Making Good our Future

Exploring the New Boundaries of Open & Social Innovation in Manufacturing

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The Social Innovation Europe initiative is working to connect policy makers, entrepreneurs, academics and third sector workers with other innovators from across Europe. It is our goal to become a hub – a meeting place in the network of European networks – where innovative thinkers from all 27 member states can come together to create a streamlined, vigorous social innovation field in Europe, to raise a shared voice, and to propel Europe to lead the practice of social innovation globally. See more at https://webgate.ec.europa.eu/socialinnovationeurope/en/about.

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“If [the] great project in the 20th century was the democratisation of consumption – that was Henry Ford, Levittown, Coca-Cola, IKEA — I think [the] great project of the 21st century is the democratisation of production”

Alastair Parvin

"When problems become distributed, the search for solutions becomes collaborative and the research agenda is driven not by multinational shareholders but by the passions of the participants, you get not just better results, you get different results"

Alec Steffens

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Executive Summary

In the political manifesto *'A new start for Europe. My agenda for Jobs, Growth, Fairness and Democratic Change'* (July 2014) Jean-Claude Juncker, the new President of the European Commission, has made strengthening competitiveness, restoring investment and creating jobs the priorities of the EU. The Commission will support entrepreneurship and SMEs and invest in innovation, strategic manufacturing industries, and digital technologies. It will create opportunities for young people and everyone affected by the crisis and excluded from the labour market.

President Juncker confirmed his commitments in his first speech to the European Parliament (October 2014) where he repeated the commitment to prosperity for all people in Europe through a new balance between economic and social priorities.

This is an inspiring agenda and its success will be only achieved if the European Union explores new strategies for reindustrialisation and growth which engage all citizens.

The policy paper 'Making Good our Future' puts a spotlight on opportunities which are crystallizing at the cross roads between social innovation, open source ICT and manufacturing. In this policy paper we have attempted to explore how social innovation and open source principles can inform manufacturing by enhancing productivity, creating more rewarding jobs, generating private and public value and, eventually, embedding new democratic practice at the core of industrial production.

We call it 'maker manufacturing' after the maker movement, and have identified three dimensions for this kind of innovation in manufacturing:

1) A horizontal dimension, **Democratisation of making**. A combination of values-based movements (the makers), new professional institutions (the FabLabs), open tools (3D printers) and open source protocols are turning manufacturing into a participatory process in which the agents share risks and benefits and increase the value of production. Highly networked regional clusters provide the infrastructure for communication and collaboration.

2) A vertical dimension, **Supply chains for good**. Full transparency of the sources of materials used in manufacturing and the conditions of production in the supply chain reveals the real footprint of a company and its commitment towards the environment and society. It is a simple but powerful drive to transform corporate strategy and consumers' choices.

3) A transversal dimension, **Corporate Citizenship.** The next frontier of corporate social responsibility (CSR) sees social and environmental impact in their relation to the business strategies and decision-making processes of companies. It makes apparent that achieving positive social and environmental impact is not only compatible with making profits, but, in

the medium term, is a pre-condition at making profits. Corporate Citizenship requires a company to look its footprint on the environment and society at every stage in the value chain. The availability of talent, intellectual property protection, rule of law and neighbourhood employment might be external to the company's perimeter of action, but they will have a material impact on its performance and are strategic intervention points for CSR.

The paper includes a set of cases and considerations based on an initial series of interviews and desktop research. It highlights the potential of maker manufacturing to contribute to the Juncker Agenda, as well as the risks and possible damaging effects. The paper draws the attention of policy makers for enhancing the potential and managing the risks.

This is a journey in its beginning. Paraphrasing the great historian of economy Karl Polanyi who explored the dawn of industrialisation, one day we might claim this was the beginning of a great transformation when neither the new wealth nor the new poverty was yet quite comprehensible.

The extent of public interest in the field is beyond doubt. It has already attracted thousands of young people, innovators and individuals who do not find a place in the current labour market or aspire to do more than getting a job. Websites multiply and public events like the Maker Fair gather hundred thousand people. The Economist has dedicated several articles to the subject, and the futurist Jeremy Rifkin wrote his last book *The Third Industrial Revolution* on the topic, thereby gaining the approbation of the European Parliament.

This transformation presents an opportunity to revive the social innovation and social entrepreneurship agendas that were launched by the Barroso's Commission.

This paper is a gaze into a possible future which requires an effort of political imagination if it is to become a real opportunity for many. This is a challenge worthy of the new European Commission.

1. Setting the Scene: Maker Manufacturing and Social Innovation

The field of social innovation is growing rapidly, with a range of networks, funds, institutions and government departments focused on supporting and promoting it, accelerated by the European Commission. Since 2008, social innovation has moved up the EU's policy agenda and has been mainstreamed through a range of policies, programmes and initiatives.[1]

There are many definitions of social innovation. The first report on the topic by the Bureau of European Policy Advisers (BEPA) defines social innovations as "innovations that are social in both their ends and their means. Specifically, we define social innovations as new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations. They are innovations that are not only good for society but also enhance society's capacity to act".[2]

The methods of social innovation usually focus on a range of core themes such as multi-stakeholder co-design, co-funding, co-delivery and co-validation of ideas, processes, products and services which aim at preserving and growing the public good. Hitherto, much of the research and practice of social innovation has been focused on new models for public service delivery, often based on the collaboration between the public and third sectors, and using ICT.[3] In this regard, a good example is provided by the Social Investment Package launched by the Commission in 2013,[4] which has been primarily focused on assisting Member States to modernize their social protection systems. Similarly, the role of social enterprises has been regarded as complementary to the role of the public sector, with social innovation intended as a mean to provide new or better services meeting social needs which are not (or not sufficiently) covered by mainstream public services. Social innovation is one

[1] The central role granted to social innovation in the Europe 2020 flagship initiatives "Innovation Union" and "A platform against Poverty" has resulted in a wide number of regulatory and non-regulatory actions, including the Social Business Initiative, the European Social Entrepreneurship Funds (EuSEFs) Regulation, the launch of Social Innovation Europe, the Social Innovation Competition and the Social Investment Package. Funding for social innovation has been made available under EU Research and Innovation Framework Programmes such as Horizon 2020. Social policy experimentations are funded by DG Employment and Social Affairs through the Employment and Social Innovation Programme (EaSI). In addition, Member States which choose to dedicate a priority axis to social innovation in their national operational programmes under the reformed Cohesion Policy can claim a 10% increase in the maximum EU co-financing rate.

[2] BEPA 2010. More recently, the EU funded TEPSIE project defined social innovation as "new approaches to addressing social needs. They are social in their means and in their ends. They engage and mobilise the beneficiaries and help to transform social relations by improving beneficiaries' access to power and resources." (TEPSIE, 2015).

[3] Collective Awareness Platforms for Sustainability and Social Innovation see http://ec.europa.eu/digital-agenda/en/caps-projects.

of the four elements that distinguish a social enterprise from any other enterprise in the definition of the Commission (BEPA 2011, 2014).

This paper looks at how social innovation finds expression in manufacturers' corporate social responsibility strategies as well as in forms of manufacturing made possible by the availability of new technologies such as 3D printing, computer numeric control (CNC), Computer-Aided Design software (CAD) and electronics assembly, and new forms of organising the production process. The transformation is not just a consequence of technological innovation. New technology has allowed manufacturers to anchor social and democratic values in the production. We have called these new forms of manufacturing "maker manufacturing", with reference to the "maker movement" which has led on the spread of the practice (see paragraph 2.1).

While particularly evident in maker manufacturing, this form of social innovation can be found in the corporate sector in Corporate Social Responsibility (CSR). According to the definition of Kellie McElhany (2009) "a business strategy that is integrated with core business objectives and core competencies of the firm, and from the outset is designed to create business value and positive social change, and is embedded in day-to-day business culture and operations".

This aspect of social innovation underlies the definition used by CSR Europe (2012): "Social innovation refers to new ideas, business models, products and services, which resolve existing sustainability challenges and create new collaborations between business sectors and stakeholders. Social innovation is increasingly seen as a sound business strategy to solve some of society's most difficult problems at local, regional, national and global level".

In this context we present an exploration of the emerging maker manufacturing model. We include its relationship to the traditional manufacturing sector, and consider the role of social innovation as a mean of addressing some of the main challenges which the labour market faces while making the traditional manufacturing sector more competitive.

While acknowledging the potential of social innovation for the private sector, the European Commission frames it principally in terms of worker participation and workplace innovation.[5] We argue that this potential needs to be understood and sustained in a wider framework, in which manufacturing industries are considered to have a central role in addressing the great social challenges Europe faces. These include an ageing population, migration, unemployment, poverty, raising inequality and climate change.

[5] See The European Workplace Innovation Network http://ec.europa.eu/growth/euwin.

In 2012 the manufacturing sector in the EU employed 30 million people directly and provided twice as many jobs indirectly, mainly in the service sector[6]. Manufactured goods amounted to more than 80% of total EU exports and manufacturing accounted for 80% of private research and development expenditure. In spite of this, manufacturing industry in Europe has declined in recent years. Over 3.8 million jobs have been lost since the beginning of the crisis, accelerating a process driven by globalisation and technological change.[7]

The Commission plan For a European Industrial Renaissance[8], adopted in January 2014, aims at reversing this trend, increasing the contribution which European industry makes to the EU's GDP from the current level of 15% to 20% by 2020. In order to achieve this goal, it will be necessary to address some important drivers of change which are already modifying the global socio-economic framework, with significant repercussions for manufacturing. These drivers include the increasing scarcity of raw materials, the ageing population, big data and the availability of ICTs which allow for the automation of a wide range of routine tasks, mass customisation and on-demand services.

The transformation of manufacturing threatens the European social model. The economist Brian Arthur (2011) stresses that maintaining high levels of employment has been the main strategy for wealth redistribution in Western countries since the end of WW2. The decline of jobs in manufacturing industries undermines the foundations of the social contract and cannot be easily compensated by welfare policies, especially in an era of austerity. Declining growth, the effects of the financial crisis and increasing inequality are affecting middle and low-income families disproportionately. The gap between rich and poor is at its highest level in most EU countries since 1913[9], and increases in productivity have not translated into higher incomes for the vast majority of households.

