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Trend report

Un-locking the potential of business and societal innovation;
how to scale-up successful new business and production models?

Business Innovation Observatory
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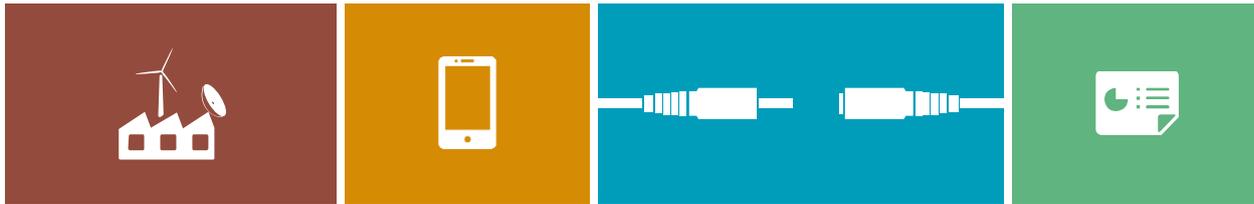
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1. Executive summary

The objective of the Business Innovation Observatory is to showcase successful and relevant business innovation trends. This first Trend report identifies some key issues among a number of trends in order to better understand these new innovation practices and how policy can scale up the successes.

A number of significant and relevant trends have been identified and analysed in 12 detailed case studies and discussed at a workshop. This report highlights the common key issues and comes to recommendations on how to boost the concerning trends and companies, and increase socio-economic impact.

The trend of New Business and Production Models

The topic of this report is 'New business, organisational and production models'. It refers to successful new ways in which companies produce goods and services, new ways to organise and new ways to serve and create markets. Under this (in short) New Models trend, several trends, models and practices have been analysed in case studies. Several case studies analyse how Advanced Manufacturing Technologies changes the way in which companies produce, e.g. in Smart Value Chains or by using environmental friendly technologies. Other case studies address: Public Private Partnerships, Big data, Workplace Innovations, or on-line peer-to-peer business models. Although the batch of case-studies includes a variety of trends, models and practices, several of them are interlinked and overlapping and there are quite a number of similarities.

One of the similarities (as detailed in the various case-studies) is a large and growing **market potential**, for instance:

- The global market in terms of revenues for 3D-printing grew by 29 percent in 2011, and will be USD 6 billion by 2017;
- The European gasification industry has a potential of annual revenues of over EUR 10 billion;

- The industrial robotics sales market was valued at EUR 6.49 billion in 2011, with an estimated growth of 5% per year;
- Out of the €400 billion annual public procurement at European level¹, it is estimated that only €3.8 billion can be considered procurement of innovation²;
- The total number of organisations that have implemented mobile work styles will rise from 24 percent in 2012, to 83 percent in 2014;
- The potential of online peer-to-peer business models is substantial, with growth in turnover exceeding 25%.

Based on the commonalities among the case studies a common story emerges: Innovative and successful trend-driving companies have developed innovative solutions which address challenges of other companies and society at large. The case-study companies offer solutions (e.g. advanced manufacturing technologies, tools for Big Data or software for organisational changes) to customers. By using the solutions these (business and public sector) customers adopt new business and production models. More demand for, and implementation of these existing innovative solutions would scale-up the macro-level socio-economic impact, in terms of both economic competitiveness and in terms of addressing societal challenges.

Many of the new (business, organisational and production) models are about **organisational innovations**, referring to open innovation, re-arranging value-chains, the importance of partnerships and the involvement of (end-)users. Users, partners and other stakeholders have become part of the New business and production models, as the conventional boundaries between companies and the external environment in which they operate become blurred. This is also evident in the importance for the companies of being located and **embedded in an innovative environment** that is relevant, aware and supportive to the concerning business and production models, e.g. a region or city with

¹ PwC, London Economics, & Ecorys. (2011) ; Which excludes public procurement below a certain threshold.

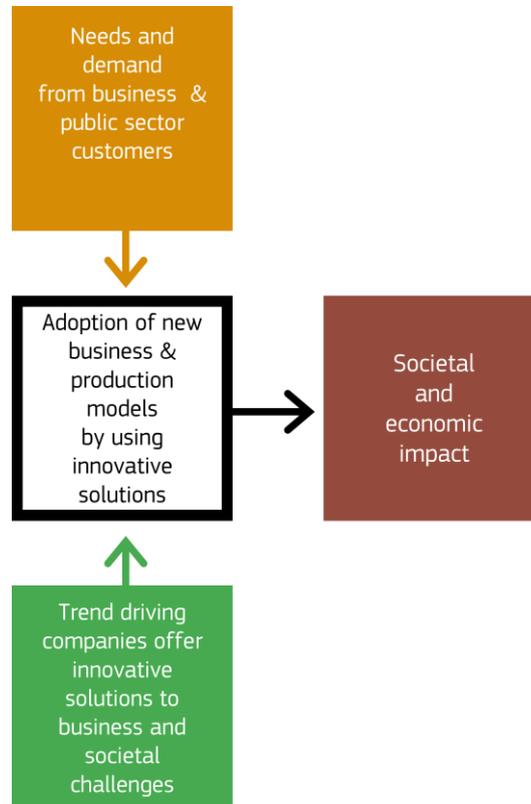
² Rigby et al. (2012)



potential partners, (lead) clients, universities, a pool of high skilled experts, end-users, access to finance, and relevant public support mechanisms. Also soft aspects like

entrepreneurial spirit, innovative culture, mentality, and awareness were mentioned.

Figure 1: A common story emerges



Un-locking the potential of the analysed trends depends to a large extent on ways to promote the wider up-take of the solutions and scaling up the use of the New Models. The **major barrier is on the demand-side**, in the form of conservatism, scepticism, and a lack of understanding the trend, the technologies and the benefits among potential clients. These clients are mainly other companies, but also public procurement officers, or consumers (which might for instance be hesitant to shop on-line). Many companies fear for disruptive changes and unknown consequences of adopting new business and production models.

In almost all new models **ICT plays a major enabling role**. The multi-purpose nature of ICT keeps extending with its wider adoption, wider range of applications, and increased familiarity in using it for any kind of activities. Another common element is that the new models and **solutions are applicable in many sectors**.

A last common issue is the **importance of SMEs** as drivers of the trends and the specific challenges they face in trying to scale-up their business.

The new policy challenge: demand-side innovation policies

Since the technologies that enable or drive the trend of New business and production models already exist, scaling up the success and exploiting the potential does not depend on additional R&D support (supply-side innovation policy).

It is rather the scepticism and **conservatism of potential customers** which forms a **barrier to the up-take** of the new production processes and business models. This calls for more demand-side policy, e.g. by offering opportunities to demonstrate and proof the benefits of the concerning new models and involved solutions in a concrete societal context.

Demand-side innovation policies are now needed for scaling up the New Models trend and the impact in terms of both socio-economic benefits as well as competitiveness (Figure 2). The case-studies on Public Private Partnerships concerning public procurement and demonstrators and testing units are good examples of such demand-side innovation policies.

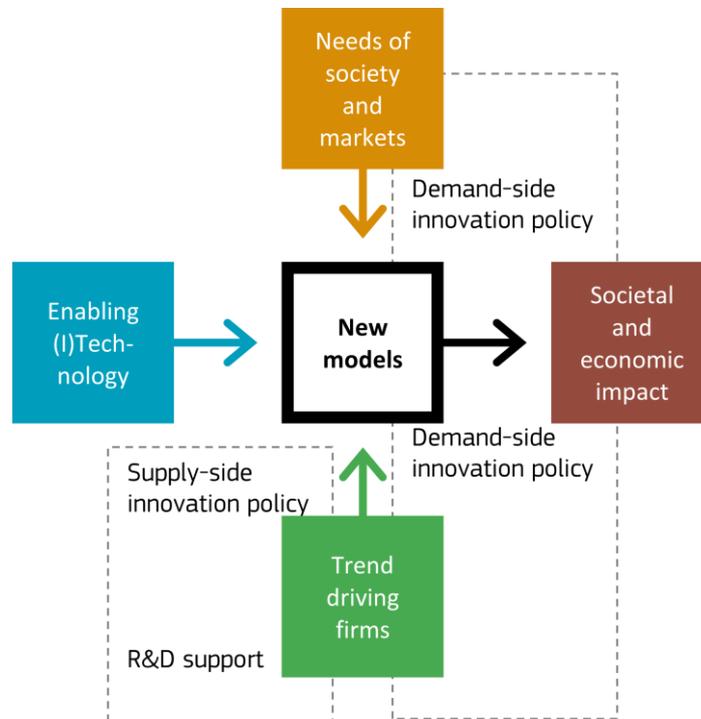
Not only the managers of potential clients have to be “educated” (as a respondent has phrased it), but it is also



important to inform and educate players of the general supporting frameworks concerning the trend-specific issues and to involve them in demand-side policy initiatives. Also changing the mind-set and increasing the awareness of business angels, banks, education institutes, students and

innovation agencies, is important for scaling up the successes of the New Models trend, as it strengthens the **trend-specific framework conditions** for this kind of modernisation of European businesses and society at large.

Figure 2: The new policy challenge: demand-side innovation policy



The future impact from more demand-side policy efforts will feed-back and generate more demand for the new models and more growth and competitiveness for the trend-driving companies. The future growth in demand for and supply of solutions will not only come from the current trend-driving companies and their clients. The need for application in other sectors will generate new entrants. Trend-specific framework conditions will enlarge the number of trend-driving companies, and diffuse the new models trend to other sectors.

Confronting this emerging policy story-line with existing literature on innovation systems shows that this literature has become fragmented, emphasizing specific policy models which are tailored to a specific type of technology, sector or to a specific societal challenge. An integrative framework addressing the commonalities of various trends is lacking; a gap that can be filled with the concept of **societal innovation policy**:

- Innovation policy is no longer seen as only instrumental for firms and economic objectives, but also for coping with societal challenges in non-economic public policy-domains;
- Increased attention for demand-side innovation policies: raising awareness, promoting diffusion and

absorption, behavioural change, involvement of (end-)users, societal transformation processes, and promoting the up-take of new business, organisational and production models;

- The broadening of the involvement of different players and sectors, including citizens and the public sector;
- Set societal innovation priorities, organise platforms and join collective initiatives;
- Broadening of support for business innovation activities. Not only subsidise firm R&D for product innovation, but also allow subsidies to be used for adopting new business models and for diffusing and 'marketing' of societal innovations;
- Bundling of initiatives often packaged into a strategic policy mix consisting of various policy initiatives, for instance in lead-market initiatives, Smart Specialisation Strategies, and European Innovation Partnerships;
- Horizontal coordination between policymakers of various policy fields;



- Multilevel-governance: alignment between local/regional, national and European level of initiatives.

The case study on innovative public procurement and the one on demonstrator and testing units already point at relevant good practice policies for scaling-up. Other **good practice policy schemes** include: Living Labs, award competitions, demand-driven cluster policies and thematic platforms, Collective Awareness Platforms, business support schemes for process-innovation, coaching schemes and schemes that organise visits among companies.

The new policy needs do not necessarily have to be met by completely new policy instruments, since many of the recommendations can be implemented by **integrating demand-side innovation aspects into the mainstream** (innovation supply/ R&D oriented) policy instruments. The details of how and what depends on the details of the various existing policy instruments. However, an important concrete recommendation is to allow companies within mainstream business innovation support schemes to use innovation subsidies not only on R&D for product innovations, but also for process innovation (implementing Advanced Manufacturing Technologies), organisational innovations (changing the business model, implementing disruptive solutions), and market-innovations (adapting solutions to other sectors or for internationalisation). Many mainstream instruments include an option for a feasibility study, which mostly refers to the feasibility of an R&D

project. Such feasibility studies should also be allowed to look at the feasibility of adopting new production processes and business models.

New types of schemes concern a large variety of demonstration policies, and policies concerning public procurement for innovation. Especially regarding demonstration initiatives it does not seem appropriate at this stage to recommend one generic format, since experimenting with new policy formats and designs seem more appropriate. This also holds for new funding schemes, new ways to fund demonstration and up-take of innovations have to be explored.

A concrete proposal for a new type of innovation support instrument is the credit model to overcome resistance against economically reasonable investments in energy efficiency. It is suggested to realise the future efficiency return already in the present earnings and liquidity. For that purpose, the company should be offered a loan that not only covers the investment costs but that also pays out a considerable advance on the increments from energy savings that are anticipated in the future based on the investment. Under these conditions, it would be possible not only to make the investment without putting a strain on liquidity but even obtain liquidity by making the efficiency returns already available today. This would draw the companies' attention on the economic potential which can be tapped by investments in energy efficiency.

2. New business, organisational and production models

The overarching topic of 'New business, organisational and production models' is a synthesized name for 5 innovations trends that have been identified. The identification and selection procedure involved a review of business literature and policy documents in order to identify significant trends with socio-economic relevance, as well as cases of innovative and successful companies which are part of these trends.

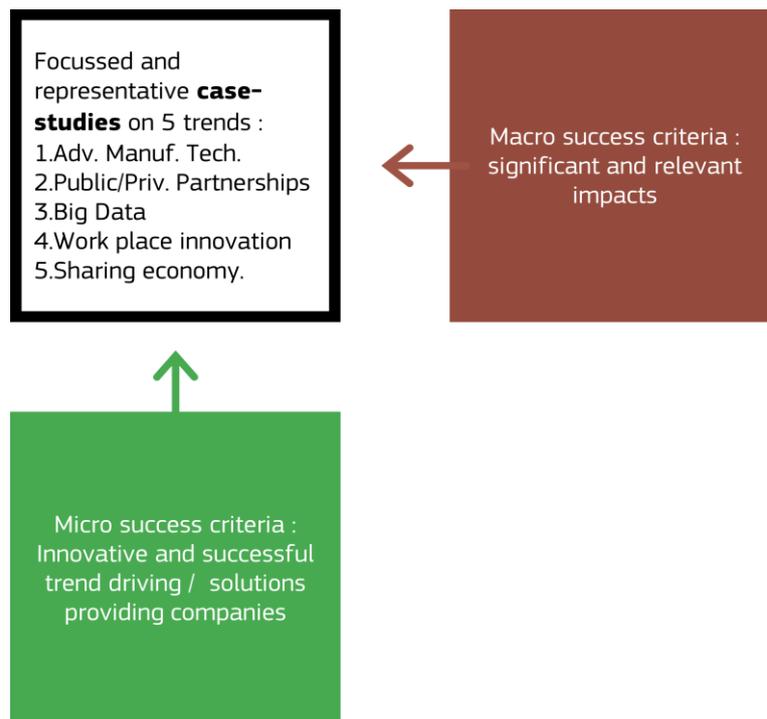
The identification process for trends and cases studies involved two different approaches (Figure 3). The first of these was a top-down approach in order to identify significant and relevant trends concerning their macro-level impact. The process involved a review of business innovation literature and policy documents, an online search for relevant trends in business-innovation along with the consideration of current policy and trends related to this as suggested by the European Commission.

The second, bottom-up, approach was designed to identify at the micro-level successful business innovation cases where companies have brought an innovative product or process on to the market successfully. A wide range of sources was used including internal and external company databases, news and press releases, awards and contests, and industry reports. Company cases were assessed based on early success signals (press reviews, first fund raising, awards, acquisition by an MNC, and technology transfers) and late success signals (performing fund managers, high growth, IPOs, commercial contracts, and new rounds of fundraising).

Based on the identified trends and the pool of identified company cases, the topics for potential case studies were defined.



Figure 3: Overview of criteria for identification of trends and selection of business innovation case studies



2.1. Overview of five trends

The five trends which are covered by this trend report are: Advanced Manufacturing Technologies, Public Private Partnerships, Big Data, Workplace Innovation, and the Sharing Economy (Table 1).

Table 1: Description of trends

Trend	Description
Advanced Manufacturing Technology	Advanced Manufacturing is defined as comprising production systems and associated services, processes, plants and equipment, including automation, robotics, measurement systems, cognitive information processing, signal processing and production control by high-speed information and communication systems.
Public Private Partnerships	A Public-private partnership otherwise known as a PPP is a government service or private business venture which is funded and operated through a partnership of both government authority and one or more private sector entities. PPPs are generally recognised to provide the following benefits: value for money, breadth and depth of skills brought by the private sector, faster implementation of projects and reduced budgetary burdens. Public private partnerships have taken different forms for different purposes. We have identified some key trends in PPP in addition to traditional infrastructure PPP. PPP for technology demonstration, for testing robustness of large scale solutions to fix a societal problem or PPP to initiate a new market have been registered.
Big Data	This term describes the exponential growth, availability and use of information, both structured and unstructured. Organizations and IT leaders need to focus on the ever-increasing volume, variety and velocity of information that forms big data. Many factors contribute to the increase in data volume – transaction-based data stored through the years, text data constantly streaming in from social media, increasing amounts of sensor data being collected, etc. Big data concerns determining relevance amidst the large volumes of data and how to create value from it.
Workplace Innovation	Workplace productivity innovation is about new ideas that facilitate the daily office work and increase productivity, such as coherently coordinating appointments, the reliable management of office documentation or enhancing workplace environment by moving away from common workplace convention.
Sharing Economy	A transition from ownership towards accessibility can be observed across a wide variety of markets. Whereas consumers would traditionally buy products and become the owner, in an accessibility-based system consumers pay for temporary access-rights to a product. Within these accessibility based business models, there is a trend towards peer-to-peer platforms that enable consumers to access consumer owned property or competencies. Thus, consumers are referred to as peers in this context. Companies can facilitate peer-to-peer markets for potentially all assets or services owned by peers.



