a biologist by my side, for example; that gives power to the team, the different disciplines present in the same team give you a lot of power."

"la importancia de la transversalidad y la multidisciplinariedad que ha sido súper fundamental porque yo nunca habría podido hacer...mi trabajo yo no lo hubiera hecho si no hubiese tenido un científico, un biólogo a mi lado, por ejemplo, eso da potencia al equipo, las distintas disciplinas presentes en un mismo equipo te dan mucha potencia."

-- Participant A, FG_LL

In the focus group in Brussels, a strong emphasis was put on the role of makerspaces to educate children into the 21st century skills. Yet, not all makerspaces provide sufficient attractiveness, accessibility and even compliance with safety regulations for this aspect to materialise. As a participant suggested, children expect to have fun, and so activities must respond to this expectation.

"(...) children they love making, because it's what I call experimental play, it's what they just naturally do, because they are children and they want to discover the world, they want to learn and you just give them new tools, new ways to look at things. No, what I try to do is just to really invest in this 21st century skills, just to give them the philosophy, look, it's not fail, even if you cannot do it, don't worry, just try. And if you cannot, ask questions, or copy what somebody else is doing. Really act, observe, and do and adopt and this way you really develop a kind of thinking that will help you in life, independent of what you will become."

-- Participant D, FG_BXL

But it is not only children's expectations and the educational offer that suggest fun as a central idea in the use of makerspaces. This is a key motivation of many of those that frequent makerspaces – see section 1.3 for the literature review on this and below for the discussions held during the focus groups.

5.1.8 Fun

As discussed already in earlier sections of this report, fun seems to be not only another key pillar of all operation of the *Maker Movement*, but it was also discussed as a dimension and driver of visions about work futures.

“What I think is also very interesting to see about the new generations, is the fact that people they just want to live and have some money, but they are not interested in the big salaries, in a big company. They don't care. (...) So, what they are interested about is not the money, it's the fun, the joy they can have in a job. (...) This is a very interesting shift in the mind-set of people. (...) Working at a desk, eight hours a day, where you don't see the impact of your job and you feel like a no one, a nobody, that's not work anymore. It used to work in the past, but that doesn't seem to be working. So it's something that is changing.”

-- Participant A, FG_BXL

Yet, as another participant notes, fun can only be equated in the context of work once money is not anymore an issue:

“What you're saying [quote above], yes, applies to people who finished university, who have the luxury of know that any job they will take will be well paid, no matter what. Because, they will look at a one thousand plus salary as a start, no matter what you do. (...) It changes for the disenfranchised, for the people who just finished a secondary education, all those people [are] simply looking for the job that will put money on the table.”

-- Participant E, FG_BXL

The idea that personal development is a prime aim of those who go to a makerspace is expressed in these quotes:

“In Makerspaces or Fab Labs, it's really more about personal interests that you try to discover while tinkering. So, [you can] combine it with entrepreneurship, of course, for sure, in the big universities, where you have like super FabLabs.”

-- Participant B, FG_BXL

“Through making you can really make it is yours, make it is your own, a part of you, a way of think, a way of looking at life.”

-- Participant D, FG_BXL

5.2 Values in the *Making*

Some of the drivers presented earlier in section 5.1, which could inspire futures of work can be understood as the *values* with which the community of makers operate in many cases. They are present in the *Maker Movement* discourses and therefore, not surprisingly we found in the discourses of our interviewees and focus groups' participants ideas of individual and collective autonomy, agency, solidarity, community accountability, care, articulated as inbuilt values of the *Maker Movement*. So, in the remainder of this section we try to delve into more commonly described values that emerged in the conversations; we concentrate on ideas of autonomy and personal agency, solidarity, time and care.

5.2.1 Solidarity

It is out of the scope of this report to go through the literature on *solidarity*, yet it is striking that the debate on solidarity is offered to contrast the challenges of globalisation (Calhoun, 2002; Fenton, 2008). Solidarity is one of the fundamental aspects of hacker ethics, along with sharing and cooperation (Niaros, Kostakis, & Drechsler, 2017)³⁷. There are many ways in which one can articulate solidarity and there is not even a clear consensus as to what it refers to, an action, attitude, motive... (Harvey, 2007). In our study the work of Dean (1995) on reflective solidarity frame the reflections offered below. Reflective solidarity, in contrast to affective and conventional solidarities is described by Dean as a more inclusive concept, which views the “‘we’ as constituted through the communicative efforts of the ‘I’s’ (...) [changing] the boundaries of community [and] the demarcation between ‘us’ and ‘them’.” (Dean, 1995, p. 123). Reflective solidarity suggests that divergence and critical thinking are used dialogically to bond people together.