Finding an answer to this situation is the priority of the new European Commission. President Jean-Claude Juncker states, in his political manifesto, that "my first priority as Commission President will be to strengthen Europe's competitiveness and to stimulate

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[6] Commission Task Force on Advanced Manufacturing for Clean Production (2014b)

[7] The growth of the Internet and ICT has led to advances – for instance in robotics and artificial intelligence - which allow businesses to move goods and ideas faster, more efficiently and more cheaply. But the same technologies are destroying thousands of unskilled and, increasingly, intermediate-skill jobs. While according to Frey-Osborne (2013) 47% of current jobs – including accountancy, legal work and technical writing - risk being completely automated in twenty years, it is already apparent that the "sharing economy" and the "on-demand economy" are facilitating non-standard employment and subcontracting, reducing substantially workers' protection and, therefore, perspective retirement incomes. For a review of the literature, see Centre for American Progress (2015).

[8] Commission (2014b).

[9] See Piketty T. (2014)

investment for the purpose of job creation." [10] The focus is on investing in education and innovation, reinforcing the digital single market and fostering entrepreneurship and SMEs. More specifically, efforts are needed to "boost digital skills and learning across society and to facilitate the creation of innovative start-ups. Enhancing the use of digital technologies and online services should become a horizontal policy, covering all sectors of the economy and of the public sector."[11] However growth must not be achieved at the expense of workers. On the contrary the Commission will enhance democratic values and social rights, paying particular attention to the younger generation.

We have identified three dimensions in which European enterprises, and particularly manufacturing, can contribute to achieve Juncker's goals with a positive social impact at the same time.

A horizontal dimension, the Democratisation of making is in line with Chris Anderson's observation that "Transformative change happens when industries democratize, when they're ripped from the sole domain of companies, governments, and other institutions and handed over to regular folks. The Internet democratized publishing, broadcasting, and communications, and the consequence was a massive increase in the range of both participation and participants in everything digital — the long tail of bits. Now the same is happening to manufacturing — the long tail of things. The tools of factory production, from electronics assembly to 3-D printing, are now available to individuals, in batches as small as a single unit. (…) Three guys with laptops used to describe a Web start-up. Now it describes a hardware company, too" (Anderson, 2010).

As we will see in chapter 2.1, the democratisation of making presents great potential for de-monopolising the existing 20th century industrial complex by opening markets up to newcomers and small enterprises especially if it is coupled with open innovation strategies and platforms for collaboration.

Secondly, there is a vertical dimension, Supply chains for good, in which enterprises can drive brand integrity, social impact and influence customer's and suppliers' decisions by promoting transparency throughout the supply chain. While new digital manufacturers seem to pay a particular attention to this aspect, information on the supply chain is a weak spot for most traditional enterprises, even though progress has been made on consumers'

[10] Juncker, J.-C. (2014)
[11] Ibid.

awareness and increasing the reputational risks for non-transparent companies thanks to efforts of organisations like CSR Europe and European industrial and trade policies.[12]

Finally, a transversal dimension, Corporate Citizenship, which puts social and environmental concerns at the centre of company business strategies and decision-making processes. This third dimension – which has been investigated mainly in relation to large companies' CSR activities - is not exclusive to the manufacturing sector. It mirrors a broader change in the social contract between companies and the communities in which they operate. Start-ups informed by maker manufacturing principles are particularly well placed to meet the expectations of society that private companies should incorporate social objectives in their business strategies from the very beginning.

These three dimensions are often present at the same time in the examples of maker manufacturing start-ups which we have considered. Indeed, a new generation of enterprises in maker manufacturing is using radically new methods, practices and organisational forms to develop sustainable and socially innovative products and services. They share a commitment to Open Source principles, democratic participation and transparency and fuse them with social purposes and outcomes. The union of social innovation principles and manufacturing will generate the products of the future. Bueno and Majumdar (2012) describe this as "creation of value through design and production of the products of the future which satisfy the ever changing needs of society, offering the potential of opening and creating new markets in Europe and abroad".

Examples of this new type of enterprise include:

> opendesk.cc a furniture company working as a global platform for local making. It specialises in workspace furniture, making it possible for everybody to download CAD files made from an international network of designers and to produce it locally either directly themselves or by commissioning local makers.
>
> fairphone.com started in 2010 as a project of Waag Society, Action Aid and Schrijf-Schrijf to raise awareness about conflict minerals in consumer electronics, with reference to mines based in Congo. In 2013, Fairphone was officially established as a social enterprise to build smartphones, using commercial strategies to maximize social impact at every stage of the value chain, from sourcing and production to distribution and recycling. 50,000 Fairphones have been sold so far, and Fairphone 2 is now under development.

[12] See for instance Commission (2014 b).

wikihouse.cc is an open source building system developed by London-based strategy and design practice Architecture00.[13] Everybody can download Creative Commons-licensed building plans from its website. SketchUp allows users to customise the design which can then be turned into plywood pieces with a CNC router. The frame can be assembled, complete with cladding, insulation, wiring, and plumbing in less than a day by people with no formal training in construction. The result is a high-performance, low-energy consumption home.

arduino.cc is "an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world."[14] While the low-cost circuit boards armed with a programmable microprocessor can be built by anyone for free – which makes Arduino one of the most popular products within the makers and DIY communities - the enterprise became economically sustainable as a consultancy for clients who want to build devices based on the board.

reprap.org stands for REPlicating RAPid prototype and is a project initiated in 2005 by Professor Adrian Bowyer to develop a desktop 3D printing machine which can self-copy. The materials cost about €350. Following open source principles, RepRap designs are distributed at no cost to everyone under an open source license.

wikispeed.org is a "United States registered automotive manufacturer and a non-profit company with R&D inputs from a global think-tank collaborating using Agile project management and open source licensing."[15] It succeeded in building a working prototype of a car that achieves 2.35L per 100 km in just three months.

We will review some of these cases in the following chapters to identify the principles embedded in their innovation strategies.

These principles are not exclusive to start-ups created within the maker movement. They can be found in well-established industries such as the car industry and can lead to unusual business strategies. An interesting example is provided by Tesla, an American company that produces electric cars. Tesla decided in summer 2014 to make openly available all its patents in order to advance electric vehicle technology and its adoption by the market through collaboration. The decision was taken on the ground that "technology leadership is

[13] See http://www.architecture00.net.
[14] See http://www.arduino.cc/en/guide/introduction ; see also http://www.arduino.cc/en/guide/introduction.
[15] See http://wikispeed.org.

not defined by patents, which history has repeatedly shown to be small protection indeed against a determined competitor, but rather by the ability of a company to attract and motivate the world's most talented engineers. We believe that applying the open source philosophy to our patents will strengthen rather than diminish Tesla's position in this regard." (Musk, 2014). Tesla's bet is that other electric car producers, such as BMW and Nissan, will adopt the Supercharge system technology and use (and upgrade) Tesla's infrastructure, leading to a growth of the market for all. This would help Tesla to achieve its mission of addressing the carbon crisis without undermining its business. In the words of Tesla's CEO: "Electric car programs (or programs for any vehicle that does not burn hydrocarbons) at the major manufacturers are small to non-existent, constituting an average of far less than 1% of their total vehicle sales. At best, the large automakers are producing electric cars with limited range in limited volume. Some produce no zero emission cars at all. Given that annual new vehicle production is approaching 100 million per year and the global fleet is approximately 2 billion cars, it is impossible for Tesla to build electric cars fast enough to address the carbon crisis. By the same token, it means the market is enormous. Our true competition is not the small trickle of non-Tesla electric cars being produced, but rather the enormous flood of gasoline cars pouring out of the world's factories every day" (Musk,2014).

Whilst the contribution of the industrial world to environmental sustainability is increasingly recognised, the potential of the manufacturing sector to address and mitigate risk against broader societal challenges requires greater efforts in research and experimentation. Innovative policy could not only boost the European manufacturing sector's competitiveness, it could also increase its positive social impact.

While the evidence base is still too limited to draw firm conclusions, we believe that sustaining the emerging maker manufacturing model through targeted policy measures and funding will be important to achieve the objective of the Europe 2020 Strategy of promoting smart, sustainable and inclusive growth, and to accelerate the transition of the traditional manufacturing sector towards advanced manufacturing.[16] The support of the European Commission for maker manufacturing will also contribute to the social commitment of the Juncker Commission to stimulate entrepreneurship and create new jobs in an empowered and fair working environment.

[16] Advanced manufacturing is not linked to any particular industrial sector. It includes activities that enable companies to improve productivity, boost production volume and speed, lower energy and materials consumption, increase operating precision, decrease waste, improve pollution management, and enable resource-efficient and low emission production. Commission Task Force on Advanced Manufacturing for Clean Production (2014b)

2. Three dimensions of social innovation

Based on an initial series of interviews and desktop research, we have focused on a select group of makers and manufacturers who are leading the fusion of social innovation and open source principles to transform industrial manufacturing. They are consciously pursuing the achievement of increased societal well-being through their business & making activities. This desire to contribute to society's wellbeing through industrial activities has three dimensions: the democratisation of making, supply chains for good and corporate citizenship. These represent trends in technological, organizational and governance innovation for social manufacturing. Where they come together, they enable individual enterprises to create a genuinely new form of manufacturing complex that is distributed, interoperable, open source, transparent and fair in its supply chain, and environmentally and socially conscious in making CSR a strategic part of their core business. Our examples include some cases where progress along more than one dimension has begun to have such an impact.