2.2. Description of case-study trends and companies

The five trends which are covered by this trend report are: Advanced Manufacturing Technologies, Public Private Partnerships, Big Data, Workplace Innovation, and the Sharing Economy. The case-study trends can be described as follows:

1. **Advanced Manufacturing Technologies - Environmentally friendly technologies and energy efficiency**

The rise of environmentally friendly technologies is closely linked to the resource-conscious mindset that has emerged since the global oil crisis of the 1970s. Forty years on, Europe continues to face similar environmental issues, whether it be resource depletion, climate change or pollution. However Europe's cultural mindset has changed and sustainable growth is key priority in the Europe 2020 strategy. In achieving the strategy's sustainable growth objectives, environmentally friendly technologies and energy efficiency will be key, as they apply cutting edge knowledge and non-technological innovations to improve existing products, processes and business models.

Company cases: Avantium (NL), Balmart (ES), BFS Bio Fuel Systems (ES), CPM Compact Power Motors (DE), Felor (FR), Innowattech (IL), Perpetum (BE), TruEnergy (BE/UA), Visuol Technologies (FR)/

2. **Advanced Manufacturing Technologies - New Manufacturing Engineering**

Manufacturing's increasingly competitive environment presents Europe with an opportune moment to further the transition from traditional to advanced manufacturing. To do so, Europe ought not to solely focus on product innovation but must also identify the processes that provide manufacturing with the means to create the products of tomorrow at an industrial scale. New Manufacturing Engineering (NME) has the potential to contribute to such an agenda, as the trend draws on the know-how of highly skilled engineers to develop advanced processes enabling the manufacturing of high-tech products.

Company cases: Materialise (BE) ATS Automation (CA/DE), evopro group (HU), Tekpak Automation Ltd. (IE/UK), CDA GmbH (DE), kringlan composites (CH), Primoceler (FI), CeNTI (PT), Clifton, (EE), Zeeko Ltd. (UK)

3. **Advanced Manufacturing Technologies - Mass customisation**

The impact of mass customisation is transversal,

as it is not a trend devoted to a specific sector. More importantly, it requires an appropriate adaptation of existing manufacturing processes to be successful. The degree to which MC should be used to answer clients' needs depends on the level of customisation required by the client and enabled by the technology. In other words, some products only require cosmetic changes to better fit client expectations. This array of possibilities have shaped mass customisation's current environment, which provides an opportunity for developing market niches but also raises barriers to entry and difficulties in raising funds.

Company cases: ArtBag Design (LV), Combeeneration (AT), Crearmoda (ES), Innosabi (DE), Muses (FR), MyCustomizer (CA), Najmtek (FR/US)

4. **Advanced Manufacturing Technologies - Measurement Technologies & Robotics**

In our age of globalisation, European manufacturers are relocating their businesses to emerging markets so as to remain competitive. These emerging markets offer wider profit margins as a result of lower infrastructure and labour costs. Manufacturers that remain in developed countries are placing even greater importance on the use of automation solutions to differentiate, develop a competitive advantage and finally remain competitive. As such, the application of automation through measurement technologies and robotics is an important tool in the sustainability of many manufacturing businesses in the European Union as it enables them to compete more successfully in the global market.

Company cases: Asyrl (CH), Fluidion (FR), Intermodalics (BE), Odico (DK), Laytec (DE), Leosphere (FR), Winterthur Instruments (CH), ZenRobotics (FI)

5. **Advanced Manufacturing Technologies - Smart Value Chains**

The advanced manufacturing market is rapidly changing. While in the semiconductor industry we see increasingly more buzz on the next manufacturing technology, i.e. 450mm production, we also see radical changes in other high-tech manufacturing markets. Recent research suggests that the market is moving towards an increasingly automated world that will continue to rely less on labour-intensive mechanical processes and more on sophisticated information-technology-intensive processes. This trend is likely to accelerate as advances in manufacturing are implemented.



Company cases: Claro Precision Engineering Ltd. (UK), EnvisionTEC (DE/US), HyGear (NL), Nanovia Ltd. (CZ), Peratech Ltd. (UK), RP2 (NL)

6. **Public Private Partnerships - Large-Scale Demonstrators & Small-Scale Testing Units**

Business innovations have the potential to tackle the societal challenges of today and become key contributors to the achievement of the European Union's 2020 objectives. Yet to realise the potential of their innovations, businesses require real-life settings in which their technologies can be assessed, and facilities in which their prototypes can be industrialised. The establishing of such settings and facilities is typically costly and risky, and may call for public support, often in the form of public private partnership (PPP). Europe is increasingly deploying large-scale demonstrators and small-scale testing units that adopt a PPP approach. These demonstrators and testing units meet the validation and industrialisation needs of businesses, and may lead to Europe realising a number of socio-economic benefits, including the tackling of societal challenges, job creation and economic growth.

Demonstrators and testing units: TIE-IN (DE), GRID4EU – Demonstrator 1 (DE), EcoGrid EU (DK), Amsterdam Smart City (NL), North West Bicester (UK), The Neobuild Innovative Centre (LU), The Bio Base Europe Pilot Plant (BE), The Cleantech Facilitator (DK)

7. **Public Private Partnerships - Public Procurement of Innovation**

In recent years demand-side policy measures have taken the form of product market regulation and standardisation as well as public procurement for innovation. Especially in the current economic climate, it is hard to acquire funding and customers for (radical) innovations. Both capital investors and firms prefer to invest their funds in products, processes and services that have a relatively short return on investment. Therefore, in such a context, public procurement could be a valuable instrument to maintain innovative capacity in an economy. This however also forms a paradox, as most governments also have their funds limited as a result of declining economic growth.

Company cases: AlertSolutions (NL), Ashwoods (UK), KEMA (NL), PHOTONIS (NL)

8. **Big Data - Analytics and Decision Making**

The big data market is at a nascent stage and is expected to develop as organisations seek to enhance their competitive advantage. In doing so, firms seek to better understand the ever-growing

amounts of data, through analytic and decision making solutions. Employing this software may involve a variety of techniques, technologies and visualisation tools. Today, there is a growing market of companies offering hardware, software and professional services solutions. The applications of analytics and decision making solutions for big data are widespread, and as part of the case-study, examples of how different companies offer various solutions in different sectors have been provided.

Company cases: AiRPX (FR), DigitalRoute (SE), Xilopix (FR), Neodata Group (IT), Trendiction (LU), Wipro Promax Analytics Solutions Pty Ltd (A Wipro Group Company) (AU), Quiterian (ES)

9. **Big Data - Artificial Intelligence**

The big data market is in a nascent stage and is expected to develop as companies as well as public bodies seek to enhance their competitive advantage by better understanding the ever-growing amounts of data. Artificial intelligence offers the technology and methodology to do so, and the market for artificial intelligence-based tools and applications is growing rapidly. Uptake of this trend can benefit European companies as well as the EU-economy and labour market, as the development and management of artificial intelligence requires highly skilled workers in a multitude of fields.

Company cases: Path Intelligence (UK), QlikView (SE), Expertmaker (SE), CogniCor (ES)

10. **Workplace Innovation – Solutions for enhancing workplace productivity**

Enhancing workplace productivity entails improvements to the efficiency of production by any organisation employing personnel. It is about new ideas that facilitate the daily office work and increase productivity, such as coherently coordinating appointments, the reliable management of office documentation or enhancing workplace environment by moving away from common workplace convention. This trend study deals with enhancing workplace productivity through business innovation driven by technology and ICT and enabling a more flexible work force.

Company cases: Novapost (FR), All-Desk (PT), OfficePod (UK), Better Workplace (CA)

11. **Workplace Innovation - Novel Organisational Setups and Management Practices**

Novel organisational setups and management practices refer to the organisational innovations that facilitate company interaction with its



environment. Currently there is a clear trend in organisational setups towards collaborative roles, stakeholder involvement and openness. This can take the form of either: an outside-in perspective, with companies that display high degrees of stakeholder involvement; an inside-out approach, in the form of external exploitation of company ideas in different markets; or a coupled process, linking both approaches by creating partnerships with complementary stakeholders with a high degree of collaboration.

Company cases: Finext (NL), Almende (NL), BlueThink (IT), Feyecon (NL)

corporate world, consumers have become more receptive to peer-to-peer business models which are centred on consumer needs, both as a supplier and buyer. In order to capitalise on this, companies emerge that host online marketplaces for matchmaking between consumers. The manner in which these companies generate revenue and impact the economy depend on their commercial interest. For all of these business models, however, community building and creating social relevance is crucial.

Company cases: Peerby (NL), Thuisafgehaald (NL), Sorted (UK), Fixura (FI)

12. The Sharing Economy - Accessibility Based Business Models for Peer-to-Peer Markets

As a result of the economic crisis, available technology and decreased consumer trust in the

2.3. Some examples of companies, innovative solutions and success signals

Table 2: Examples of solutions providing companies

Company	Business innovation	Signals of success
Balmart	Wireless monitoring solutions for agriculture and water treatment	Active member of Freescale (Motorola) Design Alliance and was awarded "best company"; commercial success stories
BFS Bio Fuel Systems	Large scale autotrophic technology to convert CO ₂ into energy	Extensive media coverage; Ecofira Innovation Award 2009
TruEnergy	Advanced thermal gasification technology for conversion of organic waste into energy	Received the much coveted Eureka Label in 2011; Eurec Agency highlighted the importance of advanced gasification processes
Visuol Technologies	Smart automated control painting system for automotive industry	Commercial contracts; SPE best paper award
Nanovia Ltd.	Industrial scale production of nanofibrous material	Nanovia Ltd is one of the first in Europe having the capacity for industrial production of nanofibrous material.
RP ²	Additive manufacturing process	Business expansion, acquisition activities, client portfolio.
AiRPX	Advanced services based on flight data processing	Winner of the 13th French national competition for the creation of innovative technology companies
DigitalRoute	Mediation and data integration solutions	Winners of several awards including the Red Herring Top 100 Europe. The Ahrens Rapid Growth List and the Gasell Enterprise awards in 2012
Neodata Group	Real-time digital content delivery platform for new-media players	Acquired a Belgrade-based start-up called "Newscurve"; Won publicly financed tenders: SIGMA, GAP.
Novapost	Online services to ease and rethink HR document management (Software as a Service – SaaS)	Since 2009 growth of over 100% turnover each year; profitable at early stage; over 100 customers in France and manages over 300.000 empl.
All-Desk	All-Desk is a global marketplace for offering, finding, booking and administering short term meeting rooms and offices.	Finalists of the IT&Web track of the MIT Competition, securing a 100K seed investment
Fixura	Fixura is an online peer-to-peer lending platform. It allows both potential lenders and borrowers to set the specific criteria against which they want to respectively lend out or borrow money.	The company is facilitating 4,500 loans, provided by 1,500 different investors to 25,000 borrowers. Fixura has facilitated over € 13 million in loans. Total interest returned to its investors exceeds € 1 million; annual average return of 10.91%.



Company	Business innovation	Signals of success
BlueThink	BlueThink deploys an open innovation structure with an extensive network of “solver” companies that deliver innovative and tailored business solutions for customers (seekers).	The company employs ten employees. It has a solver network of over 280 companies, six customers and three on-going projects. The expected revenue for 2013 is EUR 750,000.
CogniCor	Complaint resolution and negotiation technology	2012 Most innovative European Startup Award Winner, selected for the Microsoft pre-incubation programme
QlikView	Business discovery platform, allowing for associative data exploration	VC funded, entered numerous foreign markets, winners Network Products Guide’s 2013 Hot Companies and Best Products Award; The Learning! 100 Award 2013; and the 2013 Manufacturing Leadership 100 Awards
AlertSolutions	Through public procurement of innovation, AlertSolutions was able to develop a real time system for monitoring the structural integrity of dikes. The company developed measurement instruments that are inserted into the dike structure.	The company had to make significant investments in the first years. In 2012, the company was able to break-even for the first time. It is, however, still hard to fund R&D based on commercial revenue. The company currently employs 5 persons, of which 2 on a full-time basis.
TIE-IN	A testing unit in which e-Mobility products and services can be tested and developed.	
GRID4EU – Demonstrator 1	A demonstrator in which Smart Grid measurement devices and agents may be tested.	
The Cleantech Facilitator	A web portal from which entities can find facilities for testing or demonstrating their innovative solutions.	
The Bio Base Europe Pilot Plant	A testing unit in which companies can develop and scale-up biobased products and processes.	

Although there are differences between the trends and between the case-studies, this report is not aimed at ‘benchmarking’ or ranking of the various trends, but rather to see if there is a common story to tell, based on the possible commonalities among the case-studies and trends.

There are indeed several striking commonalities. Some of these common issues originate from the identification and selection procedure, and actually confirm the quality of the selection procedure, since indeed all of the case-studies evidence highly **significant and relevant** trends with high macro-level socio-economic potential. Also the innovativeness and success of the companies is convincing as they are indeed **innovative and successful companies** and worthy to be show-cased. First signals on some of the trends and their potential have already been mentioned and discussed before in other studies, but the large collection of success-stories show that concrete successes exist in practice and are promising.

For the case-studies on Advanced Manufacturing Technologies the underlying trends of new technologies and methods to increase the advancement of manufacturing is a

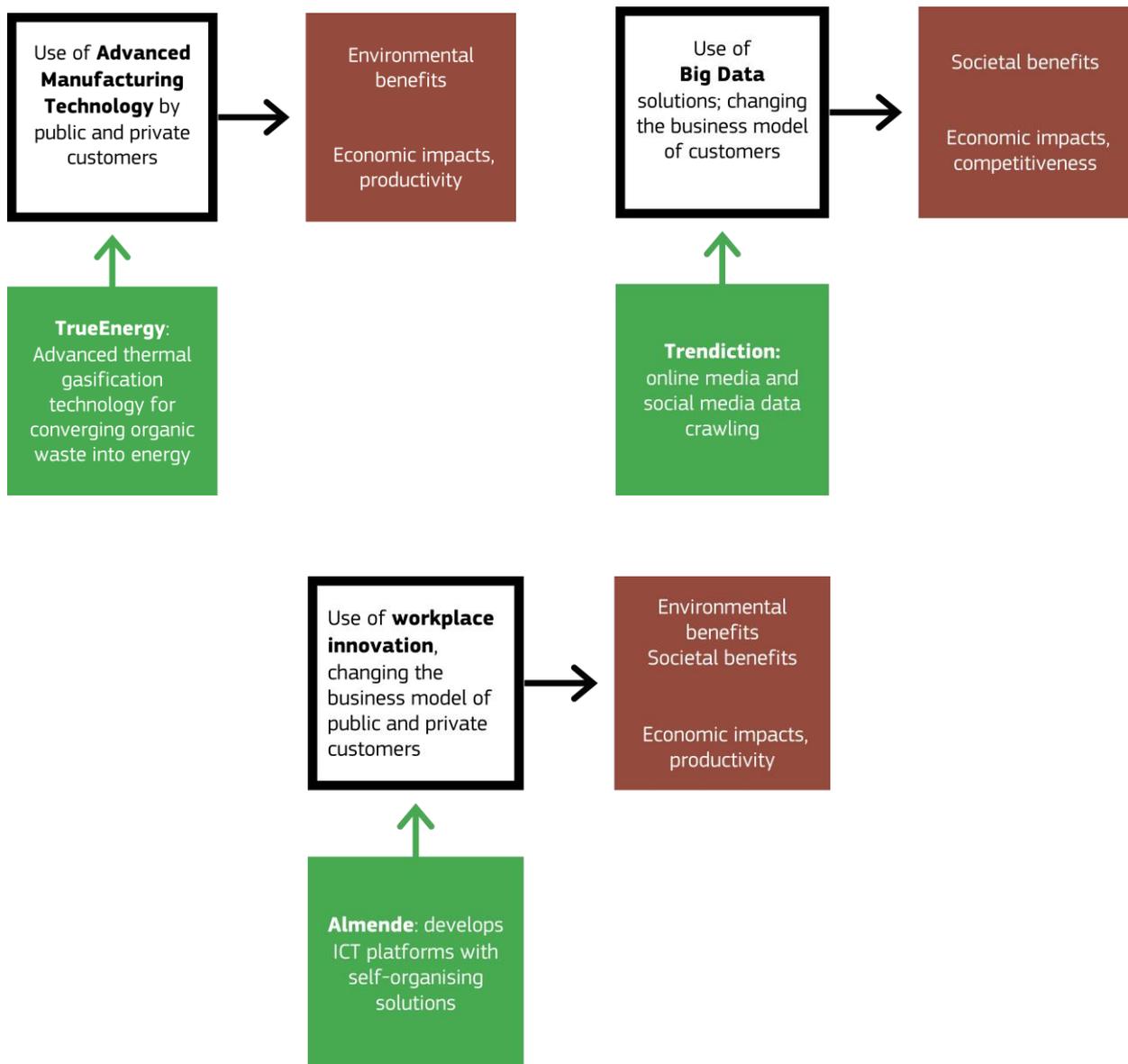
long term trend, but the case-studies show that new steps have been made in developing and applying new tools and methods that can further boost this trend. Although the name of this trend suggest that it is all about technological innovation, the case-studies show that to a large extent the trend also is strongly related to new organisational models and new management approaches and new business concepts, of which some of them are addressed in the second batch of case-studies which precisely focus on such new business models.