Interviewees and focus groups’ participants do not talk about members or membership to makerspaces, even if many makerspaces require a fee for usage of machinery and materials. Yet, the idea is that bonds within a makers community are created about shared goals, ideas and materiality, as well as, mutual interdependencies; yet different needs of individuals and communities are not sources of divergence; on the contrary they are opportunities to negotiate other forms of solidarity. To the question, who comes to the makerspace and with what expectations, there has been no homogeneous answers: a variety that we can describe as *everybody*. Even if there are strong identity(ies) associated to the *Maker Movement* (Gini, 1998), anyone can be part. The following quote expresses this idea.

“We definitely attract a lot of people, kids, but also starters, like people in their twenties or early thirties, but also like older people, like sixty plus. Because in a Fab Lab or in a Makerspace, they have access to tools that they cannot afford themselves. You are never going to buy for yourself a laser cutter of ten thousand euros, to make use of it. So, in that case, you can compare the Makerspaces (...) to libraries. They innovate, they democratise the access to knowledge, to expertise and, because of, let’s say because of the Fab Lab charter, that really emphasizes on learning, playing, but especially on sharing knowledge.”

-- Participant B, FG_BXL

As we suggested earlier, collaboration, openness and sharing are fundamental values driving the activities of the *Maker Movement*, but these could also be drivers of the futures of work. We suggest that these values are the gist of solidarities of a reflective kind, where the ‘we’s and ‘them’s are mutually constituted. This means that the *divergent* and the *different* and also those who cannot *catch up* seem to find a space of *negotiation* in the context of makerspaces. Imagining work that is based on this type of inclusiveness is not straightforward, but the experience of makerspaces is worth exploring.

³⁷ The authors quote (Dafermos & Söderberg, 2009; Levy, 2001; Maxigas, 2012; Wark, 2004) to support their suggestion.

5.2.2 Autonomy

Individual autonomy is a central value in the Kantian tradition of moral philosophy. It refers to *“the capacity to be one's own person, to live one's life according to reasons and motives that are taken as one's own and not the product of manipulative or distorting external forces”* (Christman, 2015). It is about self-governance and alignment of one's values and interests, and one's actions. In this study we are not so much interested in the individualist side of autonomy but in what Bureau and Corsani (2016) described as new form of autonomy gained by collective action when they looked at practices of appropriation of knowledge in the *Maker Movement*. Ideas of individual and collective autonomy permeate the discourse of makers, blended with ownership associations:

“through making you can really make it is yours, make it is your own, a part of you, a way of thinking, a way of looking at life.”

-- Participant D, FG_BXL

In the conversations held with the participants, ideas of flexibility as an autonomic strategy were introduced. Adaptive strategies with regards to work are already in place and are key in the narrative of life learning for example; hence, with regards to futures of work, *making* seems to offer that type of autonomy. For example, this quote:

“I think that flexibility is something that you don't really learn at school. That's why I think Makerspaces and Fab Labs are very important, because there you learn to be flexible, to change. Shit, this is not working, I'll try something else.”

-- Participant D, FG_BXL

The following quote illustrates how autonomy is framed as a political project, which cannot be dissociated from visions of how futures of work may unfold:

“I see [Maker Movement] as quite anti-hegemonic; (...) all that brings autonomy and emancipation until a certain limit, leaves you a little space to face the global hegemony and I see that very very very positive.”

“Y luego yo lo veo [estos movimientos] bastante anti-hegemónico, o sea todo lo que sea autonomía y emancipación, pues hasta un cierto límite, te deja un poco de espacio para enfrentarte a la hegemonía global y eso lo veo muy muy positivo.”

-- Participant B, FG_LL

Furthermore, collective autonomy as a desirable value is expressed in this quote, with makerspaces being possibly the harbours to escape the atrophy of institutionalised bureaucracy which hinders the exploration of creative ideas to address real societal problems or simply educational aspirations.