2.1. First Dimension: The Democratisation of Making

Maker manufacturing is an emerging practice which infuses production processes with social innovation principles. It has been described in various ways. This plurality of definitions hints at the lack of maturity and constant evolution of the sector. While it is a challenge to define clear boundaries, it is possible to identify some defining characters. Michel Bauwens, the founder of the p2p Foundation,[17] defines the sector as "open manufacturing" and "p2p production" highlighting the collaborative character of this emerging form of handcraft production (Bauwens, 2010). According to the Open Manufacturing Network – "Open Manufacturing is about bringing free and open source software development methodology and philosophy to the design and construction of the physical world".[18]

Another popular term is "open source hardware". According to the Open Source Hardware Association open source hardware "is hardware whose design is made publicly available so

[17] See http://p2pfoundation.net.
[18] See http://openmanufacturing.net.

that anyone can study, modify, distribute, make, and sell the design or hardware based on that design. The hardware's source, the design from which it is made, is available in the preferred format for making modifications to it. Ideally, open source hardware uses readily-available components and materials, standard processes, open infrastructure, unrestricted content, and open-source design tools to maximize the ability of individuals to make and use hardware. Open source hardware gives people the freedom to control their technology while sharing knowledge and encouraging commerce through the open exchange of designs."[19]

The Institute for the Future talks about "social manufacturing" (IFTF, 2012), pointing out the socio-economic transformative power of this approach with respect to the way we organize to produce what we need as human societies.

All definitions share a reference to the maker movement and to open source principles.

The term "maker" was coined by Dale Dougherty of O'Reilly Media in 2005, when the technology publisher launched the Make magazine, a quarterly journal about Do-it Yourself (DIY) projects.[20] A year later, a series of Maker Fairs provided the first showcases for the movement. According to Chris Anderson (2010 and 2012), the digitisation of the DIY approach of the maker movement will drive the next industrial revolution by "treating atoms like bits using the powerful tools of the software and information industries to revolutionise the way we make tangible objects"(Anderson, 2013).[21] The availability of open platforms, easy-to use and cheap tools such as 3-D printers, computer numeric control machines, CAD software and electronics assembly allow individuals to produce objects quickly and cheaply. Web-based collaboration, open source design, internet distribution and the possibility to scale prototypes into full production runs by means of outsourcing, are turning makers into manufacturers. The movement which is not formally organised and brings together people with very different background and mind-sets, has been growing across the world thanks to the establishment of regular meet-ups and physical spaces for co-working and co-creation such as FabLabs and HackerSpaces. These are community-based industrial spaces normally operating on a membership plan. For example, TechShop is a chain of DIY

[19] See http://www.oshwa.org/definition.
[20] "The term "do-it-yourself" has been associated with consumers since at least 1912 primarily in the domain of home improvement and maintenance activities. The phrase "do it yourself" had come into common usage (in standard English) by the 1950s, in reference to the emergence of a trend for people to carry out home improvement and various other small craft and construction projects as both a creative-recreational and cost-saving activity. Subsequently, the term DIY has taken on a broader meaning that covers a wide range of skill sets. DIY is associated with the international alternative rock, punk rock, and indie rock music scenes; indymedia networks, pirate radio stations, and the zine community. In this context, DIY is related to the Arts and Crafts movement, in that it offers an alternative to modern consumer culture's emphasis on relying on others to satisfy needs" (http://en.wikipedia.org/wiki/Do_it_yourself).
[21] The argument was already been developed by Gershenfeld, N. (2005).

workspaces with outlets across the States which offers access to state-of-the-art prototyping tools for around $100 a month. We know of 96 active hacker spaces worldwide and over 100 FabLabs, as well as a much larger number of community labs and social innovation labs promoting p2p culture and open innovation. The biggest European Maker Fair hosted in Rome in October 2015 saw the participation of 230 makers and the presentation of 600 projects from 33 countries. 90 000 people attended the event, of which 15 000 were young people (NESTA, 2015).

Open source principles are an evolution of the collaborative method developed by the open software community.[22] They include open exchange, participation, rapid prototyping and community.[23] In translating open source principles from the production of software to material objects, Will Holman (2015) suggests that they should be:

- Open: an object's technical drawings, assembly instructions, and process documentation should be available free online.

- Editable: object design should be downloadable in a free, open, and editable file and further iteration encouraged.

- Accessible: object design should use methods and materials that are as broadly accessible to the world population as possible.

- Repairable: objects should be built with methods, and materials that are easily removed, replaced, repaired, or substituted.

- Disposable[24]: objects should be able to be recycled, reused, repurposed, or otherwise sustainably disposed of - part of new circular economy.

Although the maker movement is a recent phenomenon the values it represents are not a novelty. The democratisation of production[25] has been an intellectual ideal, not to say a social revolutionary vision, ever since factory production began. The aim of the socialisation of production was to advance alternative social relations to those driven by capital. In Europe this has been exemplified by the worker co-operative movement. The Mondragon

[22] In the Open Source Initiative definition, open software is "software that can be freely used, changed, and shared (in modified or unmodified form) by anyone. Open source software is made by many people, and distributed under licenses that comply with the Open Source Definition", see http://opensource.org.
[23] See http://opensource.com/open-source-way.
[24] "Reparability" and "disposability" are two characteristics which remind us of the link between maker manufacturing and the circular economy, a priority for the European Commission, as shown by its recent communication "Towards a circular economy: a zero waste programme for Europe". The aspiration towards recycling and environmental sustainability is particularly clear in some of the most iconic initiatives put forward by the emerging maker manufacturing movement, as in the case of OpenDesk, WikiHouse and IkeaHackers.
[25] On this subject, see for instance Mota, C. (2011), Anderson, C. (2012), Powell, A. (2015).

Cooperative Consortium in the Basque Country is an example of how innovative and socio-economically successful this model of production and work relations can be. At the basis of the cooperative movement is an understanding of the need for viable business ecosystems in which worker-owned cooperatives are supported by secondary institutions (often consortia of cooperatives) for marketing, training and other collective needs. Consortia like the ones in Spain, Italy and France connect thousands of cooperatives. Indeed, a rich ecosystem of secondary institutions connecting and serving cooperatives is conducive to innovation and prosperity.

Enterprises are more likely to contribute to shared prosperity when they are networked. Smooth pathways allow intellectual, financial, and human capital to flow between enterprises at every phase of development (Kanter, 2012).

Today, the digitisation of the economy is facilitating cooperation and collaboration at a scale and scope previously unimaginable, marking a transition from the closed company or local clusters towards shared and democratised innovation across a network of open companies and clusters (Von Hippel, 2005). This democratisation of making has been driven by three structural factors[26] which together are seeding a new decentralised and participatory economy departing from the receding 20th century industrial model[27]. The three factors are:

- Lowering barriers to communication and formation of online discussion groups using web 2.0 technologies. This includes company to company, company to customers and customer to customer communications. Protocols like www.mtconnect.org address the needs of the manufacturing sector and allow companies to work together.[28] This leads to more efficient operations, production optimization and increased productivity.

[26] For the purpose of this study we have not considered how, since the beginning of the 21st century, structural factors such as globalization, demographics or the global economic crisis have accelerated the democratization of making.

[27] The same factors underlie the Internet of Things (IoT), which is defined by the European Research Cluster (IERC) as "A dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network". The emergence of the Maker Manufacturing paradigm is contributing to the raise of the IoT, and especially from the perspective of social innovation, as particularly evident in certain IoT applications, as assisted living, telecare or telework applications. The application of open source principles fostering interoperability between systems, architectures and application areas will be fundamental if we are to fully unlock the IoT potential, as it clearly emerges from Vermesan – Friess 2014.

[28] Cooperation has been fostered through the creation of "open technical standards and specifications intended to foster greater interoperability between equipment, accessories, applications, and devices as well as schema, prototype software examples, and related documentation in order to facilitate the implementation of an interoperable plug-and-play capability of these elements on the shop floor". See http://www.mtconnect.org.

- The spread of technology has accelerated as its cost falls and as usability improves. In 2013, there were 93 mobile phone subscriptions worldwide for every 100 people. Even in sub-Saharan Africa and South Asia, there were more than two mobile subscriptions for every three people (Centre for American Progress, 2015). User costs have plummeted. The average mobile subscriber cost per megabyte decreased 99 percent between 2005 and 2013 and smartphones are now available for as little as $40 (Bezera et al, 2015). The European Commission has been active on this front especially to cut the costs of roaming in the Single Market as well as by supporting standards on GSM and Bluetooth. This trend is being extended to open-hardware. According to Hatch, the cost of 3D printers, laser cutters, CNC machines, and 3D scanners has dramatically decreased over the past five years. In 2000 a CNC package cost $100,000 and needed training and knowledge to operate. CNC packages are now available for $1,500 with a much shorter learning curve. 3D printers, once a tool used solely by corporations for prototypes costing from $20,000 to $1,000,000, are now available from $600 to $2,000 (Maslin, 2014).

The rise of 3D printing

Canalys (2014) found that the size of the 3D printing market, including 3D printer sales, materials and associated services, amounted to $2.5 billion in 2013, more than double the market in 2012. It is anticipated that this market will continue to grow, reaching $16.2 billion in 2018. 2013 has been a tipping point for the industry, drawn by a combination of factors including faster print times, the availability of greater ranges of materials, colours and finishes for printing, and much lower prices. The technology is becoming a viable option for enterprises and individuals. 3D printing is already an established technology for producing prototypes and concept models in a wide range of sectors, and is regarded as a possible mainstream production technology in others, including architecture, aerospace, defence, healthcare and biotech. In the short term growth will be mainly driven by printing-to-order services, but in the next five years the customisation potential, convenience and manufacturing efficiencies connected to the technology will lead an increasing number of companies to establish in-house 3D printing studios. This trend could contribute to the competitiveness of the industrial sector, but there is also a risk of losing the link between 3D manufacturing and the open-source, community driven approach which has been put forward by the maker movement.