The overarching theme of this first trend or policy report has its focus on successful new ways in which companies produce goods and services, new ways to organize and new ways to serve and create markets, inside and outside of Europe. This trend has been labelled ‘New business, organisational and production models’, but we also refer to it as ‘New business and production models’, or ‘New models’.

Most case-study companies drive this overarching trend by offering solutions to customers in the business and public sector. By using these solutions the customers adopt the new ways and new models. Some examples are shown in Figure 4.



Figure 4: Three examples of trend driving companies



3. Framing the common story: a synthesis

Before turning to the specific drivers (in chapter 4) and the policy challenges (in chapter 5) this chapter provides a short overall synthesis of the case-study trends, based on the commonalities.

Innovative and successful trend-driving companies have developed innovative solutions which address challenges of other companies and society at large. The case-study companies offer solutions (e.g. environmental friendly technologies, tools for Big Data or software for organisational changes) to customers. This includes customers from the business and public sector. **By using**

the solutions customers adopt new business and production models. More demand for the existing innovative solutions would increase the socio-economic impact. Most of the technologies that enable the trend of New business and production models, already exist and scaling up and exploiting the potential does not seem to rely on many more years of additional R&D investments.

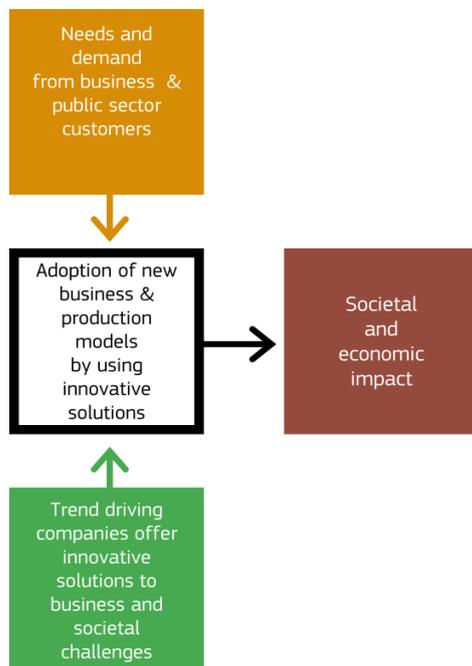
Only in one of the 12 case-studies there is a clear recommendation for supply-side innovation policy: "Promote R&D in measurement technologies and robots". Proven technological solutions exist, and European R&D in this field



is at a high level, but maintaining this good position will help to meet demand. So even in this particular case-study trend a lacking supply of technological inventions and innovations due to the quality or quantity of R&D is not a major obstacle. A more important obstacle for scaling up of this trend in Advanced Manufacturing Technologies are conservative potential customers, and for instance the limited uptake of automation solutions by SMEs. The recommendation to “educate the market about the benefits of automation” calls for typical demand-side innovation policy measures.

Other case-studies in the overarching trend towards new models of business, organisation and production are cases of user-driven innovation, where the involvement of users is an important source for innovation; sometimes industrial clients, sometimes end-users or public sector users. The involvement of users, might even take the form of co-creation. For instance, the trend of Mass Customisation (which is another trend in Advanced Manufacturing Technologies) is a technology enabled strategy to involve end-users in the design and the production process. Many cases show that most of the socio-economic impact benefits of the solutions provided by the case-study companies are generated by the use of these solutions by clients

Figure 5: How the solutions relate to the trends and impacts



Many of the new (business, organisational and production) models are about **organisational innovations**, referring to open innovation, re-arranging value-chains, the importance of partnerships and the involvement of end-users. This not only holds for the trend of New Business models, but also for the trends in Advanced Manufacturing Technologies, especially concerning Mass customisation and Smart value chains. But also the other trends in ‘Advanced Manufacturing

Technologies’ bring about new ways in organising production and business and innovation processes. Also in many of the other analysed trends clients from the private or public sector and end-users have become part of the production and innovation processes. They have become part of the New business and production models, as the conventional boundaries between companies and the external environment in which they operate become blurred. In this respect the business innovation trends analysed in this report can also be seen as societal innovation trends.

The trend analysed in the case study ‘Novel organisational setups and management practices’ focuses on this very trend of organisational innovations that facilitate company interaction with its environment. Currently there is a clear trend in organisational setups towards collaborative roles, stakeholder involvement and openness. This can take the form of either: an outside-in perspective, with companies that display high degrees of stakeholder involvement; an inside-out approach, in the form of external exploitation of company ideas in different markets; or a coupled process, linking both approaches by creating partnerships with complementary stakeholders with a high degree of collaboration. We see this trend as an underlying trend in many other of the identified trends.

A common aspect from the case-studies, which is linked to this, is the importance for the companies of being located and **embedded in an innovative environment** that is relevant to the concerning business, e.g. a region or city with potential partners, (lead) clients, universities, a pool of high skilled experts, end-users, access to finance, relevant public support mechanisms. Also soft aspects like entrepreneurial spirit, innovative culture, mentality, awareness etc. were mentioned. Linkages with such a conducive and receptive environment and partnerships with relevant players in this environment provide access to relevant resources, e.g. in terms of funding, lead-clients, new technologies, industrial partners, etc.

Un-locking the potential of the analysed trends is to a large extent depending on ways to **promote the wider up-take of existing innovative solutions**. A major barrier in this respect revolves around scepticism, fear for disruptive changes and unknown consequences, and a lack of understanding the trend, the technologies and the benefits. This calls for more opportunities to demonstrate and proof the benefits of the concerning new models and involved solutions. Public involvement in the form of partnerships for demonstrating and testing, and in the form of procurement are part of the overall trend of ‘New business, organisational and production models’, and as it is the case with many of the analysed trends, they can serve the scaling up of the other trends, models and practices.

In almost all new models **ICT plays a major enabling role**. The multi-purpose nature of ICT keeps extending with its



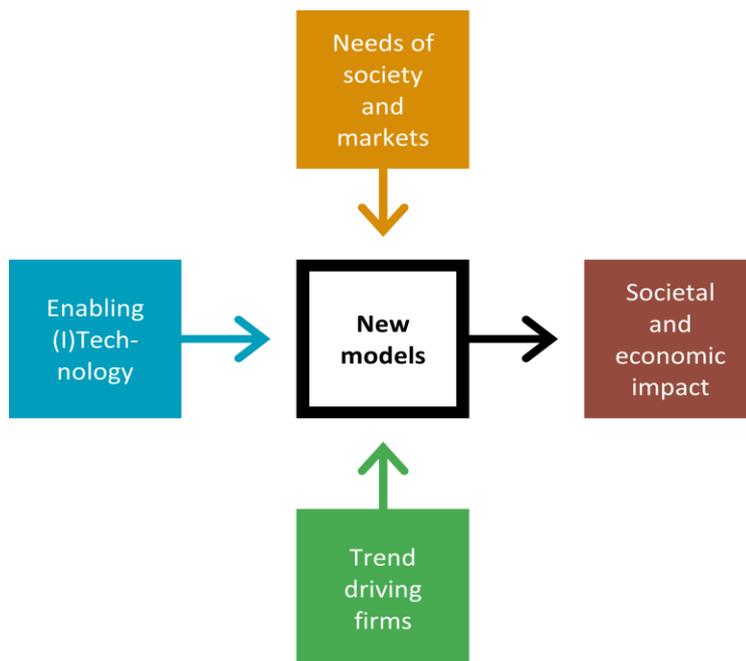
wider adoption, wider range of applications, and increased familiarity in using it for any kind of activities; not only in companies, value chains and business environments, but also in personal lives, communities and societies at large.

Another common element in the case-studies is that the new (business, organisational and production) **models are applicable in many sectors and industries**. This is especially true for the trends in new business models, but also the trends and solutions of Advanced Manufacturing Technologies are applicable in a wide variety of industries.

For instance, the impact of mass customisation is transversal, as it is not a trend devoted to a specific sector. Also the impact of environmentally friendly technologies is transversal, as they are not applied to one type of manufacturing, or one type of market.

A last, but not least important common issue which appears from the case-studies is the **importance of SMEs** as drivers of the trends and the specific challenges they face in trying to scale-up their business.

Figure 6: Framing the basic story from common elements among trends



4. Key innovation drivers and barriers

In order to come up with possible policy options for scaling up the successes of the trends, it is important to understand the various drivers of the trends and the barriers faced by the trend-driving companies and their clients.

4.1. Drivers

Among the drivers of the 12 case-study trends the **market growth** and further growth potential has often been identified as most important (see table A in Annex). However, especially in the cases on new business models and practices, sometimes the 'market' for the models is difficult to quantify, since some practices (new ways of doing things) cannot be sold (nor patented).

Examples of the large and growing potential (taken from the various case-studies) include:

- The global market for 3D-printing grew by 29 percent in 2011 in terms of revenues, and will be worth USD 6 billion by 2017;
- The European gasification industry has a potential annual market (revenue) of over EUR 10 billion;
- The industrial robotics market was valued at EUR 6.49 billion in 2011, with an estimated growth of 5% per year;
- Out of the €400 billion annual public procurement at European level³, it is estimated that only €3.8 billion can be considered procurement of innovation⁴;

³ PwC, London Economics, & Ecorys. (2011) ; Which excludes public procurement below a certain threshold.



- The total number of organisations that have implemented mobile work styles will rise from 24 percent in 2012, to 83 percent in 2014;
- The potential of online peer-to-peer business models is substantial, with growth exceeding 25%

Meeting demand does not only refer to market demand, but also to serving societal needs. **Various benefits of using the solutions** provided by companies are behind the growth and the remaining potential of the trends, even though the (potential) clients may not be aware of the full range and intensity of the benefits. Technologies and solutions are enabling conditions: without them the trends would not exist in the first place, but un-locking the potential does not seem to rely on next generations of technological breakthroughs. In this respect both the main drivers and barriers of the new models trend are on the demand-side of innovation.

Another important driver for the market potential is in the fact that **the new models are applicable to a variety of sectors** and industries. The potential market and the various benefits of the solutions are not limited to one private sector or industry.

For some trends regulation is promoting the demand, e.g. in the case of environmental friendly technologies, but in other cases old regulations and conventional standards rather are an obstacle to new ways of doing business. At the workshop another complication concerning regulation was emphasised, as changing regulations (which could mean less, more or different rules) can serve as a driver, but the rules should not change every year, and should be based on a long term strategy from government.

4.2. Challenges faced by trend driving companies

In this chapter we focus on the identified challenges faced by the trend-driving (solutions supplying, or 'solving') companies (See also Table B in Annex). This includes the barriers they have mentioned in relation to their development and growth, as well as factors they mentioned as being important in explaining their success. Challenges and barriers in relation to policy support and framework conditions are addressed chapter 6.

A main challenge for the (solutions providing) companies is the **scepticism and lack of understanding** among potential clients. The company BFS for instance feels its innovation of large-scale autotrophic technology to convert CO₂ into energy is not well understood or well perceived by the public. The company feels that in addition to a lack of technical understanding, there is also a lack of interest for such innovative technologies. This is despite the fact that the

innovation offers solutions to environmental and employment issues.

Besides a lack of understanding, the scepticism is also fuelled by the **uncertainty about the possible disruptive impact**.

Such scepticism is also translated into difficulties in accessing financing, especially for scaling up. The company Visuol Technologies for instance, needs financing to build up demonstrators in order to sell its technology to industrial clients. Even if viable solutions to address big societal changes are provided, wider market adoption remains a challenge.

Other frequently mentioned challenges include: the scaling-up phase and its financing; finding relevant partners and skilled experts; testing and demonstrating the solution; regulations and internationalisation.

Partnerships are widely seen as important factors in explaining the success of the trend driving companies.

From the results of the workshop we can add additional challenge: encouraging traditional industry and large organisations to move faster, which calls for a 'new open approach' and promotion of linkages between large and small companies.

4.3. Challenges faced by companies' clients

The case-studies also provide insights in the challenges faced by the companies' clients (see Table 3), although this mainly refers to challenges as they are perceived and reported in the interviews by the solutions providing companies. More information from potential users and effective users would provide more in-depth understanding about the considerations to use or not use the current solutions, and in the consequences and impact of using the solutions.

Given the nature of the main challenges discussed in the former chapter, it is not surprising that the challenges faced by the (potential) users of the solutions point to the same issues. A main barrier for the uptake of the technology, new model, or innovation concerns a **lack of understanding of the trends and the benefits** of the solutions offered. Another barrier is the often mentioned **fear for the disruptive impact** on the current business, organisational and production model.

⁴ Rigby et al. (2012)

**Table 3: Challenges faced by companies' clients**

Trends	Challenges of companies' clients
Advanced Manufacturing Technologies	
1 Environmentally friendly technologies and energy efficiency	Limited understanding of the technological solutions; Clients having a lack of understanding of the new value chains and the technologies being employed; Environmentally friendly technologies may disrupt value chains and production lines. In doing so, they might require the fundamental rethinking and redesigning of the client's manufacturing structures and production flows. Financial considerations as significant upfront expenditures and long investment horizons are typically required; Adoption can lead to both increases and decreases in staffing levels; Clients also need to be ensured of the reliability, viability and sustainability of both the technology and the company supplying the technology.
2 New Manufacturing Engineering	Adjusting to a higher skill level of employment demand in manufacturing. Build good and early cooperation with supplying companies.
3 Mass customisation	Mass customisation enables clients to develop their own business. Integrating an MC strategy implies carefully managing various kinds of change, mostly organisational change. Management challenges include: supply-chain management, Inventories management, sales projections and risk management.
4 Measurement Technologies and Robotics	Automation solutions are often capital-intensive and best suited for large-volume production, and secondly they are often complex systems with a single function that makes them highly inflexible. Moreover potential SME clients have difficult access to finance, poor awareness of the benefits of the solutions; and low technical competence outside core business.
5 Smart Value Chains	The solutions offered were considered to be potentially disruptive to the value chain. Requires significant capital expenditures to invest. The uptake of smart value chain manufacturing solutions requires companies to attract highly skilled human capital.
New Business Models	
<i>Public Private Partnerships</i>	
6 Public Procurement of Innovation	There is the client perspective of the public organisation purchasing the innovation through a procurement programme, and the client perspective of market organisations purchasing the innovation.
7 Large-Scale Demonstrators & Small-Scale Testing Units	Increased uptake will largely depend on the success of demonstrated innovative solutions. The main challenge for users is in assessing the appropriateness of markets. The solutions will be judged from a partners perspective on their ability to be: <ul style="list-style-type: none"> •Economically viable, i.e. their ability to develop and survive as a relatively independent economic unit; •Scalable, i.e. their ability to change scale in order to meet growing volumes of demand; •Replicable, i.e. their ability to be duplicated at another location or time; •Visible, i.e. their ability to be seen by various stakeholders; and •Implemented with a clear leadership and governance structure, providing confidence in all stakeholders, ensuring them that responsibility is integrated into the partnership and its decision making processes. Developing relevant skill-sets is a challenge for both public and private partners involved.
<i>Big Data</i>	
8 Analytics and Decision Making	There is still a cultural barrier to be overcome before the trend becomes widespread. This is because embracing data-driven decision making involves moving away from conventional decision making processes. On the one hand there is a degree of scepticism from the decision makers themselves about this new data-driven decision making. On the other hand, these new solutions would effectively cut out the "middle-man" and empower company management to make decisions themselves. Obviously such a disruptive change in process takes time before the market accepts it. There are also legal concerns, and concerns about investments in large servers.
9 Artificial Intelligence	Challenges of clients include the long investment horizon of some artificial intelligence innovations, limited understanding of the potential of the data generated by their organisation, and hesitation towards potentially disruptive technology.
<i>Workplace innovation</i>	
10 Enhancing workplace productivity	One of the most important barriers relates to the organisational resistance to change induced by workplace innovations. Resistance with middle management: in order to take a decision managers need to be aware of the benefits of workplace innovation and often they are unaware of the benefits. The availability of ICT-infrastructure and equipment on the client side. A barrier to further uptake is the (conception of the) cost of a transition towards a more flexible workplace.



Trends	Challenges of companies' clients
11 Novel Organisational Setups and Management Practices	Case companies are both the developer/supplier of the organisational innovation and at the same time a client for the innovation. Although customers of the case companies do not necessarily take up the innovation under discussion themselves, they do benefit from its results, and these results can raise awareness and influence them towards adoption of some of the principles.
<i>The Sharing Economy</i>	
12 Accessibility Based Business Models for Peer-to-Peer Markets	The lack of trust and familiarity of clients with web-based peer-to-peer platforms. From a client's perspective it is hard to perceive quality amidst this jungle of advertisement for web-based marketplaces and communities. Platforms that facilitate sharing of physical goods or services of low added value are unsuitable for (early) uptake in for instance rural areas.