“it is more expensive to justify those 50 euros than if you receive under the table – I shouldn't have said that – or as a barter, coffee or something like that. The organisation is not making it easy, so where does this takes us? To look for that spin-off or creation of start up or spin-off, technology-based companies, to be able to play in both worlds. (...) [On the one hand,] to have a certification is important, because that certification is what many people are looking for and on the other hand, to be able to work with people, provide those services, and have a certain autonomy making that [bureaucratic] backpack lighter.”

“sale más caro justificar esos 50 euros que te los den en negro o que te los den, eso no tenía que haberlo dicho, que los den en un trueque, café o algo de eso. No está facilitando la estructura, entonces ¿Nos lleva a qué? A buscar esa spin-off o creación de start up o spin-off, empresas de base tecnológica, para

poder jugar en los dos mundos. (...) Tener esa certificación que es importante, porque esa certificación es lo que busca mucha gente y por otro lado poder trabajar con la gente y dar esos servicios y tener una cierta autonomía y que esa mochila sea más ligera."

-- Participant D, FG_LL

5.2.3 Matters of Care

In her work encouraging the study of science and technology developments with an ethos of care, Puig de la Bellacasa (2011) introduces the notion of *matters of care* as implying a notion of doing and intervening: *to care*, she writes, "*more strongly directs us to a notion of material doing*" (Puig de la Bellacasa, 2011, p. 90). We would like to use the notion of matters of care to examine how care emerged in the focus groups conversations and how it permeates future work narratives. First, we found that caring is a foundational value inherent to *making*. Many people that go to makerspaces experiment, learn by doing, pursue personal quests of creativity and fun but many others do things and engage in individual or collective projects to simply respond to theirs or collective practical needs, in other words their matters of care. There are many spaces engaged in environmental projects or health projects, in the pursuit of addressing societal challenges that affect us all. Could values of care inspire futures of work and associated jobs?

In the conversations with participants of the focus groups, *caring* and *matters of care* were associated with people taking ownership of issues and acting upon them. In that regard, *making* (and makerspaces) is a place where *care* can be experimented with new and possibly tailored ideas to tackle problems identified and framed by the citizens that use these spaces to address their matters of concern and matters of care. Caring is about taking in one's hands those matters that are often relinquished to the governmental institutions. A great deal of FabLabs and other makerspaces are, for example, participating actively in air quality projects. They foster community involvement in the monitoring and also governance of air quality in cities – see for example the work done through a H2020 project called *MAKING SENSE*³⁸.

"[Normally social care is] more a top-down approach, where I guess you can receive some help, but you are always on the receiving hand. You are never on the giving hand. In the hackerspace environment, you at least are with people who, kind of, share with me, that they are actually unemployed, because you don't necessarily notice it. If they can give something back, then everyone has learned something... But I think it has to come from the people themselves (...). I just think people have very different ideas of what helping might mean."

-- Interviewee 5; October 2017

"I personally got involved when I was over 25, unemployed. I also missed school and university...you know, when you are in such a situation, it's hard in Europe to go back to study...Then I discovered a Fablab (...) I got interested in the community. I have a disability, and given that prostheses are expensive, I thought that maybe I could try to do some on my own, using the open source and technology such Arduino and 3d printers. They offered me a free space to do that, and in change I would share my advancements."

-- Interviewee 13; March 2018

³⁸ See for example a campaign about gamma radiation in the city of Amsterdam: <http://making-sense.eu/campaigns/gamma-sense/> (last access: 28 March 2018).

"People were really enthusiastic to help a disabled person, (...) I really like this way of having no plans, be free...you know meeting people to do something, it gives sense to the life I was having... actually disability was a tool to learn and create social empowerment as well."

-- Interviewee 13; March 2018

5.2.4 Time

Time is money, so goes the riddle. Scholar Barbara Adam (2003) noted that not all time is economically exchangeable, a construct that has a long history. She emphasises that "*Outside of this particular human construction time is life; it is change and difference; it is evolution, it is development, it is birth and death, growth and decay; it is the past and future gathered in the present; it is potential; it is origin and destiny. Moreover, in interaction we generate and make time*" (Adam, 2003).