- Enhanced collaboration by the rise of open source and collaborative Intellectual Property (IP) models. The open source movement fundamentally changed the way software was developed, proving its value in productivity thanks to greater speed and more robust solutions. Linux was one of the first breakthroughs. Since then the emergence of apps as well as plug-in modules for browsers and software has forced Microsoft and Apple to open up their own code for operating systems and programme suites so that a vast network of app developers can write new applications. The European Commission has played an important role in this process through antitrust decisions[29]. With the advent of the smart phone, open source app development has become a major industry in itself with over one million direct and indirect jobs in 2014.[30]

Sylvia Lindtner, a techno-cultural ethnographer at the University of California, draws a connection between the institutional forms born out of collaborative programming to "maker spaces," the physical facilities where makers gather to learn and create: "Open source is (…) a new institutional form, with all its regional, technological, organisational, and political consequences". [31]

The link between open-source principles and new ways of production[32] is particularly evident in the case of the UK based OpenDesk,[33] a furniture company working as a global platform for local making. It specialises in workspace furniture, making it possible for everybody to download CAD files made available by an international network of designers, and produce the desired furniture locally either building themselves or by commissioning local makers. The business model of OpenDesk addresses three objectives:

- To create a new way for designers to sell on a global scale while retaining their IP and setting their own prices;

[29] For a quick analysis of the most important cases see Norton Rose Fulbright (2008).
[30] See http://www.statista.com/statistics/284087/mobile-apps-economy-full-time-eu-28-employment.
[31] "Community supported manufacturing (CSM) is a business model where a production facility – a digital fabrication facility – is co-funded by a large number of individuals interested in a certain product. In this model, product development costs are covered by a voluntary, open source product development process. This development process produces documentation of fabrication procedure, and continues up to creating access to digital design files for Computer-Aided Manufacturing (CAM) using the above digital fabrication facility. The consumer in this relationship obtains product at-cost, by paying for materials and labor. The producer captures the value of their labor. The producer is the organizer of the crowd funding necessary for the digital fabrication facility to be produced. This model is a win-win situation for at-cost production – for the producer and consumer – and relies on the elimination of all waste involved in fabrication processes." See Hagel, J. and al. (2014) and http://p2pfoundation.net/Community_Supported_Manufacturing.
[32] See also Bauwens M. and Wainwright. H. (2012).
[33] See https://www.opendesk.cc.

- To offer to consumers a way to buy affordable designer furniture without the brand name mark-up, and the ability to have products tailored to their tastes and requirements;

- To generate a new source of income for professional makers operating locally.

The company was set-up in July 2013, and developed around an early adopter community of clients (including Digital Ocean, Greenpeace, Mint Digital, Impact Hubs, Revolver and the TSB Knowledge Transfer Network). A set of over 15.000 designs has been made available by 100 designers and a network of over 200 professional makers covering 37 countries has been established. Seed funding was obtained in the form of a £248k grant from the UK Technology Strategy Board and a £67k grant from the Wayra accelerator. In June 2014, a crowdfunding campaign hosted by CrowdCube[34] was launched and £308,370 was raised. 59% of the company capital was offered in the form of equity stakes, which were mainly acquired by members of the community, including designers, makers and customers. Key partners include AtFAB, Colektivo, Impact Hub, Machine Made, Matter Machine, ShopBot, and SketchUp. OpenDesk's objective is to create a profitable online market place with transaction volumes of over £1 billion annually in 5-7 years and to expand from office furniture to a wider range of furniture and other household products. These projects focus on products' reparability and disposability, as well as on limited energy consumption, in line with the principles of the circular economy:

"OpenDesk's model of open making has significant economic, social and environmental benefits. Local, decentralised making re-establishes manufacturing back into the heart and culture of local communities, bringing back jobs that are intrinsically rewarding and creative. Money from commercial sales of OpenDesk products goes directly to designers and makers: skipping the whole murky world of traditional logistics and supply chain, with its layered costs and middlemen. Cutting out shipping and stock holding has the potential to cut down carbon emission and generate less waste. In addition, open making has the potential to encourage smaller product runs and shift manufacturing post-purchase, leading to less production and waste in a world that's already stuffed with mass-produced consumer goods".[35]

The democratisation of production can also take a hybrid form, mixing professional production with users' involvement, sometimes in large numbers. This is the case of one of

[34] See https://www.crowdcube.com/investment/open-desk-15500?utm_source=Crowdcube&utm_medium=Widget&utm_campaign=Open+Desk.
[35] See https://www.opendesk.cc/how-it-works/social-impact.

the first crowd-sourced film[36] , Italy in a Day.[37] Over 40,000 home-made videos shot by ordinary Italians on a single day, 26th October 2013 were edited by film director and screenwriter Gabriele Salvatores. The film was realized by a group of producers led by Ridley Scott, the Academy Award-winning film director.

Making a user-generated film implies some radical changes in the production process. Marketing, which is usually one of the last phases, jumps to the beginning of the production chain. The main challenge in such a production is the building of a community of users who are both co-producers and future consumers[38]. To do so the producers invested in a mass information campaign in all media to reach millions of people. The success was due to the mobilization of personalities and partners from all sectors. The production of Italy in a Day, as anticipated by Alex Steffen, has shown that user-participation in the manufacturing process affects the final product. It is a film about people who work hard, enjoy their lives with family and friends, and love their own country. It is the opposite of the image of Italy portrayed by public media and opinion leaders. However, we should not overlook the new set of questions that this kind of production raises and which the producers of the film had to deal with. The first and the most important were about property rights, fair acknowledgement of everybody's contribution, quality standards, technological barriers, and ultimately rules of engagement (governance).

This gives a taste of the challenges maker manufacturing faces. The socially transformative power associated with maker manufacturing and, more generally, with enterprises which collaborate in accordance with open source principles, is threatened by a number of factors.

First, there is a risk of concentration of power in the hands of a few well-established platforms that are needed if producers and consumers are to connect and collaborate. Google controls 82% of the global search market and 98% of the mobile search market. Facebook dominates the social media landscape. And Apple, Amazon and Microsoft dominate the mobile market and cloud services platforms[39]. As pointed out by Evgeny Morozov (2011 and 2013), to enjoy the free services made available by these IT giants, users need to share their data with them, and there is very little clarity on how these data will

[36] The reader might object that a film is not a manufacturing product but the authors of the paper justify their choice recalling the interpretation of creative process initiated by Walter Benjamin (The Work of Art in the Age of Mechanical Reproduction, 1936) and endorsed by the European Commission's policy on cultural and creative industries (see http://ec.europa.eu/culture/policy/cultural-creative-industries/index_en.htm).

[37] See http://www.italyinaday.rai.it/dl/portali/site/page/Page-89e4a067-1d7a-4eb3-b510-d641f2a70b9d.html and http://www.euractiv.com/sections/future-eu/storytelling-part-european-commissions-job-311041.

[38] Or "prosumers" to adopt Tapscott 1997 terminology.

[39] It must also be noticed that in the open-software domain it is possible to find mutually beneficial partnership between open-source coders and established corporation, as in the case of the IBM-Linux collaboration investigated by Tapscott, D. and Williams, D. (2006). On this topic see Kostakis (2013).

be used. The privacy and safety of citizens are at risk, and there is also a risk of the consequences of the commodification of knowledge and personal data.

The EU funded Digital Social Innovation project reported that "the emerging cloud model of some services (proprietary social networks, big data providers, implementations of the Internet of Things), is convenient for users but also "locks users in" at the expense of security, privacy and openness: protocols are often proprietary, the systems are centralised (particularly in terms of ownership and decision processes) and interoperability between systems is not a requirement" (Nesta 2015).

The European Commission plays a major role in preventing established market players from abusing their position. At the level of services, interoperability of systems and open standards need to be secured to allow new players to enter the market and succeed. The Commission is in a privileged position to promote net neutrality, granting access to data within a common distributed and decentralized architecture which allows for open competition. This will need regulatory intervention and more investment into research on open standards, data protection and encryption, and the provision of free software and hardware[40].

It also depends on new models of multi-stakeholder governance in contrast to the centralized models of the global platforms owned by private companies. It will be fundamental to help maker manufacturing to engage with global platforms to overcome the asymmetry of power between incumbents and new entrants. In this regard, the new EU CSR strategy should foster the participation of new entrepreneurs and micro-businesses representatives in the governing bodies of established platforms. This would address a current major weakness of large companies' CSR strategies. According to the 2013 KPMG Survey of Corporate Responsibility Reporting, stakeholder engagement is a key area for improvement for almost half of the top 250 global companies.

Secondly, open access does not mean that everybody starts from the same place. The value of publicly available data is unlikely to be the same for an unemployed person as it is for a hedge fund which can use the most sophisticated technology to turn data into financial information. The Commission could play a fundamental role in sustaining emerging

[40] There is another aspect which deserves attention relating to standards. As pointed out by Holman (2015) "open source objects cannot all conform to uniform standards - cars need to exist in one regulatory regime, buildings another, and medical devices still another. Software, as a single class of thing in the universe, can live under a single set of standards". In the case of maker manufacturing products, community controlled open standards and licenses will need to coexist with regulated quality and safety standards. This topic will need further research, including in terms of consumers' perception.

entrepreneurs by funding maker labs and social labs where the necessary capacity building and equipment could be made available. The public sector is already sustaining entrepreneurs by making available large sets of data.

However, it is just as important to help citizens and local authorities turn these data into viable businesses and improved services[41]. The UK is leading on this path. In 2010, the UK Government launched data.gov.uk, one of the largest open data resources in the world, which in 2015 contained over 19.000 data sets. Two years later, it launched the Open Data Institute (ODI) "to use open data to foster new businesses, transform public services, enhance policy-making and drive creation of social, environmental and economic value". It advises governments and businesses on how to use public data to spot trends in markets and evaluate future opportunities. In 2014 ODI accelerated 18 start-ups that use or produce open data, helping them to secure £4m in contracts and investments while in the programme. The Open Data Challenge Series was launched with Nesta, awarding prizes of up to £50.000 to teams with innovative and sustainable open data solutions for crime and justice, energy, housing and education. ODI will complete the UK's most comprehensive, systematic assessment to date of how companies are creating value by using and publishing open data in 2015.[42] ICT enabled bottom-up collaboration was sufficient to ensure the success of the open software movement, but when it comes to open-hardware physical infrastructures around which communities can experiment and grow become fundamental.

While it is true that technological advances have made it easier and cheaper for citizens to create products and take it to broader audiences – enabling a proliferation of micro companies – it is also true that their numbers and associated fragmentation is creating the need for a new set of institutional infrastructures. In this regard, we recommend the Commission to provide funding – including by encouraging Member States to use structural funds at this scope – for the creation of networked shared infrastructures such as maker labs and fab labs, where innovators are empowered to learn and work locally and, at the same time, benefit from a global network of knowledge.