This latter problem that hinders clients' uptake is exemplified by Balmart's technology, which is designed for the intelligent control of the environment in order to improve decision making and increase agricultural production. Yet in implementing Balmart's technology, the traditional working practices of farmers are disrupted, and as a result, prospective clients have demonstrated a resistance to technological change.

Various policy interventions also served as a driver or barrier of the trend on 'New business, organisational, and production models'. This role of policy will be addressed in more detail in the next chapter.

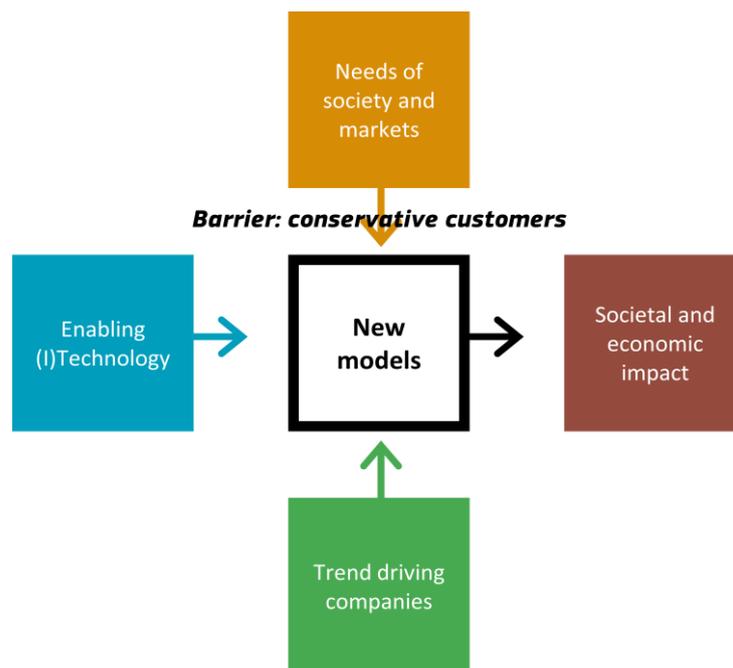
We conclude that the main barriers are: fear for disruptive changes, lack of awareness, and understanding among potential clients, which was confirmed by the workshop participants, who have summarised the barriers in one word: **conservative customers** (Figure 7).

The workshop participants again added a comment on the difference between large, existing companies and start-ups. E.g., large and existing companies are not likely to totally change their business model, unless they are forced by competition or certain regulations.

Moreover, given the fact that many potential customers are conservative, questions the extent to which user/client-driven innovation (market- or demand-pul) is the answer, and to which extent we still need some market- or demand-push.

Conservatism was also seen as a more general barrier to the uptake of innovation at the level of the European society in terms of people being risk-averse, technology-averse, and not very innovation-minded nor entrepreneurial. This is for instance also related to skill shortages for the up-take of Advanced Manufacturing Technologies and New Business Models, since students rather aim for secure jobs in large companies.

Figure 7: Main barrier to the up-take of the trends: conservative customers





5. Policy challenges: improving framework conditions and promoting wider uptake

The new business, organisational and production models might call for adjustment of existing policy support and framework conditions. First the existing policies are addressed. This is followed by discussing the policy gaps (what is missing or lacking) and the policy challenges (how to promote further up-take of Advanced Manufacturing Technologies and New Business Models).

5.1. Existing policies: R&D (supply-side) support

A special focus is given to regional and national innovation policy frameworks. The interviewed firms indeed benefited most from regional and national support schemes and regulatory frameworks (table C in Annex). Frequently mentioned policies include:

1. R&D grants;
2. Tax credits, mostly for R&D;
3. Incubator services;
4. Networking events;
5. Soft Loans;
6. Competition awards and prize-money;
7. Demonstrator & testing units;
8. Public procurement of innovation schemes.

Most frequently mentioned forms of public support concern subsidies and tax-credits for R&D and incubation services. Of course the companies interviewed regarding the two Public Private Partnership trends benefited from public funding in the concerning public procurement schemes and in the demonstrators and testing-units.

At the workshop it was confirmed that currently most support goes to R&D. The participating entrepreneurs concluded that both EU and national research and innovation funding have a bad reputation, as they are not user-friendly.

5.2. Policy gap: demand-side innovation policy

The main policy gaps identified in the case-studies (see table D in Annex) are:

1. The need of opportunities to demonstrate, test and proof the solutions provided;
2. To educate and raise awareness concerning the benefits of the solutions and the New Models;
3. Address SME specific needs better;
4. Networking, platform and partnership promotion;
5. Support for the scaling-up phase;
6. Policies addressing lack of people with specific skills and expertise;
7. Support for internationalisation.

We can conclude that most of the drivers and barriers discussed in chapter 4 are pointing at the need for more demand-side innovation policy.

The existing policy support the companies have benefited from, involved supply-side innovation policies which provided funding for R&D. This has been very welcome, and will remain important for new start-ups, but there is insufficient support (a policy gap) to enhance the demand for and up-take of the concerning solutions and business models.

"Instead of supporting the commercialisation of research, development and innovation, demonstrators and testing units start with the societal problem before identifying and validating the innovation solution. As a result, these settings are turning traditional innovation policy on its head" (Case-study 7; large-scale Demonstrators & Small-Scale Testing Units)

The existence of the above mentioned policy gaps have been confirmed and discussed at the workshop. Especially lacking are policy schemes which promote the uptake of existing (but innovative) technologies and practices.

Besides demonstration schemes and public procurement schemes, an additional gap was reported by workshop participants concerning the lack of funding schemes for companies that want to invest in existing Advanced Manufacturing Technologies: *"The European Investment Bank currently has no policy to support uptake in the market, support currently goes more to research, but there is no support for customer investment"*. There is a gap in support for companies that want to invest in process-innovations, or in non-technological innovations. An additional gap identified at the workshop was the lack of policies targeting low-tech sectors. Since the Advanced manufacturing Technologies and New business Models are applicable to many sectors, it



seems indeed relevant not to exclude low-tech industries from innovation support.

5.3. Policy challenges

When asked to the case-study companies how to fill the policy gaps (Table 4), they mention three kinds of policy challenges, which consist of three ways in which the success can be scaled-up (Figure 8):

1. Continuation and improvement of existing supply-side **R&D policies** (the companies have benefitted

from themselves in the past), which can be used to develop new technological solutions;

2. Policies which improve the **framework conditions** for the trend-driving companies and their customers (stimulating the growth and start-up of solutions providing companies and sectors);
3. **Demand-side policies** to promote the wider uptake of the trend by the market; which scale-up the use of the solutions and the wider societal and economic impact.

Table 4: Case-study policy challenges

Trends, case-study	policy challenges
Advanced Manufacturing Technologies	
1 Environmentally friendly technologies and energy efficiency	Develop awareness at the public level, highlighting the benefit of these novel technologies so as to encourage the uptake of these solutions and reduce public scepticism. Creation of large-scale demonstrators and small-scale testing units. Support SMEs bringing environmentally friendly technologies to market. Simplify administrative processes for public support. Provide access to finance for companies that adopt environmentally friendly technologies.
2 New Manufacturing Engineering	Improve access to finance for innovative SMEs and mid-caps. Improve prospective client awareness of NME processes. Improve access to relevant highly skilled labour. Increase access to vocational education and training.
3 Mass customisation	Establishing an enabling business environment. This involves administrative simplification, for example to support services in the setting-up and putting together of administrative dossiers. Facilitating access to finance. Facilitating the international development of mass customizers. Supporting entrepreneurship and favouring an entrepreneurial spirit. Improving communication between entrepreneurs and investors.
4 Measurement Technologies and Robotics	Promoting R&D efforts in automation solutions for SMEs. Educating the market about the benefits of automation. Improving support of start-ups. The primary factor to address would be the administrative burden faced by beneficiaries of public aid.
5 Smart Value Chains	Stimulate entrepreneurs to actively think of the market opportunities before developing the innovative technology. To stimulate the market uptake of innovative solutions in the smart value chain manufacturing industry. Address the lack of specialised and highly skilled human. Simplify or shorten the administrative processes for public support. Provide access to finance for companies trying to upscale and commercialise the innovation.
New Business Models	
6 Public Procurement of Innovation (Public Private Partnerships)	European governments can introduce a hybrid version of funding development as well as procurement of innovation, by co-procuring with private sector players, by combining procurement with free access to university R&D hours and knowledge, by introducing an Envy scoring mechanism for public procurement programmes, by cutting up tender procedures in several (smaller) separate assignments, and by using specific methods that can encourage or force tenderers to adopt certain innovations or technologies.
7 Large-Scale Demonstrators & Small-Scale Testing Units (Public Private Partnerships)	The EU should push for consortia to engage in international partnerships that ensure the diffusion of innovative solutions to other Member States. It is suggested that the public sector engages in public procurement activities for demonstrators and small-scale testing units. This will provide a test-bed in which the public sector will be able to tailor new demand-side policy. Demonstrators and testing units are particularly relevant in areas where regional economic growth agendas support cross-cutting themes.
8 Analytics and Decision Making (Big Data)	Ensuring appropriate access to finance for big data companies that have a financing shortfall when raising funds to commercialise new analytic solutions. Establishing an enabling business environment for data storage, data transfers and communication networks. Supporting entrepreneurship, leading to the creation of start-ups and SMEs that offer big data analytics and decision making solutions. Fostering administrative simplification. To support big data SMEs in their internationalisation process. To develop and promote an education system able to answer the specific needs of big data companies.



9 Artificial Intelligence (Big Data)	<p>European governments can improve the access to funding of young technology organisations by making it less difficult to obtain funds for early-stage technological development through seed funds and R&D grants. Tax reform to promote innovation can be targeted to improve liquidity of technology start-ups by offering them a tax holiday or the possibility of deferred taxation. Public procurement of innovation could provide for proof-of-concepts and show good practices to incorporate in cost-benefit analyses.</p> <p>Reforming immigration policy to attract highly skilled labour.</p> <p>Fostering administrative simplification. Reforming employment regulation, to reduce the administrative burden. Encouraging university-industry interaction. Encouraging mentorships, existing intermediary bodies deploy mentorship programmes and matchmaking activities. European governments can re-engage in international discussions on international patents to improve the protection of innovations.</p>
10 Enhancing workplace productivity (Workplace Innovation)	<p>A key role for authorities is to address legal/regulatory uncertainties. The public sector should play a role-model, lead by example. Support the uptake by providing employers grants or other forms of government support for further uptake by lowering the financial barriers to implement flexible work. Supporting entrepreneurship leading to the creation of start-ups and SMEs that offer productivity enhancing workplace innovations.</p>
11 Novel Organisational Setups and Management Practices(Workplace Innovation)	<p>There is a need for policy measures that maintain, expand and make existing RDI infrastructure more accessible for SMEs and start-ups. Policymakers should come up with measures that ensure the availability of funding for companies deploying novel organisational setups and management practices. Other recommendations include, more direct support mechanisms, supporting network building, to ensure a constant supply of technologically educated individuals and simplifying employment of non-EU residents in EU-member state countries</p>
12 Accessibility Based Business Models for Peer-to-Peer Markets (The Sharing Economy)	<p>Policy makers could tailor tenders aimed at innovation within start-ups according to the restrictions those companies face. European and national subsidy programmes could be tailored to be more in line with this new approach to entrepreneurship. Policy makers should facilitate the creation of minimum standards for peer-to-peer markets. Policy measures that facilitate more flexible employment of workers are desirable. It is hard for sharing economy start-ups to attract talented software developers and programmers. Policy measures that would make it more attractive for employees to receive company shares, and receive future dividends on them, could help start-ups attract skilled workers.</p>

In Figure 8 on page 20 these three policy issues are included as an additional story-line to the basic framework.. On the left hand-side supply-side innovation policies are located, of which especially the R&D support for the development of new solutions by trend driving companies have been relevant.

Framework conditions refer to the resources the companies made use of (finance, knowledge, human resources, infrastructure, etc.) and the specific business and incubation climate that was beneficial to start-up and grow.

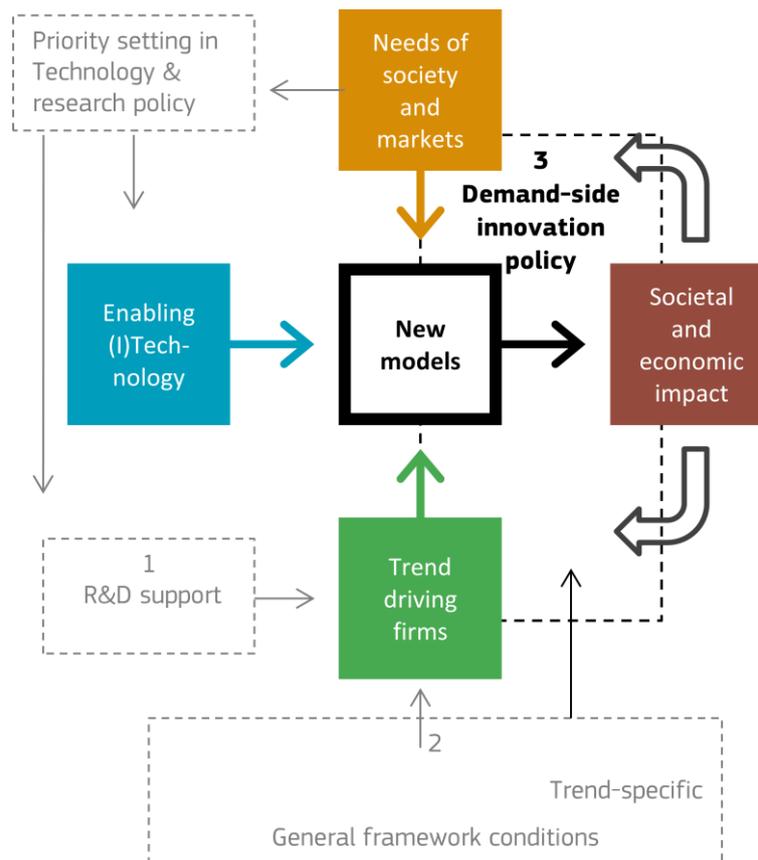
Demand-side innovation policies (located on the right hand-side in figure 6) are now needed for scaling up the New Models trend and the impact in terms of both socio-economic benefits as well as competitiveness. The case-studies on Public Private Partnerships concerning public procurement and demonstrators and testing units are good examples of such demand-side innovation policies.

Trend specific framework conditions include for instance banks which provide funding for demonstration projects or for investments in new process technologies by customers.

The future impact from more demand-side policy efforts will feed-back and generate more demand for the new models and more growth and competitiveness for the trend-driving companies.

The future growth in demand for and supply of solutions will not only come from the current trend-driving companies and their clients. The need for application in other sectors will generate new entrants, which will enlarge the number of trend-driving companies, and diffuse the new models trend to other sectors.

Also the priority setting in Europe (e.g. in its science and technology policy) is part of the success story. Although it was not often mentioned explicitly in the case-studies, the European strategy that research and innovation should address societal challenges has supported the trends, especially those concerning solutions to environmental challenges.

Figure 8: Bringing policy into the picture: promoting up-take and scaling-up the New Models trend


Legend: Left-hand-side: existing supply-side innovation policy; right-hand-side: demand-side innovation policy

At the workshop⁵ the participating entrepreneurs and policymakers have identified similar policy challenges. The concrete demand-side policy recommendations are presented in Chapter 7. Below we highlight the two more general challenges: how to come to a more innovative Europe, and how to address shortages in skills and competencies.

Towards a more innovative Europe

- **Ease access to current EU and national R&D and innovation support**

Current EU and national research & innovation funding schemes are not user-friendly, and in particular: not SME-friendly. This message was also reported by case-study companies. It was recommended by the workshop participants to simplify the access to existing public support for research and innovation. Besides more accessible public funding it was also recommended to encourage new ways to

find funding for innovation, e.g.: crowd funding or Public Private Partnerships.

Also the importance of a long-term strategy from governments and European alignment of fragmented national policies was stressed, for instance concerning energy. A good strategy would be to develop business innovations around priority sectors.

- **Change the mind-set in society**

Based on a discussion what the US and Asia do better, it was concluded that it is not only about funding, but about the environment, culture & education. The mind-set should be changed by celebrating entrepreneurship, risk-taking and engineering skills.