In the conversations with makers, time emerges with the possibility of it being experimental and unplanned; ownership of time is regained through *making* and through building and interacting with the community. Time spent in makerspaces seems to be close to the notion of time gift, *i.e.* time outside the time economy of employment relations (Adam, 2003). The oppressions of time, timely and urgency seem to be relaxed through other objectives that permeate the activities of makers. A participant suggested that decoupling time and work time from economy will see changes in the values with which we use and create our time.

"robots and automation will seriously impact the relationship between getting paid for something and working. Now, the moment those two are not connected anymore, then the role of making things becomes different, because all of a sudden you have a lot more time. So, where initially you bought ninety percent of your stuff ready, ten percent you customised and one percent you made yourself. That will shift. You will start to want to make more stuff yourself."

-- Participant E, FG_BXL

The Ancient Greek language had two notions for time, *kairos* (καιρός) and *chronos* (χρόνος). The latter is about the passage of time whilst the former is about the right, critical, or opportune moment to act and it has a qualitative nature. In the conversations with makers there seems to be a *third time*, one that is created through the establishment of caring relationships with objects and other makers, which consists of *accomplished* or *fulfilling* time, which is not expected to be rewarded in the current economy and sociology of work and labour.

"If you really want people to get involved...give them time! People now work 9 to 5, they have bad jobs, they are paid 1000 euro. How do you want them to be involved? After work they go home (...). So let's say that people work 25 hours per week, and get the same salary but in exchange you have them involved in the evolution of the society. This is the way to go!"

-- Interviewee 13; March 2018

"I think there are some scenarios that are more critical, such as the duration of employment contracts, that is a problematic scenario because it detaches from the issue of education and enters into a more complex system not simply related to skills, it has to do with the idea of an evolved social model, with the fact that if we free creative time because we aren't working, what do we do? The answer doesn't lie with education, but in society."

"Credo che ci siano degli scenari che sono più critici, tipo la durata contrattuale media del lavoro dipendente, quello è uno scenario problematico perché esce dallo scenario dell'educazione ed entra nel piano di un sistema complesso e quindi non è semplicemente controllabile sul tema delle capacità, ha a che fare con un'idea di modello sociale evoluto, ha a che fare con il fatto che se liberiamo tempo creativo perché non lavoriamo, che cosa facciamo? La risposta non è una risposta della formazione, ma è una risposta nella società."

-- Participant D, FG_MIL

6 New Narratives for the Futures of Work?

Participants of the three focus groups were invited to imagine their own narratives on the futures of work. The two following narratives are constructed based on various recurring elements debated in the different focus groups. These include elements described in the previous sections of the report, but were particularly focused on the *uncertainty* and *identity* themes.

6.1 Uncertain Times

Narrative

We live times of great uncertainties because our received notions of what constitutes an ideal life are being challenged by fragmented and distributed ideals, expectations and imaginaries. Experiments of how our economies should work are in the making: only few years ago, jobs that exist today did not exist. Political, institutional, legal, ethical and practical uncertainties make it nearly impossible to anticipate and imagine what will change. The mix of complex socio-economic and environmental factors that pressures society pave the way for continuous interrogation about past and current practices and the drivers that are assumed to be making the futures of work, jobs and employment. Uncertainties are not only about the nature of work, the skills of the future, but also its governance and, in particular, the values embedded in making those futures. Current notions of solidarity and dignity have been challenged with different economic crisis, and amidst the disturbing idea that social dialogue could be compromised through market forces, ideas of care and time as value seem to emerge. In this condition of uncertainty, the constant acquisition of skills is seen by many as the only course of action for making people resilient to dramatic changes in the nature of work. Yet, what skills are relevant? Makerspaces are taking a key role by not only providing the ground where skills can be acquired and where failure is accepted and acclaimed. Yet, which skills will play out as the most important? Will their commodification turn out as fundamentally counterproductive? Could making be a place to reimagine new economies, away or with state or market led possibilities? Could making be a place to growing individual agency about the work one imagines as its livelihood and lifestyle?