Interaction with traditional manufacturers and large companies should be encouraged in these hubs. There are already some successful examples in this regard. Talent Garden is a

[41] In this respect, one interesting case is the "Cardiff model" developed by Professor Jonathan Shepherd while studying demand placed on Emergency Departments at the University Hospital of Wales. The model utilises anonymised information obtained from ED patients about the precise location of violence, weapon use, assailants and day/time of violence. Evaluation has shown that this model enhances the effectiveness of targeted policing and local authority effort, and significantly reduces serious violence recorded by the police and violence-related hospital admissions. See http://www.theguardian.com/business/2015/jan/11/cutting-crime-surgeon-research-cardiff-violence

[42] See http://opendatainstitute.org/odis-second-year-annual-report.

network of 14 co-working campuses spread around the globe with over 35.000 members active in the field of creative and digital innovation, including open software and open hardware, and is becoming a reference point for large companies who want to innovate "by discovering and bringing the latest digital trends and technologies into their businesses". [43] Iveco, IBM, Walt Disney and Microsoft are among the clients and partners. Crucially, services for the corporate world are not limited to the technological aspects, but include "collaborative sense-making" (Holzmer, 2015), open and democratic leadership, new forms of governance and creative thinking.

These innovation hubs would be even more effective if conceived from the beginning as part of a smart specialization strategy, facilitating interaction and cross-pollination between makers/potential entrepreneurs and traditional manufacturers, as well as with local authorities and civil society organisations. Equally important will be to fund digital marketplaces promoting open source collaboration, allowing new companies to create synergies and to bring their products to the market, reaching the critical mass necessary to compete with established commercial platforms as eBay or Amazon without losing their open and social approach.

Finally we need to reflect on the possibility of a darker future for maker manufacturing. It could be the case that the space for co-creation is subject to the emergence of commercial monopolies. Dominant companies may try to extract value and create a new class of private institutional monopolies without building a new commons.

As Byung-Chul Han (2014) put it: "The change from ownership to "access" celebrated by Jeremy Rifkin does not free us from capitalism. Anyone without money does not have access to sharing. Even in the age of access, people without money remain shut out. Airbnb, the community marketplace that turns homes into hotels, even saves on hospitality. The ideology of community or collaborative commons leads to total capitalization of the community. Aimless friendship is no longer possible. In a society of reciprocal evaluation, friendliness is also commercialized. One is friendly to get a better ranking online. The harsh logic of capitalism prevails in the so-called sharing economy, where, paradoxically, nobody is actually giving anything away voluntarily."

Although these are not manufacturing companies, cases as Uber and Airbnb indicate potential risks of jobs destruction, spreading in-work poverty and systemic dropping of the risk of doing business on individuals, and increased social costs such as unemployment

[43] See http://talentgarden.org/en/about.

insurance, health and pension on the State (see chapter 2.3). A new class of institutional arrangements and regulations is needed to prevent established platforms from acquiring a monopolistic position. This is a call for the European Commission as well as for national regulators.

We must recognise that maker manufacturing is still in its infancy and our understanding of its impact is still limited. As Peter Troxler (2014) remarks: "We are so ignorant of the complexity of goods around us that anything beyond assembling a puzzle or an IKEA furniture can be hastily baptized as a DIY achievement." Moreover it is an industry where the rate of company mortality is very high, and predictions of failure and success rely on little evidence. Whilst we can see the potential of the likes of WikiSpeed – the first car built in open source – which succeeded in building a working prototype of a car that achieves 2.35L per 100 km in just three months – we should recognise that for every WikiSpeed there will be several Hiriko[44] cars which, in spite of their innovative attributes, will not succeed in the market.

Understanding and scaling the capacity needed to build these new artefacts is crucial if open, collaborative and social innovation are to go beyond prototypes and play a credible role in the manufacturing industry. The transition towards a manufacturing processes redesigned by democratic principles requires long term policy innovation and financial investment in new ecosystems, cultures of doing, infrastructures and institutional arrangements. Forward looking policy is needed to bring this new industrial paradigm to life as we will see in the last chapter.

2.2. Second Dimension: Supply chains for good

The second dimension is that of vertical supply chains, from producers of primary resources to customers. They can play a role as drivers of change and producers of social value. The Fair Trade movement[45] has shown the way forward by helping producers in developing countries to achieve better trading conditions while promoting environmental sustainability

[44] Hiriko is the car designed by MIT and Foster, and developed by the Social Innovation Park in Bilbao. It has never come into production. See http://ev.com/hiriko-folding-ev-folds-2012-2013.

[45] Fair Trade is an organized social movement whose stated goal is to help producers in developing countries achieve better trading conditions and to promote sustainability. Members of the movement advocate the payment of higher prices to producers, as well as higher social and environmental standards. The movement focuses on products which are exported from developing to developed countries but are also consumed in domestic markets (e.g. in Brazil and India). They include handicrafts, coffee, cocoa, sugar, tea, bananas, honey, cotton, wine, fresh fruit, chocolate, flowers, gold and 3D printer filament. The movement promotes equity in international trading partnerships through dialogue, transparency, and respect. It promotes sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers in developing countries. See http://en.wikipedia.org/wiki/Fair_trade.

and consumer awareness. The same principles of fair trade can be applied to manufacturing. The enterprise Fairphone has done it by producing an Android phone in which the materials have been ethically sourced.[46]

Fairphone is rigorous in driving transparency in the supply chain. The company promotes transparency on the origin of the materials used in its products, the conditions of work in its supplier companies and the nature of financial transactions at each step of the process. In addition, according to the principles of the circular economy, Fairphones are designed to extend their usable lifespan, enable reuse and support safe recycling.[47] With over 300 individual components derived from 30 minerals, a mobile phone is a complicated product. This complex supply chain raises a number of issues, not least clarity about provenance and the need to avoid the use of minerals from conflict zones. Fairphone traces two of its most important mineral components, Tantalum and Tin, from mines in the Democratic Republic of Congo. Supply chain transparency is complemented by financial transparency. A detailed cost breakdown of the Fairphone and details of the company's running costs are publicly available on the company website.[48]

These steps towards openness create a framework for a new engagement with stakeholders across network of customers, employees, funders and suppliers. The CEO Bas van Abel admits that "Fairphone will never be 100% fair because it is always thinking about how to improve things... When you go to Congo to mines that are conflict free, but there is still child labour, how is that fair?" Congo might seem a contradictory choice for the company to source its minerals, considering that local mines are well known for the poor workers' health and safety conditions and wages. However, Fairphone "wants to contribute to the situations where improvements are needed, and transparency can help us get there".

This exploration of transparency and openness is the beginning of a journey. It recognises that revealing the origins of the materials used by a firm will become an essential part of establishing trust and securing reputation (New, 2010)[49]. Transparency drives organisations

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[46] See http://www.fairphone.com.

[47] "Fairphone's ambitions for Life cycle: 1. Encourage consumers to replace their phones only when they have reached the end of their usable life; 2. Support and establish initiatives that provide safe recycling programs, particularly in regions where dangerous e-waste recycling is practiced; 3. Participate in programs that collect and safely recycle e-waste. 4. Extend the usable life of Fairphones and incorporate features that add value for reuse and recycling and 5. Offer consumers the ability to purchase spare parts and repair their own phones". See http://www.fairphone.com/roadmap/lifecycle/.

[48] See http://www.fairphone.com/blog.

[49] Paul Polman, Unilever chief executive officer, won the top spot in PR Week's Power Book, featuring the most powerful people in the industry, with this justification: "The former boss of P&G in the US and Nestlé in Europe has used comms to influence how he and his companies are fundamentally perceived. Arguably he has gone even further and remolded corporate narrative in late capitalism by putting the sustainability agenda at the heart

to acknowledge multi-stakeholder networks and their interdependencies. This transparency underpins a politics of change and helps the company's stakeholders to take ethically and politically informed decisions beyond their short term needs. This framework could lead to the establishment of inclusive models of governance in which the public interest influences decision making process.

The case of Fairphone illustrates a new branding strategy based on trust and social recognition that can be appealing to start-ups. The business models which are built on transparency and openness offer the possibility of positioning products with reference to their social and environmental values. Hyper-brandization, as practised for example by Apple, is a dominant trend in manufacturing industry. The challenge is to create a space where social values oust the brand as a guarantee of quality. This is also a strategic decision as the industry shifts from prototyping to full production. More mature ventures might subcontract production to third countries, particularly China[50]. But this choice would be at odds with the search for greater transparency and respect of social values[51]. Open and transparent supply chain is not limited to new ventures. Every manufacturing company could, in principle, disclose the origins of the materials it uses for the benefits of producers and consumers. This is already the case for the 15,804 companies that have obtained PEFC Chain of Custody certification, demonstrating that the wood and wood-based products they use in their products have been sourced from sustainably managed forests.[52] Such a transparency in the supply chain would enable consumers to make informed choices that reflect their social values, and would foster the public's understanding of the intertwined structure of the global economy. This would be an appropriate realm for CSR, and is demonstrated by the recognition gained by Unilever through its Responsible sourcing policy.[53] This year, Unilever achieved the target of sending zero non-hazardous waste to

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of the business; increasing the overall profile of responsible business practices". See http://www.prweek.com/powerbook/ourpowerlists.

[50] "Over the past few years, Chinese manufacturers have evolved to handle small orders more efficiently. This means that one-person enterprises can get things made in a factory the way only big companies could before. For a lens into the new world of open-access factories in China, check out Alibaba.com, the largest aggregator of the country's manufacturers, products, and capabilities. Just search on the site (in English), find some companies producing more or less what you're looking to make, and then use instant messaging to ask them if they can manufacture what you want. Alibaba's IM can translate between Chinese and English in real time, so each person can communicate using their native language. Typically, responses come in minutes: We can't make that; we can make that and here's how to order it; we already make something quite like that and here's what it costs" Anderson, C. (2010).

[51] Cost-effective and sustainable solutions to improve production processes, product or asset tracking, predictive diagnosis, recycling and re-manufacturing are being researched, tested and rolled out in the IoT domain, see e.g. the FITMAN project: http://www.fitman-fi.eu. See further examples in Vermesan and Friees, 2014.