- **Extend the systemic approach:** engage a larger variety of parties and promote decentralised innovation hubs

Several of the roundtables have mentioned that for increasing the dissemination and uptake of the trends in Advanced Manufacturing Technology as well as in new business models, it is needed to engage many parties in

⁵ See :

http://ec.europa.eu/enterprise/policies/innovation/policy/business-innovation-observatory/files/workshops/wks1-18-09-2013-agenda_en.pdf



working together. Policymakers should provide a forum for this engagement between stakeholders. This includes governmental bodies and knowledge institutes, and companies from various sectors. It includes parties in the value chain (from raw resources to the end-user industries), the innovation chain (from research to demonstrations and market). An extension to such a systemic approach also concerns various parties in the industrial chain, ranging from large companies to SMEs. Inter-relations between small and large companies were emphasized as being important to increase the uptake of new manufacturing technologies and especially for incubation of new business models. Several workshop participants have stated the importance of the regional level and promoting decentralised innovation hubs (smart specialisation). Regional intelligence in this respect involves identifying where companies are in the complete value chain (but also the innovation and industrial chain), and questioning to what extent these chains can be transferred to and embedded in the regional level? Regions should develop a long-term strategy, which includes developing interfaces with other regions, but especially to use of Regional funds to modernise the industry by promoting the demand and uptake of business innovation.

Policy challenges concerning skills shortages and competencies

Two roundtable groups at the workshop discussed the issue of trend specific of skills and competencies. Concerning Advanced Manufacturing Technologies it is difficult to attract

talent. Both innovative skills and traditional skills are lacking. Solutions are to be found in engaging schools, in apprenticeships and in a more free global skills market (import skills). Concerning New Business Models skills are both specific and rare. Skills for New Business Models are specific to each development step. It involves multi-purpose and multi-task managers, high skilled experts and creative profiles. The skills needed are also specific to the business models, e.g. in disruptive IT models, flat organisations or models which channel creativity. Possible policy solutions include:

- **Education programs** to develop an entrepreneurship mindset;
- Fostering **cooperation** between companies and education institutes, e.g. concerning skills sourcing;
- Support “**Refresher**” **programs** within companies or through business schools;
- **Visas program** for highly qualified profiles;
- **Voucher** schemes for acquiring specific services;
- **Tax incentives** for professional training schemes.

6. Confronting the emerging story with policy literature & good policy practices

The main policy issues which have emerged from the previous chapters will in this chapter be confronted with the existing policy literature and good policy practices. To what extent do our results point at a gap in the policy literature? To what extent are the policy issues new and trend-specific? This chapter also gains insights from existing good practice policy instruments.

6.1. Gaps in Innovation System concepts: towards Societal Systems of Innovation

The New Models trend and practices as described in the former chapters may call for new or revised conceptual frameworks. The concept of Innovation Systems is one of the most widely adopted concepts. It started with the concept of ‘national systems of innovation’ as it was developed in the 1980s by Freeman (1987), Lundvall (1992), and Nelson

(1993). Based on this, various versions emerged, including regional innovation systems (Cooke 2010), sectoral innovation systems (Malerba 2002) and technological innovation systems (Carlsson & Stankiewicz 1991). Soete et al. (2009) state that one of the shortcomings of these systems of innovation concepts is the limited attention for the increase of innovations which do not need “particular leaps in science and technology”. The combination, use and diffusion of known practices has become more important for innovation and its economic impacts. Also Iizuka (2013) points at some limitations; she calls for a framework that incorporates societal perspectives. New players such as end-users and the public sector have to be included. The New Models trend as show-cased in this report confirms these limitations.

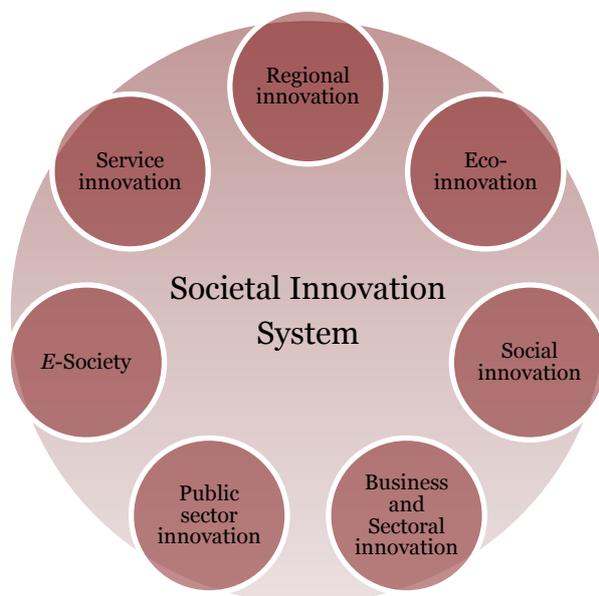
While the conventional innovation systems approaches merely focused on the economic impact from innovation, New approaches also address how innovation systems can



help in coping with certain societal challenges. Concerning sustainability challenge several eco-innovation systems approaches have been developed⁶. Geels (2004) for instance speaks of socio-technical systems pointing out that developing new technologies (e.g. an electric car) and 'strategic niche-management' (Kemp et al. 1998) is not enough and that it can take a long time to bring about a whole system transformation ('regime-change'). Addressing environmental challenges asks for a broadening of the concept of Innovation Systems (Foray et al. 2012), and for new policy models (Mowery et al. 2010). Literature on social innovation (Murray et al. 2010) shows how innovation can also be instrumental for social challenges in society (including other than 'green' challenges).

Since the New Models trend is not about only one type of innovation or one type of societal challenge, it can benefit from existing insights from several of these models which are tailored to a specific type of innovation, a specific technology or sector, or tailored to a specific societal challenge. However, there is a gap in the policy literature concerning the commonalities, linkages, overlap between and integration of the currently fragmented fields. This also applies to the need to integrate the concerning fragmented policies. The commonalities among the various case-study trends show that there is need for an integrated societal innovation system perspective, as illustrated in Figure 9. A more demand-side oriented system of innovation that serves to un-lock the potential of business and societal innovation by scaling up the New Models trend.

Figure 9: Towards Societal Innovation Systems



Aspects of this new Societal Innovation policy model⁷ would include:

- Innovation policy is no longer only seen as instrumental for firms and economic objectives, but also for other (non-economic) societal challenges, in one or more other public policy-domains.
- Increased attention from policymakers for demand-side innovation policies, raising awareness, promoting diffusion and absorption, behavioural change, involvement of (end-)users, societal transformation processes, and promoting the up-take of new business, organizational and production models.
- The broadening of the involvement of different players and sectors, including the public sector and citizens.
- Set societal innovation priorities, organize platforms and join collective initiatives. Since the various players have their own public or private motives, objectives, habits and different area's of scepticism and fear for disruptive changes, it is important to invest in the collective search for shared priorities and entrepreneurial visions in thematic innovation platforms, which can lead to collective initiatives, e.g. in the form of testing units and demonstrators. In this respect, the focus on specific themes, challenges, lead-markets, or Smart Specialization Strategies has already increased the systemic nature of the policy approaches towards a societal innovation approach.
- Broadening of supported business innovation activities. Not only subsidize firm R&D for product innovation, but also allow subsidies to be used for adopting new business models and for diffusing and 'marketing' of societal innovations.
- Bundling of initiatives often packaged into a strategic policy mix consisting of various policy initiatives, as it is for instance implemented in lead-market initiatives and foreseen in the European Innovation Partnerships (EIPs). This bundling or packaging of related initiatives can also be served by aligning the policy initiatives at the various policy levels (local, regional, national, European). E.g. in the case of demonstrating and testing units it was stated that local initiatives are more sustainable when embedded in a larger regional strategy.
- Horizontal coordination between policymakers of various policy fields;

⁶ See Coenen & López (2009) and Cooke (2011) for an overview and comparison

⁷ See also Wintjes, Turkeli & Henning (2013) Societal Innovation in metropolitan area's.



- Multilevel-governance: alignment between local/regional, national and European policies and initiatives.

6.2. Supply-side innovation policies become less dominant

The New Models trend as analysed in the previous chapters, calls for more demand-side innovation policies. Several authors have already shown the importance of demand for innovation⁸, but supply-side innovation policies are still dominant in the regional and national policy mix. In this respect there is a policy gap that has to be filled with policies that meet the new policy needs.

Edler (2009) even states that: *“the demand side has long been systematically neglected in innovation systems analysis and subsequently in concepts and practice of innovation policy-making”* (Edler 2009, p.2). For many years in Europe a supply-side innovation target (set in Barcelona in 2002) to increase the R&D intensity to a level of 3 % as share of GDP, was the dominant innovation strategy. Policy makers have for a long time favoured the linear rational and the arguments on the supply side: an increase in R&D would lead to more technological inventions and patents which would lead to more successful innovations and economic growth. Typical examples of supply-side or technology push policies are: public funded R&D and R&D tax credits.

One of the explanations for the limited use of targeted demand-side innovation measures could be that many governments have historically tended to rely on macroeconomic policies and framework conditions to support market demand and to avoid market distortion; “Much of the role of government on the demand side of innovation has focused on ‘getting prices right” (OECD, 2011). Also bad memories of old industrial policy of governments favouring or protecting (vested interest in) specific sectors, may have played a role. Especially the notion that innovation should address (‘grand’ and/or ‘global’) societal challenges⁹ has lead to an increased attention for demand-side policies. Even the new EU industrial policy¹⁰ (EC, 2010d) puts competitiveness and sustainability at the centre. It includes those policies which target innovative competitiveness, but it also notes the importance of the competitiveness effects of other policy fields, e.g. concerning transport, energy, consumer-protection, environment, single-market and trade policies.

⁸ E.g. Mowery and Rosenberg (1979).

⁹ As it is formulated in for instance the Lund declaration (2009), the OECD “Innovation Strategy” (2010) and the HORIZON 2020 programme.

¹⁰ EC (2010) An Integrated Industrial Policy for the Globalisation Era: Putting Competitiveness and Sustainability at Centre Stage SEC(2010) 1276. See: http://ec.europa.eu/enterprise/policies/industrial-competitiveness/industrial-policy/files/communication_on_industrial_policy_en.pdf

Over the last few years the innovation policy approach has changed. The strategy has broadened, became more strategic and focussed, with more attention to the demand-side of innovation and several new ‘missions’ for innovation policy have been integrated for addressing societal challenges. With EU2020 the role of innovation became more important and broader. Also the Flagship initiatives and HORIZON moved away from a dominant supply-side innovation strategy, by adopting more demand-oriented policy approaches, and by a research agenda focussed on societal challenges (Table 5).

Table 5: Proposed research funding for societal challenges (million Euros, 2014-2020)¹¹

Horizon 2020	Million Euros, 2014-2020
Health, demographic change and wellbeing	8,033
Food security, sustainable agriculture, marine and maritime research& the bio-economy	4,152
Secure, clean and efficient energy	5,782
Smart, green and integrated transport	6,802
Climate action, resource efficiency and raw materials	3,160
Inclusive, innovative and secure societies	3,819

The increased need of demand-side measures is also emphasized in the Innovation Union Flagship (EC, 2010): “the potential of the single market should also be activated through policies that stimulate the demand for innovation”, moreover it states that a “bolder approach associating the supply and demand sides is needed”.

At regional level the supply-side innovation policy measures are still dominant. One of the main conclusions from the Regional Innovation Monitor (RIM) annual report 2010¹² was that: “policies remain heavily focused on the supply-side despite efforts to support knowledge transfer and collaboration activities between the research base and industry”. But also at regional level innovation policy there is a recently increased interest in implementing demand-side innovation policy elements¹³.

¹¹ EC DG Research & Innovation 2020 presentation, accessible: <http://ec.europa.eu/research/horizon2020/pdf/press/horizon2020-presentation.pdf>

¹² See: <http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/monitor/>

¹³ Wintjes, René (2012), “Demand-side innovation policies at regional level”, Regional Innovation Monitor, Thematic Paper 3. Available at: <http://www.rim-europa.eu/>



6.3. Demand-side innovation policies

Demand-side innovation policies have been defined by Edler & Georghiou as “a set of public measures to increase the demand for innovations, to improve the conditions for the uptake of innovations or to improve the articulation of demand in order to spur innovations and the diffusion of innovations”¹⁴.

The instruments of demand-based policies are broad and include: “public procurement of innovation, direct or indirect financial support for the purchase of innovations, various kinds of training, and awareness mechanisms to build up and broaden absorptive capacity for innovation and the shaping of conducive regulatory framework conditions”¹⁵.

The further shift in attention towards demand-side innovation has also been fuelled by the increased importance of for instance: service innovation, public sector innovation, non-technological innovation, and ‘Open Innovation’. Also the horizontal integration of innovation policy with other policy-fields has enforced the call for demand-side policies for innovation. The specific demand for innovation in other policy fields (for addressing societal challenges) has led to new priority setting practices, which some have characterized as ‘a new mission-led approach’¹⁶.

Demand-side policies serve in this respect as a focusing mechanism, not only for innovation strategies of companies, but for instance also for policy fields such as the new industrial policy, research policy (Horizon), and regional policy (Smart Specialization Strategies). Here we see a similarity with the strategies of many of the trend driving companies from the case-studies, since many of them mentioned that, although their solutions and technologies are applicable in many sectors and for multiple-purposes, their success is largely based on focusing on specific kinds of applications.

Main demand-side policy tools include:

- Regulation, including standardization and the screening of the innovation regulatory framework
- Public procurement, including public procurement of R&D and public procurement of innovative goods and services;

- Private demand support in the field of tax incentives and demand-subsidies;
- And systemic policies, such as user-driven innovation platforms, spurring the innovation uptake across the stakeholder’s communities, e.g. through ETPs or EIPs.

Table 6: Demand-side innovation policy instruments

Demand side innovation policy tool	Short description
Public procurement of innovative goods and services	Public procurement of innovative goods and services relies on inducing innovation by specifying levels of performance or functionality that are not achievable with ‘off-the-shelf’ solutions and hence require an innovation to meet the demand.
Public procurement of R&D	These programmes support suppliers of innovations by procuring R&D services. Governments articulate a specific need, call for R&D proposals and select among the competing tenders. Various models for tender procedures can be used. Most recent programmes use the PCP (Pre-Commercial Procurement) approach.
Use of regulations	Use of regulation for innovation purposes is when governments collaborate broadly with industry and non-government organisations to formulate a new regulation that is formed to encourage a certain innovative behaviour.
Standardisation	Standardisation is a voluntary cooperation among industry, consumers, public authorities and other interested parties for the development of technical specifications based on consensus. Dynamic standardisation is an important enabler of innovation.
Demand subsidies	The purchase of innovative technologies by private or industrial demanders is directly subsidised.
Tax incentives	Tax incentives can increase the demand for novelties and innovation by offering reductions on specific purchases.
Articulation and foresight	Societal groups, potential consumers and public and industrial users are given voice in the market place, signals as to future preferences (and fears) are articulated and signalled to the marketplace, including demand based foresight.
Catalytic procurement	Catalytic procurement involves the combination of private demand measures with public procurement where the needs of private buyers are systemically ascertained. The government acts here as ‘ice-breaker’ in order to mobilise private demand.
Awareness raising campaigns	Awareness raising actions, and demonstration projects promoting private demand have the role to bridge the information gap consumers of innovation have about the security and the quality of a novelty.

¹⁴ Edler J. and Georghiou L. (2007). “Public procurement and innovation - Resurrecting the demand side”. Research Policy 36 (2007) 949– 963.

¹⁵ Evaluating the demand side: New challenges for evaluation by Edler, J. Georghiou, L.; Uyarra, E.; Blind, K. in: Research Evaluation 2012, pp.1-15.

¹⁶ Gassler, H., W. Polt & C. Rammer (2008) Priority Setting in Technology Policy: Historical Developments and Recent Trends. In: C. Nauwelaers & R. Wintjes (eds.): Innovation Policy in Europe; Measurement and Strategy. London: Elgar.



Cluster policies, support to user-driven innovation, Sector-, technology-, or theme-specific platforms	Policies that try to influence the development of the innovation system by stimulating dialogue between users, producers and other innovation players, so as to increase their levels of coordination and cooperation and promote innovation and subsequent take-up.
Lead market initiatives	Lead market initiatives support the emergence of lead markets. A lead market is the market of a product or service in a given geographical area, where the diffusion process of an internationally successful innovation (technological or non-technological) first took off and is sustained and expanded through a range of different policies.

Source: Izsak & Edler (2011, p.11), and Edler 2009

Table 6 provides a more detailed list of instruments. The concept of 'lead-markets' adds a strategic component to demand-side innovation policies. Von Hippel (1982 and 1986) introduced the concept of 'lead users', which he defined as: "consumers whose present strong needs will become general in a marketplace months or years in the future" (von Hippel 1986, p.792). With innovative procurement the public sector can also adopt such a role as 'lead user'.

This 'lead users' concept can also be applied to the regional level. Regional Innovation Strategies could for instance include the development of strong needs and thus create a regional 'lead-market' as a way to construct a regional competitive advantage. As such, demand-side innovation policies can fulfil an important role in Smart Specialization Strategies. At the higher policy levels of the European Union and of the individual countries, it is more difficult to select priorities and fields of specialization. At regional level it is less difficult to accept that the region cannot excel in every possible field and has to set priorities.

A difficulty in designing demand-side policy instruments is not to distort market competition. Favouring individual companies or support the marketing of individual products or services, is not allowed according to state-aid rules. Governments may favour 'green' solutions, and promote the demand for it, but governments should not close the rivalry among 'green' solutions, or reduce the incentives to search for even better solutions.