6.2 New Identities

Narrative

The way individuals think about work is in the making. By embracing more experiential ways of relating to the world, citizens have also distanced themselves from state and market expectations, living more independent lives from those based on the business and pay check goals. The implementation of a conditional basic income enables individuals to work towards the stuff that matters, but having the time and the resources to actually make that happen. Individual fulfilment is paradoxically inspired by drivers such as community formation, care, collaboration and sharing. Gradually, work and lifestyle are positioned as a new explicit mix. Work becomes a way of living. Feelings of ownership, satisfaction and

realisation are linked to work, achievable through making. Through making people develop and perform their own expectations: they are able to act on what they deem relevant, without the pressure to deliver, the right to fail and the return to direct experience. People can connect with the issues, and thus feel actual impacts of their deeds in society. Making helps with acquiring self-esteem, challenging the sense of the self and the collective and, more generally, fulfilling other needs beyond merely economic ones. This paradigm starts with younger generations, who take some habits of learning, of doing, of how to react in front of a problem. The identity of the individual in relation to work is vital for its governance. Making is the new work identity in the block amidst other identities, fostering a more existential underpinning of the meanings of work.

7 Final Remarks

7.1 Key Messages

“The burgeoning maker culture or maker movement has been heralded as a lot of things, not least a postcapitalist, utopian revolution capable of breathing life back into stagnating First World economies, redistributing wealth opportunities and even rescuing the environment” (Elliott & Richardson, 2016)

The work presented in this report does not show that the *Maker Movement* is or will revolutionise the futures of work. However, the conversations that have been presented here illustrate that the *Maker Movement* is *de facto* enacting work futures; the narratives, drivers and values by which it develops and works have been inspirational not only for the communities involved but also to policy making and the entrepreneurial world.

Hence, not a single participant in our empirical study would take for granted received meanings of *work*, or many elements of the narratives that seem to sustain the imaginaries of how work should be in the future. The vast majority of participants did not connect *makerspaces* to the discourses about work, jobs and employment and their possible developments in the future, but in few cases they discussed some opportunities for entrepreneurial development within makerspaces. Hence, the main goal of *making* does not seem to be to become a changer of work paths into the future, but the movement could have a great deal of influence on how some futures could unfold because of their social and cultural underpinnings. Some participants are convinced that the *Maker Movement* can, in some ways, provide a transformative space in which a series of dimensions that interest the futures of work, can or are already being experimented.

In the remainder of this section we summarise key findings in relation to narratives, driving forces and values that could inspire imaginaries about work in the future.

7.1.1 Narratives

The main findings in regards to the narratives presented and discussed by the participants in the three focus groups are listed below (note that two of the narratives – Narrative 7: *Ageing*; and Narrative 8: *Migration* – were not selected in any of the focus groups by the participants and thus could not be analysed):

- **Automation:** The effects of automation on the futures of work are continuously progressing and growing, and there seems to be no stable anticipatory ideas on this. At the present time, the effects of automation is not primarily in regards to physical activities but rather, and more significantly, about intangible services *i.e.* current effects of automation are and will be mostly visible on the service sector. Even if the idea that automation is changing the nature of work and also possibly taking many current jobs away, the importance of collaboration between humans and technology is acknowledged as a more plausible paradigm than that of substitution.

- **Globalisation:** Globalisation has paved the way to many transformations in relation to the nature of work, such as redefinition of market players, and privileging existing large companies. The *Maker Movement*, and in particular the FabCity Global Initiative³⁹, are equated in the narrative as a framework that could enhance processes of local production, services and know-how paradoxically sustained by global sharing practices and politics.
- **Micro-Factories:** Micro-Factories are not seen, at least in the way they were framed in the narrative, as a viable response to counteract in Europe the impacts of capitalistic models and delocalised production. When linking micro-factories to makerspaces, it becomes even more evident that the aim is not to provide the same types of products. Production is possible in makerspaces, but not production in the traditional sense of mass manufacture. Indeed, these types of spaces are above all *manufacturers of ideas*. Focus is on providing learning opportunities *i.e.* in democratising knowledge, that can (or not) be transformed on specific and highly personalised products (democratisation of personal fabrication).
- **Sharing Economy:** The narrative opens the discussion to the meaning of what is indeed the sharing economy and what ideals it should represent. Participants argue that the principles of sharing economy have been distorted because of conflicts of interest, lack of regulation and, above all, because those who own the IT platforms do not act differently from large corporations in the long run. Most criticism is focused on whether or not business models and practices treat workers fairly. The sharing economy concept, as it stands, is not truly about *sharing* and thus should be revised.
- **New Skills:** Skills and skills development are core to the discourse and imaginary of futures work. Participants suggest that formal systems of education are currently unable to provide the necessary skills for the work of the future, a core role that makerspaces can support. Beyond provide learning spaces in STEM related disciplines, makerspaces have a prominent role in teaching people to be flexible. However, how can the skills acquired in places such as makerspaces be formally recognised?
- **Green Economy:** Ideas of care, of passion, and of ownership are suggested as to be the key dimensions for such narrative to be plausible and to have a stand on its own; otherwise these ideas risk being appropriated as a rhetorical device of installed economies.