[52] See http://www.pefc.org/about-pefc/who-we-are/mission-vision.

[53] See http://www.unilever.com/sustainable-living-2014/enhancing-livelihoods/fairness-in-the-workplace/advancing-human-rights-with-suppliers/targets-and-performance.

landfill from its global factory network of 240 sites. This is believed to be a global first, involving activities in 67 countries.[54]

Consumers shall be encouraged to exert pressure on companies to act responsibly all along the supply chain. The Commission could help by making available more information to consumers, for instance through e-platforms as the EU funded Wikirate[55], which allows citizens to rate companies on CSR, or by scaling-up at EU levels apps as Noteo[56] (France) or GoodGuide[57] (UK) which scanbarcodes to deliver the health, environmental and social responsibility ratings of products and companies.

The Commission is already encouraging transparency among the corporate sector (see chapter 2.3). There are initiatives such as the European Commission Strategy for CSR[58], raising awareness through awards[59] and the collection and sharing of best practices[60], collaboration with EU networks such as CSR Europe[61] and, on the policy and regulatory front, proposals such as the recently approved Directive 2014/95/EU on disclosure of non-financial and diversity information by certain large undertakings and groups (Commission, 2014d), the Timber Regulation[62], the proposal of regulation "Setting up a Union system for supply chain due diligence self-certification of responsible importers of tin, tantalum and tungsten, their ores, and gold originating in conflict affected and high-risk areas"[63], the Communication Building the Single Market for Green Product (Commission, 2013b) and the Communication on Trade, Growth and Development (Commission, 2012).

We believe that funding should be provided for research under the Horizon2020 and COSME programmes, to further investigate:

- Technology for transparency which facilitate real-time reporting across the supply chain and

- New models of governance which use information from the supply chain as a basis for effective collaborative decision making processes, taking into account economic, social and environmental factors.

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[54] See http://www.unilever.com/mediacentre/pressreleases/2015/Unilever-achieves-zero-waste-to-landfill-across-global-factory-network.aspx.
[55] See http://wikirate.orgu.
[56] See http://www.noteo.info.
[57] See http://www.goodguide.com.
[58] See http://ec.europa.eu/enterprise/policies/sustainable-business/corporate-social-responsibility/index_en.htm.
[59] See http://www.europeancsrawards.eu.
[60] See http://ec.europa.eu/growth/industry/corporate-social-responsibility/index_en.htm.
[61] See http://www.csreurope.org.
[62] See http://ec.europa.eu/environment/forests/timber_regulation.htm.
[63] See http://trade.ec.europa.eu/doclib/docs/2014/march/tradoc_152227.pdf.

Communication campaigns and initiatives, such as the European Social Innovation Competition and the European CSR Awards, could provide a suitable framework and stimulate good practice within large companies as well as makers and micro-entrepreneurs. An important role could also be played by Startup Europe. According to Wayra Telefonica research,[64] one in six tech start-ups globally have a social focus. Fostering this focus by turning it into a tool for brand recognition and fund-raising (e.g. via impact investing, public contracts, public and private procurement) through targeted capacity building in the enterprises incubation and early growth stages could help advance this model in the future. From a regulatory point of view, we would like to point the Commission attention on the recent Italian law for innovative social ventures (art. 25, 4 DL 179/2012, L. 221/2012) which grant tax incentives for corporate and private investments in social ventures (25% tax credit for people or 27% tax deduction for legal entities compared to 19% and 20% for investors in innovative start-ups who do not have a social mission).

Open and transparent supply chains should be incentivised by public procurement rules. The new EU directive on public procurement takes into account social and environmental factors. Within the private sector, the same process could be stimulated by granting fiscal benefits to enterprises which choose to work with ethical suppliers, making publicly available all the related information. Additionally, due diligences systems such as those required by EU Timber Directive and the proposed Conflict mineral regulation could be extended to other sensible sectors.

2.3. Third Dimension: Corporate Citizenship

Whilst the first two emerging dimensions examined focus on collaboration (horizontal) and supply chains (vertical) in manufacturing, the third dimension provides the context in which enterprises operate. This is historically comparable to the "licence to operate" which corporates consider that they are granted by governments and society if they comply with expectations about their economic performance together with environmental and social impact.

Fortuna takes the view that: "business exists at the pleasure of society; its behaviour and methods of operation must fall within the guidelines set by society. Like government, business has a social contract – an implicit set of rights and obligations. The details of the contract may change as societal conditions change, but the contract in general always remains as the source of business legitimacy" (Fortuna et al., 2011). Donaldson and Dunfee

[64] See https://unltd.org.uk/2013/05/09/wayra-unltd.

(2002) remind us that this notional social contract has changed a lot in the last 50 years, and that while in the 1950 enterprises were basically expected to produce goods and services at reasonable prices, now they are considered responsible for a wider range of issues involving fairness and quality of life across their ecosystem of operation.

This change has been accelerated by both the financial crisis and the consequences of globalization, and is illustrated by the evolution of definitions of CSR used by the Commission in 2002 (an approach "whereby companies integrate social and environmental concern in their business operation and in their interactions with their stakeholders on a voluntary basis" – Commission, 2002) and 2011 ("the responsibility of enterprises for their impacts on society" – Commission, 2011b). The expectations of the public sector and society at large are required to be translated into a more active and systemic approach to CSR, which becomes a central element of corporate strategy rather than simply a matter of philanthropic donation.

The 'CSR Europe's Enterprise 2020, The power of collaboration' report states that "the company of the future, Enterprise 2020, operates profitably through mainstreamed responsibility and transparency, and innovates solutions for the planet and its people, in closer cooperation with all stakeholders. Together they lead the transformation towards a smart, sustainable and inclusive society" (CSR Europe, 2012). This new approach to CSR, often called strategic, operates profitably as "business strategy that is integrated with core business objectives and core competencies of the firm, and from the outset is designed to create business value and positive social change, and is embedded in day-to-day business culture and operations" McElhany (2009). As McElhaney explains, nobody could say that Ford supporting the Susan Komen Cancer Research Fund with $100.000 per year is wrong or unworthy, but it would make much more sense to invest the same amount in research for alternative fuel vehicles. The definition of strategic CSR follows the framework developed by John Elkington (1997) in his "Cannibals with Forks: the Triple Bottom Line of 21st Century Business": "the triple bottom line agenda focuses corporations not just on the economic value that they add, but also on the environmental and social value that they add or destroy". In order to create social, environmental and economic value at the same time, companies will need to engage with a wide range of stakeholders, particularly with the public sector. The same understanding of the role of enterprises as interconnected stakeholders pursuing both economic and social impact is developed by Michael Porter, who put forward the concept of "shared value" "which involves creating economic value in a way that also creates value for society by addressing its needs and challenges" (Porter and Kramer, 2011). Creating shared value means establishing mutually beneficial and mutually reinforcing

strategic relationships between a company and the society that it interacts with, at local community level or globally everywhere it transacts business.

We have identified two main ways in which strategic CSR translates into practice in manufacturing. On one hand, there is an "open API approach", where large companies act as catalysers of open ecosystems and become more innovative while sustaining emerging enterprises. Some IT companies are moving in this direction, acquiring a role as incubators and accelerators of digital social ventures. Google has created Impact Challenge[65] and, in the maker manufacturing field, Project Ara.[66] Telefonica has created the Wayra accelerator[67] and Vodafone has a project called Mobile for good. [68] By funding the digital ventures of the future, established corporations are reinforcing their talent base, reaching new clients and markets, and building future partnerships.

IKEAHackers is an interesting case.[69] The website, launched in 2006 by Malaysian Ikea-fan Yap Mei Mei, collects ideas for modifying and repurposing Ikea products, submitted by Ikea "hackers" worldwide. It has a library of more than 3.000 Ikea customisations, including a 3D printing subsection[70], and an average of 30.000 unique visitors a day. In June 2014, Mei Mei received a Cease and Desist letter claiming that the blog was infringing on the company's intellectual property rights. The alternatives were to voluntarily transfer the domain name IKEAhackers.net to Ikea or being sued. Hundreds of fans mobilised and wrote to the Company to pledge for IKEAHackers survival, as a consequence, Yap Mei Mei was invited to Sweden to find a solution with the company top-management. In a first moment, Ikea tried to convince her to have them as the only advertisers on the site; but then they understood that independence was the strength of IKEAhackers. In Mei Mei words: "it is powered by fans for fans. I have never and never would want to feel obligated to blog/promote anything for IKEA because I have to. I am open to collaborations but independence is vital for the site and my sanity".[71] Eventually, IKEAHackers obtained to remain an independent fan site with permission to use the IKEA trademark in its domain so long as it does not damage the brand. Collaborations between IKEA's designers and makers/hackers are on the pipeline, and IKEAHackers will have a session dedicated in the IKEA Museum which is going to open in Älmhult.

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[65] See https://impactchallenge.withgoogle.com/uk2014.
[66] See http://www.projectara.com.
[67] See http://wayra.com.
[68] See http://www.vodafone.com/content/index/about/foundation/mobiles_for_good/mobile_for_good_programmes.html.
[69] See http://www.ikeahackers.net/about.
[70] See http://3dprint.com/28273/ikea-hacking-meets-3d-printing.
[71] See http://jules.ikeahackers.net/2014/10/trip-update-part-3-lets-talk.html.

When collaboration is extended not only to a network of companies, but to society at large, then we have the second approach to strategic CSR, which implies the understanding and strategic management of societal risks and opportunities connected to companies' activities. For example, in India, Steel Wire Manufacturer Usha Martin has invested up to $15m through its CSR budget over the last 5 years into the development of the rural economy adjacent to its plants. This is considered a strategic investment, and not simple philanthropy: investing in growing wage equality in the region means driving the reduction of risk of regional sectarian/class based violence, and therefore maintaining operating "access" to local mineral resources.