This difficulty is for instance evident concerning innovative public procurement, but also in large scale demonstration projects. Demonstrating the success of only one solution at a large scale, may distort the competition with other solutions. It should at least be based on testing of several solutions in concrete societal context. In this respect we can learn from the concept 'strategic niche management' which is developed in the literature concerning sustainability challenges (Kemp et al. 1998). After supporting various niche initiatives at a decentralized level, in a next phase the best niches could be picked up by the market, or publicly supported and demonstrated at a higher, more central level

of governance. Conceptually this kind of policy learning is also close to the policy approach taken with Smart Specialization Strategies, 'Lead market initiatives' and European Innovation Partnerships.

6.4. Comparing the case-study results with other studies

In order to assess to what extent the results of the case-studies are different, and characteristic for the concerning new trends, we compare some results with other studies on policy-gaps/framework conditions and aspects of existing policies that need to be improved.

In the GPrix survey¹⁷ SMEs in various regions in Europe were asked: "What are the specific needs for SMEs to enable them to participate in innovation support programmes?" The main need identified was procedural simplicity and transparency. Bureaucratic procedures are a barrier since they impose a fixed cost on programme participation. Although the respondents to this survey involved SMEs in traditional manufacturing sectors, the same needs have also been mentioned by many companies in the Business Innovation Observatory case studies. This suggests that not all policy needs mentioned by the companies that drive the new models trends, are specifically related to those trends. In this respect the need for more simple application procedures seems a more general need. It is a problem that any region or country in Europe will have to address as a general framework condition.

As assessed by the Regional Innovation Monitor the up-take of dedicated demand-side innovation policy instruments has increased, but they did not yet have a pertinent and recognizable place in regional innovation strategy documents. However, a RIM thematic paper¹⁸ has shown that many relevant new policies at local level of cities in metropolitan areas have appeared.

This corresponds with the stories of the case-study companies, which highlight the importance of being located in a stimulating environment which can drive the concerning trend: close to R&D infrastructure, a pool of talent, potential partners (public and private), venture capital, receptive policy-makers, lead-users, etc. Some of the trends and companies even benefit from being located in a city with a relatively high level of familiarity and usage of web-based and mobile technology.

In this respect, developing Smart Specialization Strategies could build on those 'place-based' advantages. Local and regional lead-market type of initiatives can serve to develop

¹⁷ <http://www.gprix.eu/>

¹⁸ Wintjes, René, Serdar Turkeli and Florian Henning (2013), "Innovation Policy in Metropolitan Areas: addressing societal challenges in functional regions", Thematic Paper 6. Available at: <http://www.rim-europa.eu/>



specialized ecosystems for one or more of the 'New business, organisational or production models'. Many of the Smart Specialization Strategies¹⁹ which are currently developed focus on a few combinations of a sector with a societal challenge. A coherent package, a mini-policy-mix of demand-side innovation policy measures which un-lock the potential of the New Business and Production Models could also serve to develop 'lead-regions'. Regions where trend driving companies can flourish can develop into trend driving regions. As it is phrased in the project European Service Innovation Centre²⁰ which promotes the use of 'the transformative power of service innovation', regions can develop into 'demonstrator regions'.

Chesbrough (2010) has looked into the question why it is difficult for companies to innovate their business model. He refers the insights from Amin & Zott (2001) and Christensen (1997) that in the cost-benefit perception of adjusting the business model that is required to exploit a disruptive technology the established technology and business model is disproportionately favoured. According to Chesbrough (2010) established business models build up a 'dominant logic' of those involved, which makes a company blind for some opportunities that do not fit this 'dominant logic'. This is why McGrath (2010) claims that adopting a new business model calls for a discovery driven approach instead of a cost-benefit analysis. Possible implications for the search for appropriate policy instruments to increase the adoption of the New business and production models is that policymakers should rather support such a discovery and experimentation processes than subsidizing a cost-benefit analysis, a feasibility study or other kinds of expert advice.

Concerning the impact of a more widely adoption of the solutions provided by the trend-driving companies more insight is needed from the clients of these solutions, in order to check their claims. Some of these claims can be supported by evidence from other studies. Lachenmaier and Rottmann (2010) for instance show that process innovations have a higher positive effect on employment than product innovations.

6.5. Good policy practices

Several companies interviewed as part of the case study Public Private Partnerships - Large-Scale **Demonstrators** & Small-Scale Testing Units have mentioned the benefits of public support in the form of public private partnership (PPP) within the EcoGrid EU project and the GRID4EU project. Especially several EU projects have lead to European exchange and diffusion among similar demonstration projects, where 'societal innovations' are tested and demonstrated in a real-life, societal context.

¹⁹ See <http://s3platform.jrc.ec.europa.eu/home>

²⁰ http://ec.europa.eu/enterprise/initiatives/esic/index_en.htm

Two Swedish policies which have benefited companies interviewed for the case study Big Data - Artificial Intelligence. QlikTech has been helped by a **revolving fund** that provides mezzanine funding and equity investment to promising innovative companies and the company Expertmaker has benefited from the bank loans guaranteed by the Swedish government, which allowed them to borrow from banks that normally would consider them unfit for the bank's risk profile. With the aim for scaling up the use of these Big Data solutions, it would be interesting if the same policies could also be used by the clients of the mentioned companies.

Quite a number of case-study companies have benefitted from **awards, contests or prizes**. Although such awards have been used as an indication of success in selecting companies, these awards seem especially relevant as a validation, signaling and reputation effect for innovations that address societal challenges, since the involved prize money is often limited. These awards also serve as kind of demonstration and diffusion of (formats for) initiatives. Such awards are frequently used for social innovation initiatives. The role of such awards for the reputation of those involved might be similar to the reputation effect that a patent-portfolio often has for technology focused companies.

In the case study on public procurement of innovation the **SBIR scheme** in the US has been mentioned as a good example. Concerning public procurement of R&D two types of programmes exist. One type includes the two older programmes in the UK and the Netherlands which are inspired by the Small Business Innovation Research (SBIR) programme in the US. More recent programmes follow the EC directive on Pre-Commercial Procurement (EC 2007). The general process is as follows: government authorities articulate a specific need for which no current solution is available, they call for R&D proposals and select among the competing bids in several phases. The supply-side element of this instrument is that it supports R&D activities of suppliers. The demand-side element relates to the targeted articulation of demand, which is for instance much more targeted than the research priorities set by national research councils. During the process, the interaction between the user and the competing suppliers is restricted (in order to comply with competition law and state-aid regulations), but this differs between the various schemes.

Although most programmes which promote Pre-Commercial Procurement (PCP) are in initial phase and have not yet been evaluated, a main difficulty of the approach seems to be that it does not often lead to the commercial phase of actual public purchasing of the product developed. Therefore, one of the company case-studies referred to the benefit of participating in such a scheme as a 'reputational' effect: it helped as a signal in trying to win other clients. This also explains why the concerning company recommended to add as a follow up to the scheme a demonstration activity.



As stated at the workshop the European Investment Bank currently has no policy to support uptake in the market: “support currently goes more to research, but there is no

support for customer investment”. The EBRD provided us with some good practices in this respect (see the below textbox).

Advanced Manufacturing Technologies and long term Investors: the case of EBRD

The European bank for Reconstruction and Development (EBRD) is an international financial institution that supports projects from central Europe to central Asia and southern and eastern Mediterranean, investing primarily in private sector clients whose needs cannot be fully met by the market. In the post crisis context, capital investments in manufacturing are being delayed or reduced. The following examples provide information on specific EBRD investment projects in advanced manufacturing technologies.

- Metsa Tissue is a Finish supplier of tissue and cooking paper and EBRD has financed its subsidiary in Poland for investment in the best available energy efficiency improvements. The provision of longer tenor funding was needed in order to properly match the long term nature of the investment programme. The Project will replace old and inefficient paper machines, close down the coal-fired CHP plant and use natural gas boilers for heating requirements and it will increase production capacity by 30,000 tonnes.
- EBRD has financed capacity expansion in favour of Getrag Ford Slovakia, at its plant in Kechnec, for R&D expenditures related to manufacturing of dual clutch transmissions – a high-tech complex part needed in production of vehicles. The commercial lending market was unable to fully support the financial package for corporate technological upgrading. This project will allow the Company to adapt to the recent market trend of increased automation in newly registered vehicles, offering a state-of-the-art solution addressing the need of lower fuel consumption and reduced CO2 emissions.
- ABS Sisak is an ironworks factory which was privatized and is fully integrated into the Danieli steel-making division of ABS Italy. The main elements of the on-going corporate restructuring are: a) to focus production on higher value-added products; b) establishment of local R&D capacity; and c) setting-up an efficient production process and the application of innovative production technology. EBRD financing was in response to the need to mitigate local risks and the difficulty to obtain long term financing in Croatia. The EBRD loan will be used for financing the investment necessary to resume operations at the Sisak plant and to turn it into a state-of-the-art engineering steel making facility.

Source: EBRD, Industry, commerce and agribusiness (ICA) group.

An interesting, new model that was mentioned at the workshop is the **Credit model for energy efficiency investments**²¹, however it is not applicable to any kind of energy efficiency investments, but only in specific cases.

Investments in energy efficiency are often not made, even if they are completely economically reasonable. Some of the reasons often given are “Amortisation takes too long”, “...not provided for in the investment budget”, “Liquidity strain too high”. The problem is often that the efficiency gains do not appear strong enough at the time of the investment decision.

The credit model briefly described below aims to overcome resistance against reasonable investments. For this purpose, VDMA suggests to realise the future efficiency return already in the present earnings and liquidity. For that purpose, the company should be offered a loan that not only covers the investment costs but that also pays out a considerable advance on the increments from energy savings that are anticipated in the future based on the investment. This would draw the companies’ attention on the economic potential which can be tapped by investments in energy efficiency.

The loan can be adjusted in such a way that a large amount of the cash value of the efficiency return can be paid out and the remaining efficiency return is enough to manage the ongoing annuities. In doing so, the model goes essentially without subsidies.

In principle, this model is not different from conventional investment financing; it is just the credit volume that extends far beyond the norm. In this respect, various features must be taken into account:

A required prerequisite for this comprehensive loan is a regular and reliable cost/income statement that has been tested by experts (energy system experts). It must be ensured that the annuities that arise from the loan can be borne by the return from the efficiency gains.

Evidence must be provided to prove an investment is especially “energy-saving” – whatever that means (development of suitable criteria is a key task). This could be linked to the achievement of energy efficiency classes (in the sense of labelling), to the evaluation of the effect of the investment on the energy balance of facilities (it often concerns the evaluation of complex systems) by neutral assessors etc. A vital support would be achieved through the preparation of benchmarks and key figures by manufacturers, to which the VDMA assures its involvement.

Various companies have provided the VDMA with specific realistic examples, including:

- Industrial furnaces (flow-through system for annealing steel strips): Replacement of outdated burners with highly efficient burners – Investment volume of EUR 2.1 million, annual energy costs savings of EUR 495,000, amortisation period – about 4 years. Over an assumed term of 10 years, the present value of savings is almost EUR 4 million. Loan of EUR

²¹The information is provided by Holger Kunze (VDMA, European Office, 2013)



3 million (142 % of the amount to be invested): Annuity almost EUR 400,000, additional free liquidity of approx. EUR 100,000 p.a.

- Optimisation of hot water pumps. Additional investment of EUR 84,000, saving of EUR 26,500 p.a. present value of additional incremental income of EUR 120,000 (term: 5 years). Amortisation in 3.2 years. Loan of EUR 100,000 (119 % of the investment), annuity of EUR 23,000, residual free liquidity of EUR 3,400. After 5 years: unencumbered surplus profit (before tax) of EUR 26,000.
- Pumps for district heating. Investment of EUR 67,000, saving of EUR 32,500 p.a., present value of saving over 10 years: EUR 260,000. Loan of EUR 134,000, annuity of EUR 17,300, excess liquidity of EUR 15,000 p.a.

From desk-research some additional good policy practices have been identified.

Testing and demonstrating 'societal innovations' is different from technical testing of prototype products or machines in a fully controlled ('dead') laboratory environment. Societal innovations have to be tested and demonstrated in a living and social environment. The number of **living labs** is increasing very fast, but not always as a new, separate policy instrument, but for instance as a new element in existing cluster policy, or centres of excellence, or technology transfer facilities. Living labs can be described as user-centred, open innovation systems, which facilitate collaborative innovation processes of researchers, companies, users, and public sector that are locally bound, taking place in an embedded experimental setting.

Often, but not necessarily, living labs are situated in a smart city context, which makes it an especially relevant tool for social innovation in metropolitan areas: "A Living Lab is a user-driven open innovation ecosystem based on a business – citizens – government partnership which enables users to take an active part in the research, development and innovation process"²². Niitamo et al. (2006) describes living labs as Public Private Partnerships "in which firms, public authorities and citizens work together to create, prototype, validate and test new services, businesses, markets and technologies in real-life contexts". Real-life contexts both stimulate and challenge research and development as public authorities and citizens not only participate, but also contribute to the innovation process. Living Labs are

therefore environments for experimentation in which technology is given shape and (end) users are considered "co-producers" of the concerning innovations²³. Since these Living Labs are rather new policy instruments, not many evaluations and impact assessments exist.

For **Collective Awareness Platforms** (CAPs), the EC is pushing the research agenda and has a dedicated website where CAPs are broadly described as ICT-based platforms that support the creation of 'distributed situational awareness', i.e. bottom-up, up-to-date and relevant knowledge ("situational awareness") that is generated by a collective/community, rather than selected players, through open access ("distributed") and shared through ICT networks ("platforms"). Fundamental elements are user-generated knowledge, distributed (rather than central) control of internet, and the society/community (rather than individuals/businesses) as key agents. ICT play a central role by leveraging network effects to create (social) innovations, by combining social media and data from internet sources. A local-level CAPs example is the London Datastore (<http://data.london.gov.uk>). Next to being aimed at opening up data held by the Greater London Authority (GLA) for open use, this platform is aimed at providing a community for developers that use this data to create IT tools and "apps" (applications) for public use. CAPs could also be a useful instrument for instance for Big Data, sharing economy, work place innovation, etc.

Technology Financing is a good practice policy from Baden-württemberg²⁴. This scheme could facilitate the uptake of Advanced Manufacturing Technologies. Companies can use this scheme to finance new plants and machinery. The technology loans can also be used for costs of adaptation or development of new markets. The programme has been developed for small and medium-sized enterprises (SMEs) with a maximum of 300 employees. Fundable costs are: costs for plants, machinery and equipment; cost of operation-specific adaptation developments; costs for a project manager in the initial phase; expenses for market development; as well as introduction of new products; and cost of external market analysis, demonstration projects and pilot manufacturing series. This is a scheme that is specifically relevant for process-innovation, e.g. for clients of the solutions concerning advanced manufacturing.

An increasing amount of regional innovation policy instruments provide support to export of innovations and to internationalisation of innovative firms. For example, the **Export and Internationalisation Offensive in the Fields**

²² European Commission Information Society and Media, Unit F4 New Infrastructure Paradigms and Experimental Facilities. Living Labs for user-driven open innovation. An overview of the Living Labs methodology, activities and achievements.; Accessible: http://ec.europa.eu/information_society/activities/livinglab/s/docs/brochure_jan09_en.pdf

²³ Ballon, P., Pierson, J. and S. Delaere. Open Innovation Platforms for Broadband Services: Benchmarking European Practices. Proceedings of 16th European Regional Conference, Porto, Portugal, September 4-6, 2005.

²⁴ <http://www.l-bank.de/lbank/inhalt/nav/unternehmen/>



of Eco-Energy and Eco-Technology²⁵. This project supports enterprises and individuals that are partners of the Upper Austrian eco-energy cluster or the Upper Austrian networks for environmental technologies and energy efficiency. The supported projects must have a strong focus on export. Support is provided in the form of grants for: patent applications and certification; the adaptation of products; specific market research and visits to specific events on the relevant new markets; training of employees with regard to the new markets; visits to trade fairs; consultancy; and marketing. Projects are supported with up to 40% and a maximum of €50,000 per project and eligible firm. Before a proposal is submitted, potential applicants can ask for advice at the Upper Austrian Energy Saving Association. To develop the required export strategy, potential applicants can make use of the export consultancy services offered by the Export Centre Upper Austria.

The **Flanders Action Plan on Public Procurement of Innovation** is a scheme with a horizontal approach to pre-commercial procurement of R&D. This implies that the regional government buys innovation from companies and knowledge institutes in 13 different policy areas. It can help government to identify public demand and define purchasing needs, thereby enhancing the public commitment to procure innovative solutions from the private sector. Innovation platforms can contribute to the involvement of stakeholders and exchange of information between the demand and supply side through the process of decision making, market consultation and technical dialogue. One of the lessons learned is that the procedures for pre-commercial R&D should take into account legal obligations linked to contracts and be kept open and transparent in order to be non discriminatory²⁶.

For supporting users of the New Models solutions in implementing new business (organisation and production) models, we can think of the relevance of various **coaching schemes**. For instance the Strategic Innovation Scheme which facilitates the development of an innovation strategy in SMEs. The approach is as follows: a consultant organises strategic sessions in a company, facilitates the management team of an SME to make an assessment of the current and future situation and to (re-)develop their business strategy: put priorities, make choices and implement these choices. As such, a large number of individual SMEs are facilitated at micro level.