7.1.2 Drivers

We started this work with the question: *is ICT the only driver of futures of work?* We have found out that many other drivers could be performing futures of work. We list below the main findings in regard to key drivers that from the point of view of the participants of the focus groups are or could boost work futures:

- **Innovation:** Some participants conceptualise makerspaces as places of innovation that can lead to the creation of new products and the development of start-ups, thus offering indirect opportunities of job creation, not least for their highly experimental orientation, also characterised by the *right to fail*. These spaces are also seen as providing the

³⁹ FabCity Global Initiative: <http://fab.city/> (last access: 28 March 2018).

opportunity to explore and develop unique solutions and local production as opposed to the *mass production* paradigm. However, innovation is not exclusively technological but includes more dimensions *i.e.* at the social and cultural levels. The types of innovation with which different makerspaces are engaged could change or influence work futures. To draw light on these dimensions it is important to interrogate further how makerspaces are being used, by whom and with which objectives, as well as how such spaces connect to other existing infrastructures and contribute to the creation of collectives.

- **Skills:** *Making* is suggested as an effective way to develop strategic and new skills, *upgrade* existing knowledge, and acquire flexibility to face everyday problems. The *Maker Movement* is conceptualised as a promoter of such skills, also by offering vocational paths to learning, as well as, by rediscovering the importance of *disappearing* skills. Preserving old-fashioned (analogic?) skills is a key function of makerspaces. While all participants agree on the importance of skills as a main driver for the future, some highlight the particular importance of collaborative skills beyond human collaboration, *i.e.* in the context of human-machine interaction.
- **Open everything:** Open source is a fundamental characteristic of the *Maker Movement*, being often heralded as a way to foster innovation. However, the paradigm of openness sometimes is not always depicted as an appealing and economically viable option for starting businesses. More needs to be done, for example in terms of regulation, for this to become a strong driver of work futures.
- **Sharing:** Conceptualised as the movement cornerstone, sharing is also suggested to be a fundamental driver of the futures of work. The sharing paradigm permeates multiple facets of the *Maker Movement*, from connecting people, to knowledge, tools and resources available to the community.
- **Fantasy:** Makerspaces are described but also expected to be safe spaces where one can experiment with fantasy without the pressure to deliver or the pressure to succeed (right to fail). *Personalisation of creativity* is claimed to be an opportunity provided by these spaces to explore concepts and ideas to one's or to the community's interests, concerns or matters of care.
- **Collaboration:** Participants claim that makerspaces help to develop a collaborative attitude among participants, since values of care and solidarity entrench the collaboration driver. Collaboration as opposed to competition could be a strong driver of work futures. This is in striking contrast with the way many institutions and businesses work where competition and top-down decisions determine workers' relationships and work organisation.
- **Education:** Education futures and paths are a pivotal driving force to imagine work futures; one can say that they are co-produce. New proposed models of education rely on *learning by doing*: experiential, hands-on, experimental, and peer to peer learning. These concepts are not offered as substitutes of formal modes of learning but they could and should co-exist. Makerspaces expect to provide alternative curricula *not only with tinkering activities* but more fundamentally about other norms of conviviality, partnership and a collaborative

spirit as opposed to a competitive one. Makerspaces are imagined to be helpful to educate children into the *21st century skills*.

- **Fun:** Personal development is described as a prime aim of those joining makerspaces; *making* is often characterised by the traits of fun and hobbyism. To have fun in one's work is not a farfetched goal and could be a strong inspiration for how work could be imagined in the future, exploring ideas of personal fulfilment way beyond the pay check objectives.