This "systemic" approach has been at least partly driven by regulatory action: a law was recently passed to the effect that companies above a certain size by net worth or financial turnover have mandatorily to spend 2% of their net annual profits on CSR activities.[72] While the law does not specify what kind of CSR actions should be pursued and its real impact is still to be proved, it was clearly useful in igniting the debate on companies' social responsibility and in forcing enterprises to report on their activities in this field. Companies' CSR reporting grew by over 53 percentage points in India since 2011 according to KPMG 2013. Further to this, given the large amount of funds implied, enterprises have been obliged to think strategically at how to align their interests with public interest. This of course risks being seen as late 19th century corporate paternalism, but if a genuine shared value framework is put in place, and societal and environmental risks are considered in terms of future viability of companies, then the potential economic and social benefits for society at large are remarkable.

Is this new in Europe? Not really. Paying attention to our own history should be part of this public awareness raising effort. Since the beginning of industrialisation a few enlightened industrialists understood the interdependence between company and community. An example, amongst the several, is the Olivetti of Adriano Olivetti. The Italian entrepreneur theorized and practised the 'enterprise-community' model, building one of the Italian most innovative and fast-growing technological companies in '50s.[73] Certainly a rediscover of the social principles that inspired industrial policies and strategies in Europe after WW2 could provide an inspiration for today corporate culture.

Critically, the Commission could have a leading role in encouraging large firms to contribute to the development of the infrastructure for social manufacturing by funding the collection

[72] See http://en.wikipedia.org/wiki/Evolution_of_corporate_social_responsibility_in_India.
[73] The case of Matera is particularly interesting, see Bilò, F. and Vadini, E. (2013).

and exchange of best practices, and building trust between private and public actors. Pilots could be funded from structural funds and within existent European Innovation Partnerships and public private partnerships. These would bring together new entrepreneurs, established entrepreneurs, representatives of the public and third sectors and citizens at large to build partnerships for the creation of public good. Innovative financing models, as well as products and services could be collaboratively designed, delivered and evaluated in order to solve shared social issues such as poverty, inequality, education attainment or unemployment.

The main point of strategic CSR is that achieving positive social and environmental impact is not only compatible with making profits, but, in the medium term, is a pre-condition at making profits. Leading industries increasingly recognise that they cannot continue to view value creation narrowly, optimising short-term financial performance while ignoring the broader influences and risk that determine their longer-term survival. Companies cannot overlook the loss of natural resources vital to their operations, the viability of supply chains, or the economic distress of the neighbourhoods in which they produce and sell, without undermining their future activities.

Strategic CSR requires a company to look its footprint on the environment and society at every stage in the value chain. The availability of talent, intellectual property protection, rule of law and neighbourhood unemployment might be external to the company's perimeter of action, but will have a material impact on its performance and are strategic intervention points for CSR.

KPMG Global Chairman Yvo de Boer has said that investing in CSR and CSR reporting "is essential to convince investors that your business has a future beyond the next quarter or the next year" (KPMG, 2013). According to KPMG's 2013 Corporate Sustainability Report, business is already largely convinced. 93% of the world's largest companies report on CSR, of which 9 in 10 use their reports to identify environmental and social changes that impact the business and its stakeholders. 8 in 10 report that they have a strategy to manage the risks and opportunities. 7 in 10 report that these changes bring opportunities for the innovation of new products and services. About one third also report opportunities to grow their market share and cut costs (KPMG, 2013). However, the quality of reporting is uneven. Only half of the 250 largest global companies invest in external audits to validate their results, and 41% of them do not explain the process used to identify the issues considered

material to their business and stakeholders, 54% do not report on supply chain issues[74] and 47% do not report on stakeholder engagement. While the taking-up of globally recognized reporting standards[75] is facilitating the analysis and comparison of information, more should be done to assess the real contribution of the private sector to achieving positive social impact. A systemic view needs to be taken of companies' interactions with different networks of stakeholders. The Commission already has several initiatives which could be instrumental in this, including the Impact evaluation framework developed by the Expert Group on Social Entrepreneurship.[76]

Helping companies to validate their results and demonstrate genuine attempts to achieve social impact is important for overcoming traditional barriers between the public and private sector and to create the synergies necessary to address entrenched social issues. This is in line with the spirit of the new European Commission which has stressed greater emphasis on social impact of public policies and corporate strategy (Juncker, 2014). The forthcoming Commission strategy to combat tax fraud and evasion will be key. It is clear that CSR will not be taken seriously by citizens, the public and the third sector unless companies are required to demonstrate that they meet this basic social requirement.

Encouraging transparency is pivotal to corporate citizenship, and not only in relation to supply chains. Incentives for enterprises which disclose information not only on single initiatives, but on salaries, taxes, governance structures and stakeholder relationships should be put in place. The financial crisis, the globalisation process and technological advance have transformed work-relations, leaving workers far more exposed to casual employment and with limited negotiating power. As highlighted by the Center for American Progress (2015) "the structure of the employment relationship in some advanced countries has been fundamentally altered by legal and other changes. Firms have created flexibility for themselves while weakening existing worker protections. There has been a rise in non-standard employment such as part-time work, on-call work, temporary employment, and self-employment, as well as significant growth in subcontracted work; this so-called race to the bottom allows firms to hire labour without committing to long-term employment relationships or to providing the benefits that were historically the norm. More recently, technology has allowed a sharing economy to develop (…); many of these jobs offer

[74] A similar picture emerges from Commission (2014c) according to which "a key area of CSR is the extent to which companies manage their supply chains responsibly, particularly in relation to operations within developing countries".
[75] The Global Reporting Initiative guidelines are used by the 82% of the 250 largest global companies. See https://www.globalreporting.org/Pages/default.aspx.
[76] See http://ec.europa.eu/internal_market/social_business/expert-group/social_impact/index_en.htm.

flexibility to workers, many of whom are working a second job and using it to build income or are parents looking for flexible work schedules. At the same time, when these jobs are the only source of income for workers and they provide no benefits, that leaves workers or the state to pay these costs". The dominant focus of many corporations in the last decades has been the maximization of share prices and, strictly interrelated, the compensation of their top management. Together, these two trends have contributed to rising inequality to levels unseen since 1914, while reducing opportunities for social mobility.

Strategic CSR needs to put the spotlight on worker protection and salary distribution within firms, promoting workplace innovation, especially in terms of training and career advancement opportunities for employees. It shall create governance mechanisms less conducive to financial engineering and the promotion of short term earnings over long term growth. Companies' unfair behaviour in relation to working conditions and casual employment should be publicised and punished. While this is mainly a matter of national competence, the Commission is in a privileged position to help member states in encouraging transparency and strategic CSR. First, it is necessary to encourage enterprises to put in place CSR strategies which are genuinely strategic.

One way forward would be to offer tax breaks and access to European funding and contracts for those companies which put in place externally audited strategic CSR policies and which accept to be completely transparent about financial information including their fiscal position, as well as about salary gaps between entry-level employees and top management and working conditions. The Commission could undertake a feasibility study to understand if the measure could be effective.

The European Commission is already funding the digital platform Wikirate.eu which is moving in this direction. The platform is a pilot for crowdsourced assessment of CSR policies.[77] The project is interesting but the extent to which companies are actively involved is not clear, nor its impact on CSR strategies.

Secondly, more should be done to help micro-enterprises and SMEs to put in place their own strategic CSR strategies. Compared to large companies, micro-enterprises from the emerging maker manufacturing sector will need to rely much more on collaboration and joint action in order to achieve social impact. This is not new. There are many examples of collaborative CSR actions, and several best practices have been identified by the

[77] Wikirate is funded by DG Connect's Collective Awareness Platform for Sustainability and Social Innovation, see http://ec.europa.eu/digital-agenda/en/caps-projects.

Commission under its CSR Strategy.[78] However, the kind of interactions allowed by modern technology requires different analytical tools in order to understand the non-linear relationships between different stakeholders and so-doing evaluating their impact. Funding for studying physical and digital interactions within the maker manufacturing sector and understanding enablers and barriers to the achievement of economic and social impacts will be key.

The economic crisis has been a force of change driving both public and private actors to reassess their division of labour. The Juncker Investment Package is a good example of the need for greater collaboration between public and private sectors to re-launch growth and employment not through efficiency of outsourcing but through a genuinely collaborative systems' led model of change. For Europe to bridge this gap it will be necessary for public policy and corporate policy leaders to recognise the need for collaborative leadership, and to come to terms with their interdependency as a prelude to building frameworks for systems focused social innovation and investment.

[78] See http://ec.europa.eu/growth/industry/corporate-social-responsibility/index_en.htm.

3. Conclusions and recommendations: Making Good for the Future

This paper shows how the maker manufacturing is opening up new practices to stimulate innovation addressing the societal challenges of our time. It can be seen as a new open and collaborative cooperativism suited to the 21st century capitalist economy.[79] We are witnessing the emergence of opportunities to reinvent business clusters with networks for horizontal innovation and more inclusive economies; the re-empowerment of vertical supply chains built on transparency and fair relationships; and corporate leadership built around shared value. Together these practices are creating the framework for a whole new generation of social innovation.

The United States is approaching the making economy with a largely economic perspective. President Obama announced during his 2013 State of the Union address that he would spend $200 million to create the manufacturing hubs that bring together companies and universities for research and development of products. Inaugurating the Digital Manufacturing and Design Innovation Institute headquartered in Chicago, he declared that "We want suppliers to be able to collaborate with customers in real-time, test their parts digitally, cut down on the time and money that they spend producing expensive prototypes. We want our manufacturers to be able to custom-design products tailored to each individual consumer. We want our troops to be able to download digital blueprints they can use to 3-D print new parts and repair equipment right there in the field. And these are all ambitious goals, but this is America — that's what we do, we're ambitious. We don't make small planes" (quoted in Slack, 2014).

It is our belief that in Europe we are far more ambitious, not only in terms of funding where perhaps as much as a fifth 300 billion euro cohesion policy package will be available for the implementation of smart-specialization strategies at regional level – but also in terms of vision. Maker manufacturing offers an opportunity to create growth and employment across the continent. In its open form, it also represents an experiment with a new socio-economic model, in which environmental sustainability goes hand-in-hand with equality and social inclusion. In this model, companies will earn the right to profit because they take responsibility for the creation of public goods and public institutions create the framework for corporate and individual citizens to participate, contribute and benefit according to their own and different aspirations.

[79] Or as "Commons based P2P Production" according to Bauwens, M. (2010).