Another format which could be applied for supporting users of the New Models solutions is to have an external expert and coach organise one or a few days to find solutions to barriers in developing a new business, organisation or

production model. Such schemes are for instance existing for companies which struggle with design issues. During a Design Pressure Cooker²⁷, a design expert works in one intense day (under high time-pressure conditions) with the companies on solutions. Letting-in external experts in this way often has an 'eye-opening' impact. Also a voucher scheme²⁸ could be designed to support companies with adopting new business and production models.

There are also schemes that organise for **visits among companies** that have implemented new production processes. Companies that still hesitate can visit a company that has applied for instance certain advanced manufacturing technologies. This kind of real-life demonstration often works better than showcasing on an international trade fair, since also the drawbacks and disruptive aspects can be addressed.

[vorhabenbestehenderunternehmen/technologiefoerderprogramm.xml?ceid=100221](http://www.vorhabenbestehenderunternehmen/technologiefoerderprogramm.xml?ceid=100221)

²⁵ <http://www.rim->

europa.eu/index.cfm?q=p.support&n=13589&r=AT31

²⁶ See also OECD (2011, p115)

²⁷

http://www.syntens.nl/eu/Documents/Microsoft%20Word%20-%20stakeholder%20ENG%20_2_.pdf

²⁸ See for a general description of Voucher schemes:

http://www.technopolis-group.com/resources/downloads/Innovation_Voucher_for_OECD.pdf



7. Policy recommendations

This chapter provides recommendations at various policy levels with the aim of scaling up the successes of the New Models trend.

7.1. Recommended demand-side innovation policies

In line with the recommendations from the case-study companies most recommendations from those participating in the workshop concerned the following demand-side innovation policies:

- Use **public procurement** as first customer more widely;
- **Open data** / access to business from government (generates start-ups with new business models);
- Use **innovation awards** to provide credibility;
- Promote participation in international **standardisation**;
- **Good demonstration centres or schemes** which can be used to demonstrate technology under real conditions;
- Give **grants** to companies to cover the costs of installing initial production or technology centre; In order to avoid distortion of competition a public company could be considered
- **Raise awareness**; Communication, interaction, demonstration and engagement with others is what raises awareness. For instance between National and Regional Authorities and Private initiatives; organise matchmaking on offers and needs.
- Increase inter-relationships of **SMEs with large companies** which trigger the (demand for and) incubation of new business models.
- Provide **tax benefits for clients who buy existing solutions** for advanced manufacturing. This kind of modernisation makes best use of existing R&D findings.
- Launch a **credit system** for the customer to generate efficiency gains at the beginning of the investment. In this cost neutral scheme (it is not a subsidy) companies that buy and use new process technology get up-front the money for the investment that will be saved and paid back, e.g. from a reduced energy bill.
- Allow innovation subsidies to be spent on **non-technical innovations**. In this respect companies from low-tech industries should not be excluded from application for support.
- Initiate **capacity building** on workplace and organisational innovations, and on the involved disruptive processes.
- **Assist companies in analysing their needs**; analysis and coaching can trigger the need for innovation in companies. SMEs need information in their own language.
- **Support internationalisation**; Demand beyond national and EU borders is important for the growth of companies and can accelerate the dissemination of new business models and advanced manufacturing activities.

7.2. The need for new policy models

New business and production models call for a new way of designing and implementing policy. The policy rationale consists of a new approach, not supply-driven, but more demand-driven. The rationale behind public support for R&D activities (the innovation/technology supply-side) is based on the idea that the societal return is larger than the sum of the individual benefits for companies. The same rationale applies to public support for the New Business and Production Models and innovation practices. Concerted efforts of a wider set of players in society are needed to un-lock the potential of societal innovation.

We noted a gap in the Innovation Systems literature, since the current conceptual models are tailored to a specific type of innovation, a specific technology or sector, or tailored to a specific societal challenge. However, the commonalities among trends in the New Business and Production Models show there is a need to address these commonalities, possible linkages, overlap between and integration of these currently fragmented fields and policy models.

The new policy model can be labelled 'societal innovation policy', which comes down to the following recommendations

- Innovation policy should no longer only be seen as instrumental for firms and economic objectives, but also for other (non-economic) societal challenges, in one or more other public policy-domains.
- Policy makers should invest more in demand-side innovation policies: raising awareness, promoting



diffusion and absorption, behavioural change, involvement of (end-)users, societal transformation processes, and promoting the up-take of new business, organizational and production models.

- Broaden the involvement in innovation initiatives of different players and sectors, including the public sector and citizens.
- Set societal innovation priorities, organize platforms and join collective initiatives. Since the various players have their own public or private motives, objectives, habits and different areas of scepticism and fear for disruptive changes, it is important to invest in the collective search for shared priorities and entrepreneurial visions in thematic innovation platforms, which can lead to collective societal initiatives.
- Broadening of business innovation support: not only subsidise firm R&D for product innovation, but also allow subsidies to be used for adopting New business and production models and for diffusing and 'marketing' of societal innovations.
- Bundling of initiatives often packaged into a strategic policy mix consisting of various demand-side policy initiatives. By aligning the initiatives at multiple-levels of governance (local, regional, national, European) these packages of policy-mixes can include support from the various policy levels, and allows for scaling-up of local policy initiatives to European policy initiatives.
- Horizontal coordination between policymakers of various policy fields;
- Multilevel-governance: alignment between local/regional, national and European level of initiatives.

7.3. Possible adaptation of existing policies

The need for new policy models does not mean that all existing policy measures become obsolete. We therefore make suggestions on possible changes, e.g. by specifying which policy design features could be added to the existing instruments, as we have already done when drawing lessons from several good practices.

According to a discussion paper of DG ENTR-Unit D2 (2009, p.9) "many clusters shift from a 'research-driven' approach towards a more 'user-driven' approach, where the leading edge lies in the co-creation of values with the customers and in new forms of business cooperation". This may be true for some cluster policies, but certainly not for all. Many cluster policies could be adapted by including more demand-side

innovation activities. Examples of clusters that have adopted more demand-driven policy instruments such as 'living labs', demonstrators or testing-units, can be found for instance in Finland, The Netherlands, Sweden, France, UK, Spain, and Austria; and the number of new initiatives of this type are increasing considerably.

One of the most common types of direct support of private demand for innovations is the possibility in many 'supply-side' (R&D) programmes to use a part of the subsidy or grant for purchasing of innovations, e.g. machinery. Especially in many Central and East European Countries this kind of direct subsidy of demand for innovations from companies is often included in their basic and generic (non-sector specific) instruments to promote research and innovation in firms. Modernisation and increasing productivity is often the overall objective. These kinds of schemes could also support the take-up of Advanced Manufacturing Technologies or any of the other new models of business, organisation and production. Many of these main-stream innovation support programmes are however focussed on R&D for product innovation.

The recorded shift in the use of EU Structural Funds from supply side support towards business innovation support is promising. Also the fact that many mainstream instruments for direct business support now also allows to use a part of the concerning subsidy for prototype-testing and marketing, but testing and marketing of 'societal innovations' is different and more complex. Besides testing technological solutions in a clinical lab environment, the New Business and Production Models need to be tested and demonstrated in a real-life societal context, for instance in Living Labs, or a Smart Cities context.

Not only the managers of potential clients have to be "educated" (as a respondent has phrased it), but it is also important to inform, educate and involve players of the general supporting frameworks concerning the trend-specific issues. Also increasing the awareness of business angels, banks, education institutes and innovation agencies, is important for scaling up the successes of the New Models trend.

More horizontal coordination between various policy domains are needed, e.g. for the first plan to implement the European Innovation Partnership on green building many DGs are involved. A similar need for horizontal coordination exists at the national and regional level.

Support for enhancing workplace productivity/mobility could for instance come from joint efforts of the involved ministries, including the ministry of transport since it also is helpful in reducing traffic jams.



7.4. Lessons concerning scaling-up of policies

Examples of horizontal transfer of policies between regions or between countries

An example of a Collective Awareness Platform at international level is **Urban Eco Map** (<http://urbanecomap.org>), which is a global platform aimed at creating people's awareness to take eco-conscious decisions at local level by providing them with suggestions for concrete actions to take in order to reduce their carbon footprint. On the website, people can for instance look up emission levels in their neighbourhood, explore their own "priority portfolio" and receive recommendations for concrete steps to reduce carbon emissions that take into account their preferences. Many more examples are listed by the European Commission on its dedicated website for CAPs.

The European Clusters and Regions for Eco-Innovation Network Plus (ECREIN+) builds on the results of the **ECREIN project** (See also <http://www.ecreinetnetwork.eu/>). ECREIN focuses on increasing the awareness of existing financial instruments at the European, national and regional levels with the ultimate aim of becoming the main network for regional support of eco-innovation. ECREIN+ takes this forward by defining regional eco-innovation policies and practices with a wider application across European regions, including Green Public Procurement, technology transfer, cluster policies and eco-parks. The knowledge generation regarding eco-innovation policies and practices includes: market analysis for environmental goods and services, how institutions can be improved in order to support eco-innovation, and how efficiently such innovation policies function. The direct beneficiaries of the project include public administrations and business support institutions, with R&D institutions and small and medium sized businesses being the final beneficiaries²⁹.

Another example is the **European Service Innovation Centre**³⁰ which develops practice in supporting regions with large scale demonstrators concerning service innovation, and to diffuse the models and lessons from the demonstrator regions to other regions.

A final example concerning horizontal policy-learning is: Working Towards Sustainable **Energy Communities** throughout Europe (SUNFLOWER)³¹. The objective of this project in the framework of Intelligent Energy Europe, is to create conditions that attract investment in renewable energy sources: projects that have potential, but are not

attractive to the industry. It has also been implemented in Moura (PT), NorthYork (UK), Kilkis (Greece), and various Czech regions³². The project has been structured around three priorities: political commitment, market stimulation and environmental awareness. The aims are: to generate interest towards energy plants powered by renewable energy; to attract investors to the region and raise the number of partnerships between the renewable energy industry and local authorities; to promote entrepreneurship by training graduates and young businessmen interested in the field; and to raise the awareness of local communities. To what extent this policy initiative is a good practice is not clear, but in the case-studies the concept of 'communities' often has appeared in several ICT-based models. Horizontal linkages between communities can speed up the diffusion of the concerning models and practices.

Example of vertical transfer of policies between regional/national and EU policy level

An example of a top-down, vertical transfer of a policy format is the EU format for Pre-Commercial Procurement that has been developed by the European Commission in 2007, and has served as a sort of standardisation of the format. There are however several other legal tender procedures, including: 'competitive dialogue', Forward Commitment Procurement³³, 'negotiated procedure', 'design contest', and 'framework agreement'. Each of these approaches has specific advantages and disadvantages according to the specific situation³⁴.

Concerning a vertical linkage between different policy-levels we recall the recommendation concerning demonstration and testing initiatives to seek for embeddedness of local initiatives in regional or national strategies, as it makes the local initiatives more sustainable and effective.

Examples of joined policy efforts from different policy domains

Since many of the trends involve multiple sectors and policy domains it is important to coordinate policy efforts and share policy lessons among relevant stakeholders.

The Energy Research Scheme is an example of a policy scheme that is funded by two ministries which are from different policy domains: the ministry of economy and ministry of environment. Each has its 'own societal objectives'. The Ministry of Economy has an interest in boosting competitiveness and the other ministry in

²⁹ <http://www.rim-europa.eu/index.cfm?q=p.support&n=15298&r=BG34>

³⁰ <http://ec.europa.eu/enterprise/initiatives/esic/>

³¹ <http://www.rim-europa.eu/index.cfm?q=p.support&n=15316>

³² See also: <http://www.sunflowerproject.eu>

³³ http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/files/conference/230316_en.pdf

³⁴ For a comparison between the different procedures, see Sloth (2011) and Müller (2009).



addressing environmental challenges. In addition to research oriented tracks, there are also tracks for supporting participants in market development. The co-funding from the ministry of environment has led to a more demand-driven approach. For example: with the aim to achieve environmental impact the scheme allows for sub-contracting to non-european partners, which is still not very common in supply oriented schemes because they rather not support R&D in competing countries. For achieving the environmental objectives a 'not-invented-here' syndrome is not very effective, so a more open innovation approach was adopted.

Concerning joint efforts from different stakeholders we can think of sponsoring of initiatives from various ministries, e.g. in the case of policy to promote work-place mobility.

The European Innovation Partnerships are an example of the involvement of various DGs from the European Commission.

7.5. Selection of concrete policy proposals

The new policy needs do not necessarily have to be met by completely new policy instruments, since many of the recommendations can be implemented by integrating demand-side innovation aspects into the existing mainstream (innovation supply/ R&D oriented) policy instruments. The details of how and what depends on the details of the various existing policy instruments. However, an important concrete recommendation is to allow companies within mainstream business innovation support schemes to use innovation subsidies not only on R&D for product innovations, but also for process innovation (implementing Advanced Manufacturing Technologies), organisational innovations (changing the business model, implementing disruptive solutions), and market-innovations (adapting solutions to other sectors or for internationalisation). Many mainstream instruments include an option for a feasibility study, which mostly refers to the feasibility of an R&D project. Such feasibility studies should also be allowed to look at the feasibility of adopting new production processes and business models.

New types of schemes concern a large variety of demonstration policies, and policies concerning public

procurement for innovation. Many of the recent pilot initiatives have however not been evaluated, which makes it difficult to identify best practices.

Especially regarding demonstration initiatives it does not seem appropriate at this stage to recommend one generic format, since experimenting with new policy formats and designs seem more appropriate. Moreover, we have concluded that it is beneficial to link demonstration initiatives to other policy initiatives, e.g. after a national Pre-Commercial-Procurement project, or as an integrated part of a regional Smart Specialisation Strategy. This implies that the concrete design features of demonstration schemes have to be adapted to such specific purposes, which again calls for more policy experiments.

The same actually also holds for new funding schemes. New ways to fund demonstration and up-take of innovations have to be explored.

A concrete proposal for a new type of innovation support instrument is the **credit model** to overcome resistance against economically reasonable investments in energy efficiency, as proposed by VDMA, and explained in Chapter 8. It is suggested to realise the future efficiency return already in the present earnings and liquidity. For that purpose, the company should be offered a loan that not only covers the investment costs but that also pays out a considerable advance on the increments from energy savings that are anticipated in the future based on the investment. Under these conditions, it would be possible not only to make the investment without putting a strain on liquidity but even obtain liquidity by making the efficiency returns already available today. This would draw the companies' attention on the economic potential which can be tapped by investments in energy efficiency. The already available incentives for this type of investment would be strengthened; the model should be highly appealing for companies.

The loan can be adjusted in such a way that a large amount of the cash value of the efficiency return can be paid out and the remaining efficiency return is enough to manage the ongoing annuities. In doing so, the model goes essentially without subsidies.