7.1.3 Values

We identified in the discourses of our interviewees and focus groups' participants values intrinsically linked to the *Maker Movement* that could inspire imaginaries about work in the future. We list below the main key findings in relation to those values:

- **Solidarity:** *Everybody* can access makerspaces. Intrinsic to the making communities, are the bonds among individuals strengthened by shared goals, creative ideas and materiality but also through mutual interdependencies to address individual or collective challenges. Individual challenges can be the solely impossibility of enrolling with the current arrangements of work where up-skilling is an invariable rhetoric. What about those that cannot do this? What role communities such as those of makerspaces have to address the *outcasted*? Collaboration, openness and sharing are fundamental driving values of the *Maker Movement*. We suggest that these driving values through which the *divergent*, the *outcasted* and the *different* could enter in dialogue are the gist of solidarities of a reflective kind; this could inspire new solidarities in future work arrangements and benefit the taming of societal challenges.
- **Autonomy:** Ideas of individual and collective autonomy permeate the discourse of makers, blended with ownership associations, as well as ideas of flexibility as an autonomic strategy. Adaptive strategies with regards to work are already in place and are key in the narrative of life learning for example; hence, with regards to futures of work, *making* seems to offer that type of autonomy.
- **Matters of care:** Caring is inherent and foundational to *making*. Oftentimes *caring* and *matters of care* were associated with people taking ownership of issues and acting upon them. Many people that go to makerspaces experiment, learn by doing, pursue personal quests of creativity and fun but many others do things and engage in individual or collective projects to simply respond to theirs or collective practical needs, in other words their matters of care. Could values of care inspire futures of work and associated jobs?
- **Time:** Time emerges with the possibility of it being experimental and unplanned; ownership of time is regained through *making* and through building and interacting with the community. The making of time reads as a feature of *making* and seems to be closer to the notion of time gift, *i.e.* time outside the time economy of employment relations.

7.2 Insights for Policy

The EU has responsibilities in a wide range of policy topics⁴⁰. The authors provide below a summary of the main key conclusions and insights for policy of the present report, in four specific areas:

- **Education, training and youth:** Makerspaces are among the places for developing the necessary skills for the 21st century; they can serve as spaces to freely access to alternative or complementary education. More time needs to be spent on activities that require social and emotional skills, creativity, high-level cognitive capabilities and other skills relatively hard to automate. School and university systems should take this into account and adequate resources should be allocated.
- **Research and Innovation:** Makerspaces can have a central role in fostering innovation and the creation of new products and services, but these spaces seem to focus more on the ideation and prototyping phases (makerspaces are not suitable for mass-manufacture). Innovation policies cannot ignore the potential of these spaces to attract people that otherwise would not have access to tools and knowledge that help them be creative and innovative in solving problems that might affect us all. A great deal of *making* concentrates on actual individual and community needs and not imagined ones.
- **Employment and social affairs:** Employment is not the core business of makerspaces, but employment policies could take inspiration of the makerspaces' operation. Makerspaces can inspire individuals to create their own work, or to find pleasure and satisfaction beyond the income, for example. With regards to jobs, the implementation of a *conditional basic income* for specific contexts could motivate and enable people to work in issues that matter for society, whilst having the necessary resources to do it. Work, jobs and employment policies could take inspiration from the driving values of the *Maker Movement*, such as: solidarity, open culture, sharing, collaboration, creativity, fun, care, and the value of time.
- **Consumers:** EU consumer policy safeguards consumer rights and guarantees the safety of any product within the single market. However, open source DIY kits developed at makerspaces do not always comply with the existing rules and certifications in EU. Some participants point out that in order to promote the *maker culture* and foster innovation, norms and regulations (e.g. EC certification) need to reflect the open source DIY nature of products developed at makerspaces. Specific certification programs and regulation are required that allow, for example, the use of open source DIY kits in educational environments.

The discussion of the ethics and values by which we would like to live our working life should be an open debate to all; this has been largely relinquished to the ideals of profit and other business oriented criteria. Any discussion on futures of work in social, economical, policy and political terms needs to include all actors of concern, including citizens. All citizens are concerned and we all need to appropriate the conversation and make the imagination of plausible work futures to be ours. We

⁴⁰ See https://europa.eu/european-union/topics_en (last access: 29 March 2018).

suggest that a debate needs to be organised in the form of a public project, so that the futures of work are not left to self-organisation or relinquished to powerful corporative elites.