The Commission is already leading on this path by linking economic and social policies across a broad range of policies and programmes. Since the introduction of the European Semester process in 2010, European Member States have further deepened the coordination of their economic and budgetary policies with the scope of reaching the agreed Europe2020 targets for employment, innovation, education, poverty reduction and climate/energy.[80] This means that social policies are part of the economic governance process, and can be effectively discussed and monitored at EU level. The Social Investment Package launched in 2013 fully recognized the importance of ensuring adequate and sustainable social protection and to promote social investment all across Europe, calling for a more efficient and effective use of member states' social budgets. The importance of involving civil society, social entrepreneurs and businesses in the process of reconciling economic progress and social impact has been acknowledged in a number of European policies, and the central role granted to social innovation in the Innovation Union Flagship Initiative has resulted in a wide number of regulatory and non-regulatory actions, from the Social Business Initiative[81] to the European Entrepreneurship Funds Regulation (EuSEFs)[82].

EU funding to help member states achieving smart, sustainable and inclusive growth is being disbursed through a number of programmes directly managed by the Commission (as Horizon2020[83], COSME[84] and EaSI[85]), but especially through the EU cohesion policy[86], which will make available up to €351.8 billion to Europe's regions, cities and the real economy by 2020.

The Investment Plan[87] launched by President Juncker in November 2014 with the intention of catalysing private investment in the European economy offers a further opportunity. According to the Commission's calculations, the newly established European Fund for Strategic Investments (EFSI), with 21 billion Euros, will mobilise at least €315 billion of additional investment over the next three years (2015-2017). Projects to be funded under the new facility will be selected according to four criteria – EU added value, economic viability and socio-economic value, maturity and potential for leveraging other sources of funding.

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[80] Namely: 75% of 20-64 year-olds in employment by 2020, 3% of the EU's GDP to be invested in RDI, early school leaving rates below 10%, 40% of 30-34–year-olds with third-level education, 20 million fewer people in or at risk of poverty and social exclusion, reduction of greenhouse gas emissions at least 20% lower than in 1990; 20% of energy from renewable sources and energy efficiency.
[81] See http://ec.europa.eu/internal_market/social_business/index_en.htm.
[82] See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:115:0018:0038:EN:PDF.
[83] See http://ec.europa.eu/programmes/horizon2020.
[84] See http://ec.europa.eu/growth/smes/cosme/index_en.htm.
[85] See http://ec.europa.eu/social/main.jsp?catId=1081.
[86] See http://ec.europa.eu/regional_policy/en/funding.
[87] See http://ec.europa.eu/priorities/jobs-growth-investment/plan/index_en.htm.

Selected projects will be assessed by a dedicated independent investment committee made up of experts who will validate each project from a commercial and societal perspective, based on what added value they can have to the EU as a whole. Finally, the Commission is about to launch its post 2014 CSR Strategy.

In this framework, we invite the Commission to consider taking action to foster the emerging maker manufacturing movement and to influence its development towards the creation of shared value and the reinforcement of all the dimensions described in the previous chapter. Once social manufacturing is established as a category of interest for the European institutions, we recommend that more detailed consideration is given to the specific policy interventions which should be undertaken to advance progress along the three dimensions which we have identified. This would establish a defining framework for the promotion of maker manufacturing as a whole.

In order to arrive at that position, we provide a set of recommendations to the European Commission. It is worth noting that, while our main focus in this report has been European, many of these recommendations apply equally well to national and local governments.

3.1 Regulatory and policy action

3.1.1 Stimulate reflection on the business model behind the emerging maker manufacturing sector, encouraging new entrepreneurs to position their products with reference to their social and environmental values. Communication campaigns and European awards could be organised for this purpose, using existing initiatives such as the Social Innovation Competition and the European CSR Awards. With reference to start-ups, Startup Europe could help turning making manufacturers' social mission into a tool for brand recognition and fund-raising (e.g. via impact investing, public contracts, public and private procurement) through targeted capacity building in the enterprises incubation and early growth stages. From a regulatory point of view, we would like to point the Commission attention on the recent Italian law for innovative social ventures (art. 25, 4 DL 179/2012, L. 221/2012) which grant tax incentives for corporate and private investments in social ventures (25% tax credit for people or 27% tax deduction for legal entities compared to 19% and 20% for investors in innovative start-ups who do not have a social mission). Promoting this model among Member States could help foster maker manufacturing and to scale its social impact capacity.

3.1.2 Promote democratic participation, transparency and the creation of shared value in the future European CSR Strategy. For instance, one objective of large companies' stakeholders-engagement activities could be encouraging participation of new entrepreneurs and micro-businesses in their governing bodies. Additionally, more should be done to help micro-enterprises from the maker manufacturing sector to develop their own CSR strategies through open collaboration and joint action so that they are genuinely strategic and achieve both economic and social impact.

3.1.3 Consider regulatory action to preserve and enhance the democratization of making. Interoperability of systems and open standards (such as Open API standards for tooling machines and equipment, and new distributed and decentralised warranty structures) need to be secured in order to allow new players to enter the market and succeed. Involve all the stakeholders in the definition of standards, collaborating with existent EIP and PPP, and particularly with the European Cloud Initiative, the EIP on Smart Cities, the Future Internet and Big Data PPP and the Internet of things European Research Cluster.

3.1.4 Continue to promote net neutrality, granting access to data within a common distributed and decentralized architecture which allows for open competition (Digital Single Market).

3.1.5 Bind EU funding to transparency. For instance, EU funding could be granted only to those enterprises which publicly disclose information not only on single CSR initiatives, but

on salaries, taxes, governance structures and stakeholder relationships. A milder option would be privileged access to funding or entry-points in competitive funding processes. In time, this information should be published in digital formats that are machine readable. The Commission could then exhort Member States to regulate along the same lines.

3.1.6 Promote the collection and exchange of best practices in public private collaboration for the creation of public good, building trust between private and public actors though communication campaigns and awards.

3.2. Invest in the new market institutional infrastructure

Member States (for instance through structural funds) and the European Commission should invest in building the institutional infrastructure for the new ventures to thrive. This would include:

3.2.1 New facilities such as maker labs and fab-labs, design tools and formats. Physical spaces are fundamental in order to empower innovators to work locally, possibly alongside traditional manufacturers, while relying on a global network of knowledge. These innovation hubs would be even more effective if conceived from the beginning as part of a smart specialization strategy, facilitating interaction and cross-pollination between makers/potential entrepreneurs and traditional manufacturers, as well as with local authorities and civil society organisations.

3.2.2 New platform marketplaces — which serve the needs of connected and networked companies and customers. Platform marketplaces should be created promoting open source collaboration, allowing new and small companies to create synergies and to bring their products to the market, reaching the critical mass necessary to compete with established commercial platforms as eBay or Amazon without losing their open and social approach. The DG Connect's programme Collective Awareness Platform for Sustainability and Social Innovation (CAPS) would be a valuable reference.

3.2.3 Capacity building for makers and entrepreneurs so they can acquire financial and business management skills and strategic CSR knowledge. This could be promoted through the ESF or as part of the activities offered by the maker spaces and fab labs.

Funding for infrastructures should come with an evaluation budget to learn lessons about how networks evolve and innovate. Interactions should be analysed with complex science approach, in order to understand the non-linear relationships between different stakeholders and how impact is achieved.

3.3 Promote further research

3.3.1 The social innovation potential of the emerging field of maker manufacturing, as well as its relationship to the traditional manufacturing sector, needs to be further investigated along the three identified dimensions (democratising of making, supply chains for good, corporate citizenship) starting with an accurate mapping of existing initiatives. There should be research to identify types of governance models for public-private partnerships, including the definition of social impact in the field. This could be a basis for sharing knowledge about what is most likely to be effective.

3.3.2 Horizon 2020 could fund research on technology for transparency including technologies for real-time, machine-readable reporting across the supply chain.

3.3.3 New models of governance which allow stakeholders' engagement practices and information in the supply chain to be used for collaborative decision-making. This should take into account economic, social and environmental factors in a systemic way. The European Cloud Initiative, the European Innovation Partnership on Smart Cities, the Future Internet and Big Data Public private partnerships, and the Internet of things European Research Cluster together with the CAPS programme under Horizon 2020 and the StartUp Europe initiative could be used to this end, allowing for the right mix of theoretical research and field experimentation. Makers and new entrepreneurs should be among the stakeholders involved into and funded by these initiatives.

3.3.4 This research has largely focused on the process and organisation of making as opposed to the new generation of social and connected objects being manufactured. The nature and design of these social and connected objects have also a lot to offer in terms of aiding and accelerating societal impact. Further research in terms of the role of connected objects to data driven social innovation is recommended.

3.3.5 Feasibility studies and pilot projects on incentives for transparent and socially innovative enterprises could be funded under the Cosme and Horizon 2020 programmes. Companies which put in place externally audited strategic CSR policies and which accept to meet transparency standards for financial information could receive tax breaks.

3.3.6 Shared Value pilots should be funded through structural funds or within existing European Innovation Partnerships and public private partnerships to bring together new and established entrepreneurs, representatives of the public and third sectors and citizens at large to build public-private partnerships for the creation of public good. Innovative financing models, as well as products and services could be collaboratively designed, delivered and evaluated to address shared social issues. If successful, these experiments could be replicated and scaled across countries and industrial sectors.

3.3.7 In reference to the design of future mechanisms/tools for consumer protection, further research is recommended in reference to post "standards" driven futures, to model of customer protection which cater for versioning, decentralised quality control, localised production and social design & assembly. Some aspect of this research should focus on designing & developing new models of distributed, social referenced accountability/customer protection.

We are witnessing new trends in manufacturing which bring together an increasing democratization of the means of production, with the integration of externalities of the

supply-chain and corporate impact on the societal context through the bottom line. These trends are in their infancy but the European Commission could help them to maximise their potential for sustainable growth, rewarding work and expanded public good if it invests in the appropriate institutional infrastructure.

This opportunity is tantalising. Taken together, the trends we have identified in maker manufacturing can drive investment in welfare services, promote industrial democracy and contribute to the realisation of the broader democratic vision of the European Union.

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