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9. Annexes

Table A: Main drivers of the trend

Trends	Drivers of the trend
<i>Advanced Manufacturing Technologies</i>	
1 Environmentally friendly technologies and energy efficiency	<p>The need to be compliant with environmental and pollution regulations is the main driver of the trend.</p> <p>High estimations of potential markets; e.g. the European gasification industry has a potential annual market of over EUR 10 billion.</p> <p>Being located in a region with potential partners and pool of talent as well as good links with research centres is important for the companies which provide solutions.</p> <p>The introduction of new standards, eco-incentives and requirements helps to frame the market and the relations between stakeholders, whether public or private entities.</p> <p>The companies have very few competitors operating within their respective industries.</p>
2 New Manufacturing Engineering	<p>Market growth and potential: 3D printing is expected to continue its trend of double-digit growth, as forecasts anticipate estimate that the 3D printing market will be worth USD 6 billion by 2017, and USD 10.8 billion by 2021.</p> <p>The benefits of: reducing operating and capital costs; improving product quality and consistency; increasing production output rates; increasing manufacturing flexibility; reducing waste and pollution; and saving space in high value manufacturing areas.</p>
3 Mass customisation	<p>Among the drivers supporting the trend, mass customizers consider the access to an enabling business environment the most important.</p> <p>Application areas for mass customisation exist in all sectors. It is a horizontal, non-sector-specific, cross-industry trend. It has significant potential, with wide applications and major benefits for end-users.</p> <p>Changes in mentality and consuming habits: increased demand for customised goods; increased on-line shopping habits; and confidence.</p> <p>Crowd-sourcing techniques help integrating consumers right from the beginning of the product design process. In so doing, consumers feel more engaged in the brand strategies of products they like.</p>
4 Measurement Technologies and Robotics	<p>The industrial robotics market was valued at EUR 6.49 billion in 2011, with an estimated growth of 5% per year.</p> <p>The need for European manufacturing to increase productivity and gain a competitive advantage.</p> <p>The uptake of the trend relies on the success of start-ups bringing new developments and innovation to market.</p> <p>Proof of concept improves access to finance.</p> <p>The solutions are applicable in many industries.</p> <p>All interviewed companies benefitted from the presence of centres of excellence established in their relative fields, or from the background of their key employees at nearby universities or research centres.</p>
5 Smart Value Chains	<p>Market growth: The global market for Additive manufacturing (3D-printing) grew by 29.4 percent in 2011 alone, comprising a 1.7 billion USD global market.</p> <p>Demand driven approach enables quick results for trend driving companies.</p> <p>Solutions supplying companies noted that it was relatively easy to gain market share or internationalise at the beginning. The innovative solutions set them apart from competitors in such a way, that large customers found the companies themselves.</p> <p>Successful uptake of smart value chain manufacturing is mostly driven by market demand.</p>
<i>New Business Models</i>	
Public Private Partnerships	
6 Public Procurement of Innovation	<p>The market potential: annual public procurement at European level is estimated at €400 billion. Of this €400 billion, it is estimated that €3.78 billion can be considered public procurement of innovation at the European level.</p> <p>Companies can realise competitive advantages through public procurement.</p> <p>Increasing need for more efficiency in the public sector.</p> <p>The increased role for policymakers in Europe in addressing societal challenges.</p> <p>Increased awareness of the benefits of demand-side innovation policy measures.</p> <p>Regulation and needs of end-users drive market uptake.</p> <p>Public procurement of innovations makes innovative companies less reliant on external funding.</p> <p>Public procurement can facilitate access to conventional markets.</p>
7 Large-Scale Demonstrators & Small-Scale Testing Units	<p>The market potential and socio-economic impact.</p> <p>The public and private benefits of partnerships.</p> <p>Public sector funding, since the eight selected demonstrators and testing units would not have come to fruition had the public sector not offered financial support to the private sector.</p>
Big Data	
8 Analytics and Decision Making	<p>The benefits of data-driven analytics and decision making solutions. What the solutions of the analysed companies have in common is that they help improve business performance through a better understanding of data and the ability to make more relevant and timely decisions. Impacts for clients are: empowered decision making, increased revenue and reduced costs.</p>



Trends	Drivers of the trend
9 Artificial Intelligence	A growing market: The big data market is in a nascent stage and is expected to develop as companies as well as public bodies seek to enhance their competitive advantage by better understanding the ever-growing amounts of data. Artificial intelligence offers the technology and methodology to do so, and the market for artificial intelligence-based tools and applications is growing rapidly.
Workplace innovation	
10 Enhancing workplace productivity	The total number of organisations that have implemented mobile work styles will rise from 24 percent in 2012, to 83 percent in 2014. That is a compound annual growth rate of 86 percent. Only 9 percent of organisations do not have plans to adopt mobile work styles. Drivers are the socio-economic effect of enhancing workplace productivity and the productivity enhancements. Positive employee perceptions on flexibility, productivity and reduced commuting. Offering cost reductions of operational cost of organisations adopting the innovation. The environmental benefits.
11 Novel Organisational Setups and Management Practices	There has been a shift in corporate philosophy from creating shareholder value to creating stakeholder value. Rising complexity of technology demands collaboration between companies specialised in various aspects of a technology. Another driver of the trend is the shift towards a service economy, and associated service innovation since this often involves organisational and relational changes within supply-chains or networks. The impact of the type of innovation described in this case study is not limited to a particular industry or market. The companies that were sampled do not show much overlap with regards to the markets they supply. The market potential is difficult to measure. There are competitive advantages to be gained through novel organisational setups and management practices.
The Sharing Economy	
12 Accessibility Based Business Models for Peer-to-Peer Markets	Due to its wide applicability, the potential of online peer-to-peer business models is substantial, with growth exceeding 25%. Start-ups can benefit from the uptake of the sharing economy trend because it provides them with opportunities for entrepreneurial activity in a wide variety of markets. The economic crisis is a driver with high unemployment rates and dropped purchasing power of consumers people are in need of ways to earn money and are seeking ways to save money on their daily needs. Decreased consumer trust in the corporate world. Available technology, especially ICT. The public is getting more and more familiar with online activities and shows growing trust in online transactions.

Table B: Challenges faced by trend driving companies

Trends	Challenges mentioned by trend driving companies
<i>Advanced Manufacturing Technologies</i>	
1 Environmentally friendly technologies and energy efficiency	Access to finance; Scepticism in the region or countries towards new technologies; The absence of an established track record or a market accepted proof-of-concept; It is crucial that environmentally friendly technologies demonstrate scalability; Environmental or energy efficiency considerations may not be sufficient selling points. The products need to meet or exceed consumer expectations in terms of quality and cost. Choosing a location with possible partners and pool of talent.
2 New Manufacturing Engineering	Access to finance for innovative SMEs. SMEs interviewed belief that Europe has created a business and innovation environment that is skewed towards large enterprises and universities. Making potential clients aware of New Manufacturing Engineering competences. To have a good cooperation or partnership, companies should come together at a very early stage. Adjusting to a higher skill level of employment demand in manufacturing.
3 Mass customisation	The key phase - and the main barrier of the trend - is the scaling-up stage and its financing. It follows the stage of prototyping and precedes a more massive business industrialisation. The importance of multidisciplinary skills. Need for market testing and prototyping. Data is needed to define what customers want and assess solutions. These data management challenges may be related to crowd-sourcing tools. Customisation induces higher costs which have to be overcome by revenues. Internationalisation: Markets targeted by mass customizers are often global or require fast international growth to guarantee first-mover margin. Choice of the right customisation: Need to have a clear understanding of clients' needs and how to integrate them into existing manufacturing processes.
4 Measurement Technologies and Robotics	Proof of concept improves access to finance. Low uptake of automation solutions by SMEs in the manufacturing sector. The technologies can be used in several different automation solutions, but the companies deliberately chose to focus on a single application, which appears to be a successful strategy.



Trends	Challenges mentioned by trend driving companies
5 Smart Value Chains	<p>Access to finance is critical for companies trying to capitalise on the market uptake. The analysed companies did not face particular difficulties in raising funds for starting up and for developing the innovation.</p> <p>A demand driven approach, providing an innovative solution to a clear market demand enables quick results. Although regulation was generally not found to drive the innovative trend in smart manufacturing nor significantly hinder it, some of the analysed companies noticed increasingly more pressure from regulation. Some companies found it difficult in the early days to move from relatively low production for relatively few clients to high volume production for more clients.</p> <p>Up scaling requires significant capital expenditures to invest in the necessary machinery. One critical success factor for all companies was having access to a highly skilled workforce, for some it remains a challenge.</p>
<i>New Business Models</i>	
Public Private Partnerships	
6 Public Procurement of Innovation	<p>Conservative clients can be risk-averse. As a company has put it: "Developing new solutions pose a risk to end-users. It is therefore key to proof your innovation in practice, which is a process that takes time".</p> <p>Companies need to be able to deploy a demand-driven approach to innovation. Tendering procedures can form a barrier for public procurement. Having access to a highly skilled and specialised workforce is considered to be crucial. Challenges with regards to internationalisation.</p> <p>A main challenge from the public perspective is to comply with state-aid rules, as distorting competition should be avoided.</p> <p>Diversity of regulations within Europe. Regional aspects can drive the development and commercialisation of publically procured innovations.</p>
7 Large-Scale Demonstrators & Small-Scale Testing Units	<p>The need for public sector funding. Private entities are challenged by resistance to change, particularly from the public sector. 25% of EU Member States still do not have demand-side policies on their policy agendas.</p> <p>The need for international partnerships. Involving SMEs in PPPs is an important challenge. Developing relevant skill-sets.</p>
Big Data	
8 Analytics and Decision Making	<p>Access to finance is the most important factor for the development plans of firms interviewed for this case study. The majority of companies offering big data analytic and decision making solutions are in their nascent stage. The lack of companies with a successful track record suggests that access of finance is a challenge since investors are prudent. Proximity to a technical school and IT companies are important to facilitate the development of big data companies. The firms that develop big data analytic and decision making solutions have a tendency not to solely rely on a regional or national market but to internationalise rather rapidly.</p> <p>Entrepreneurial culture and a skilled labour force is important. The regional knowledge infrastructure: higher education and research institutions in fields specific to the industry, technology transfer organisations and shared technology platforms, as well as sector specific courses or training in the region.</p> <p>Data privacy and security.</p>
9 Artificial Intelligence	<p>Challenges include a highly educated workforce, scalability of developed solutions and public support programmes fostering innovation.</p>
Workplace innovation	
10 Enhancing workplace productivity	<p>Access to finance is essential for scaling up. The importance of partners in the start-up phase. Building a critical mass of consumers in an early stage.</p>
11 Novel Organisational Setups and Management Practices	<p>The availability of partners that are willing to get involved is a key driver. Creation of synergies between different players is another key challenge. Companies deploying technology centred novel organisational setups effectively make use of existing R&D&I infrastructure. Availability of skilled and motivated workforce is key. Case companies are both the developer/supplier of the innovation and at the same time a client for the innovation. The nature of this type of innovation makes it difficult to sell on a market.</p>
The Sharing Economy	
12 Accessibility Based Business Models for Peer-to-Peer Markets	<p>Being resourceful in finding funding sources for sharing economy ventures. Internationalisation looks promising for peer-to-peer platforms, but there are legal obstacles. Lack of clarity on whether conventional industry laws apply to peer-to-peer markets. Success and adoption rate of peer-to-peer business models is dependent on the culture of local markets. No substantial partnerships with other industry players have been established. The companies all show some form of differentiation strategy that distinguishes them from competing peer-to-peer business models. Companies in the sharing economy largely rely on programmers and software developers.</p>

**Table C: Existing policies the companies benefitted from**

Trends	Existing policies
<i>Advanced Manufacturing Technologies</i>	
1 Environmentally friendly technologies and energy efficiency	Enterprises interviewed in this case study are usually looking for support in financing; legal advice; networking activities; nurturing cooperation between stakeholders; knowledge transfer; and going international. Most of the companies underlined the added value of incubators and accelerators.
2 New Manufacturing Engineering	It was generally accepted among interviewees that the EU plays an influential role in financing research and development (R&D), but fails to provide sufficient financing for making technologies market mature, commercially produced, and/or internationally distributed.
3 Mass customisation	Public support has different components, such as: direct grants, organisation of forum and industry fairs, support in networking and support to incubators and accelerators.
4 Measurement Technologies and Robotics	The companies interviewed benefitted from a range of support measures including business incubation services, government subsidies, tax credits for private investors and R&D activities as well as research grants. The technologies were developed within a research or academic context through public funding, national or EU funding, and in some cases the funding was from a public-private partnership.
5 Smart Value Chains	While different types of funding were identified across the analysed business cases, there was a remarkably low percentage coming from public funding. Peratech Ltd. benefitted from FP6 funding, HyGear from 'Innovatiekrediet' from the Dutch government and FP funding and Nanoviã Ltd. from EU Structural funds.
<i>New Business Models</i>	
Public Private Partnerships	
6 Public Procurement of Innovation	Public procurement of innovation has meant for the companies in this case study the facilitation of access to conventional markets and making them less reliant on external funding. Feedback from the public procurer and the end-users to the innovating company was very helpful.
7 Large-Scale Demonstrators & Small-Scale Testing Units	The demonstrators and testing units would not have existed without financial support from the public sector. It is less difficult to get supported if the field in which the demonstrator or testing unit operates is part of a broader national or regional agenda. For instance: The e-Mobility Competence Centre, Dortmund is tied to North Rhine Westphalia's "Master Plan for Electric Mobility".
Big Data	
8 Analytics and Decision Making	The companies interviewed benefitted from a range of support measures including business incubation services, government subsidies, tax credits for private investors, and tax credits for R&D activities, and research grants.
9 Artificial Intelligence	The companies interviewed benefitted from support measures such as soft loans and small research grants. Start-ups can use any funds they can acquire for the development of their technology.
Workplace innovation	
10 Enhancing workplace productivity	Some of the firms benefitted from financial subsidies, grants or business competition awards (angel investors, government loans without interest.). This depended on the regions they were located in. The companies interviewed benefitted from a range of public support measures including business incubation services, government subsidies, and tax credits for R&D activities, and research grants.
11 Novel Organisational Setups and Management Practices	Depending on the type of service or product delivered, companies deploying novel organisational setups effectively make use of existing R&D&I infrastructure, incubator programmes, partnerships with universities and other technology companies.
The Sharing Economy	
12 Accessibility Based Business Models for Peer-to-Peer Markets	The companies in this case found various sources for funding their peer-to-peer platforms, ranging from government subsidies, angel investments, prize money, accelerator/incubator funding, founder capital and donations from NGOs. Companies faced barriers in acquiring support from existing support organisations.

Table D: Policy gaps from the case-studies

Trends	Case-study policy gaps
<i>Advanced Manufacturing Technologies</i>	
1 Environmentally friendly technologies and energy efficiency	The market needs to be better educated as to the benefits from these new technologies. Support needed for implementing environmentally friendly technologies since they are often disruptive. There is a need for opportunities to demonstrate proof of concept (viability of these technologies). Demonstrators and testing units play a crucial role There is a need for more specific and tailored support systems for SMEs trying to bring these technologies to market. Support systems and regulations should be delivered on time, kept in place and enforced.



2 New Manufacturing Engineering	Many companies which offer advanced manufacturing processes are facing obstacles in increasing market awareness of product and service potential. More support is needed to promote the technologies. Policy initiatives and funding for skills development should take into account the growing need for skills at the interface of technologies, e.g.: concerning laser technologies and 3-D printing techniques. Lack of policies increasing the availability of apprenticeships or bringing advanced manufacturing processes into the classroom.
3 Mass customisation	Impulse and incentivising regulation. Support in networking, such as (1) involving public players in innovation platform meetings (2) organisation of travels to meet investors and potential partners, and (3) networking with large companies and foreign partners. Promoting demonstration projects and participation in the experimental use of products. Financing for investment and development.
4 Measurement Technologies and Robotics	An obstacle for many of the companies is the administrative burden in order to obtain public support. Companies like Odico and Laytec did not apply for public funding because they felt the costs outweighed the benefits.
5 Smart Value Chains	Market uptake is favoured by a clear demand driven approach. When an innovative solution is developed as a reaction to existing demand, the potential for a good and swift market uptake is higher. There is a need for opportunities to demonstrate proof-of-concept. Access to finance, especially at the start-up and up-scaling stages. Improved access to public funding, long bureaucratic procedures often need to be tackled. The gap between the availability of and demand for highly skilled engineers needs to be addressed.
<i>New Business Models</i>	
Public Private Partnerships	
6 Public Procurement of Innovation	Gaps in policy are noted in assessment and monitoring of public procurement programmes; discouraging upfront investments for participating in public tender and calls that are often broadly defined; the extent to which they offer companies the opportunity to test their innovation in a real world context; and the difference in difficulty of acquiring public support for incremental innovation as compared to radical innovation.
7 Large-Scale Demonstrators & Small-Scale Testing Units	Small-scale testing units fear a shortfall of public funding to cover costs upon going-live. The cost of pursuing public sector financing is high, particularly at the European-level. There is an obvious need to locate demonstrators and testing units in regions that offer competitive advantages for the cross-cutting theme in question.
Big Data	
8 Analytics and Decision Making	Education: there is a need for more interdisciplinary training and the development of specialists with complementary areas of expertise and skill sets; Data Protection: it is highly important that sensitive data is handled securely and is not leaked in accordance with the Data Protection Directive (95/46/EC). Policies focusing on improving the overall business environment and favouring entrepreneurship.
9 Artificial Intelligence	Early-stage start-ups find the tax burden heavy, and could benefit from tax holidays. As artificial intelligence technology is cutting-edge, proof-of-concepts and cost-benefit analyses are not easy, public procurement of innovation could provide for proof-of-concepts and show good practices in cost-benefit analyses. Immigration policy and employment regulation hinder hiring highly skilled staff. Technology start-ups at times are isolated in academia, unconcerned with industrial exposure. Mentorship: Guidance and advice from experienced entrepreneurs is invaluable for technology start-ups that often do not think big enough or have not defined precisely enough why they run a business. Artificial intelligence technology companies find themselves involved in international patent disputes and legal battles.
Workplace innovation	
10 Solutions for enhancing workplace productivity	A long-term policy perspective is lacking; A lack of advice and guidance for improvement projects, which involve social partners and civil society. In order to better understand the conditions under which workplace flexibility leads to productivity gains, pilot projects on innovative workplaces are needed. Policy approaches to increasing the uptake should take cultural differences and country-specific barriers into account. The market needs to be better educated as to the benefits and costs from new technologies regarding workplace innovation.
11 Novel Organisational Setups and Management Practices	The availability of partners is of key importance. All companies or organisational parts focus on a specific part of the process or function, and require collaboration with other parties to develop innovations or successfully conduct certain business functions. For all companies interviewed in this case study, the creation of synergies between different group's players is a key challenge.
The Sharing Economy	
12 Accessibility Based Business Models for Peer-to-Peer Markets	Regulations and support measures that are suitable to facilitate and coordinate B2B or B2C transactions, are not always applicable to the newly created C2C market. There is a need for tailored policy frameworks. The existing government infrastructure aimed at supporting entrepreneurship (e.g. chambers of commerce and innovation agencies) does not possess the required knowledge to aid internet start-ups.