Movements like the *Maker Movement* can be inspirational of policy making in areas of great complexity and uncertainties as work, employment, jobs are. It would be important to secure that all possible aspirations and inspirations are crowdsourced and marshalled into the thinking in this area, avoiding the pitfalls of taking for granted narratives that could be obsolete, implausible, inappropriate or even damaging to policies in this area. Debates about futures of work should not be locked up on methodologies that do not mobilise the imagination, the insights and expectations of wider ranges of society. Policy making should look for inclusive methodologies that help with governing challenges and expectations, such as participatory *futuring*, social and political sciences which can foster co-creation of the necessary knowledge to approach this major societal issue.

There are no stable policies or practical solutions to the challenges put by different driving forces with regards to present nature and organisation of work. Equally there are many futures of work, and no report will be definitive. Policy making should be nurturing necessary studies, experiments and conversations until some resilient ideas are found.

7.3 Further Research

No report on the futures of work will ever be conclusive. Futures of work are in the making. The *Maker Movement* is not certainly a homogeneous entity as it emerged both from the literature and the empirical study presented in this report; there are very different aspirations among those that call themselves *makers*, and therefore the relationships with broader societal endeavours are also very different. Therefore, future research should investigate the range of contexts in which the *Maker Movement* develops to draw representative conclusions of its role in performing futures of work or of other areas of social endeavour. In addition, research on other loci where possible work futures could be developing should be investigated.

Two of the narratives that we planned to discuss were never taken on-board by the participants; interestingly they refer to demographic dimensions that we believe are of vital relevance for imagining futures of work: *migration* and *population ageing*. Future research should look at these and other demographic variables.

There are a number of JRC projects addressing the futures of work with equally a number of different angles. The work done in this report, confirms that a comprehensive examination of the complexity, spill-overs and uncertainty associated with studying this topic is better dealt with through interdisciplinary studies. Hence, this topic constitutes yet another opportunity for the JRC to tackle the broad policy questions, by using many different methodologies in which the JRC is competent. The JRC could be a relevant actor to develop mechanisms to address spill-overs in a comprehensive way and facilitate this debate in a strategic way.

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List of Abbreviations

App	Software Application
CNC	Computer Numerical Control
DIY	Do-It-Yourself
EC	European Commission
EU	European Union
FabLab	Fabrication Laboratory
FG_BXL	Focus Group Brussels
FG_LL	Focus Group La Laguna
FG_MIL	Focus Group Milan
ILO	International Labour Organization
JRC	Joint Research Centre
ICT	Information and Communication Technologies
IT	Information Technology
MS	Member State
OECD	Organisation for Economic Co-operation and Development
UK	United Kingdom
USA	United States of America
STEM	Science, Technology, Engineering and Mathematics
STEAM	Science, Technology, Engineering, Arts and Mathematics

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Annex A: Focus Group Agenda

- 09h30** **Welcome**
- 09h45** **Introduction to the Focus Group**
- 09h55** **Introduction of the participants**
Name, affiliation, and why did you accepted the invitation.
- 10h00** **Icebreaker: Pick an object**
- Reason for choosing that specific object.
 - Connection with the object.
 - Relation of the object with the topic of the focus group.
- 10h15** **Eight narratives for the Future of Work**
Group discussion: 2 groups / one narrative per person
- Validation: Do you see the narrative as plausible? Is it familiar/connected to your personal experience?
 - Temporality: What is the timeframe of the narrative? Is it an immediate narrative or something to be expected in 25+ years?
 - Relation with the *Maker Movement*: How to you see the *Maker Movement* in this narrative? Is it a driver?
- 11h10** **Coffee break**
- 11h25** **The *Maker Movement* and the *Future of Work*.**
General discussion + Exercise
- What other narratives do you imagine?
 - How makerspaces impact the transformation of the nature of work?
 - Insights and recommendations.
- Exercise: Imagine a narrative on the *future of work* driven by the *Maker Movement*
- 12h30** **END**

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