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To cite this article: G. Haidegger and members of the ManuFuture HLG 2018 *IOP Conf. Ser.: Mater. Sci. Eng.* **448** 012062

View the article online for updates and enhancements.

Vision 2030 on Manufacturing by the HLG of the European ManuFuture Technology Platform

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Abstract. The ManuFuture European Technology Platform (ETP) among other ETPs is probably the strongest, most highly reputed entity within the EU; representing the value-generation sectors in the manufacturing domain of the economy. The High-Level Group (HLG)– with experience in the last 15 years in harmonizing Visons, Strategic Research Agendas and Road-Maps – has taken up the task and role to prepare a vision paper for the European manufacturing scene for 2030. The presentation will first detail the scenario of the ETP's output processes, and will show the experiences gained in the Hungarian ManuFuture NTP. It will give a nut-shell overview of the presently publicised, 'consultation-version' of the VISION paper on European Manufacturing in 2030. The summarized findings was authored by the large number of participants in the HLG group. The details of the ideas are to be fed to the decision makers in the EC and EP, while forming the base for Strategic Research Agenda and Road-Maps for the FP9.

1. **Introduction**

More and more high-level politicians are requesting usable, harmonized, consensus-based working documents to help their responsible tasks, e.g. to generate reliable options for valid decisions. Technology Platforms – by definition – are experts groups that have basically the right partnership of all involved players or actors in a given scientific-technologic field, to cope with the preparation of such interdisciplinary set of issues. The members of the EP (European Parliament) and EC (European Commission) are requesting verified, harmonized ideas generated by European Technology Platforms (ETPs).

2. **The wide range of Technology Platforms**

Since TP-s are self-organizing fora, during the past 2 decades, many formulations had emerged on various industrial topics. Naturally, there are very relevant and less dominant economic sectors, but each has its own field of essential importance as given in Table 1. [1]

Bioeconomy	Energy	Envir	ICT	Prod@Process	Transport
ETIP	Biofuels	WssTP	ARTEMIS	ECTP	ACARE
ETPGAH	EU PV TP		ENIAC	ESTEP	ALICE
FABRE TP	TP OCEAN		EPoSS	EuMaT	ERRAC
Food fo Life	RHC		FTP 4 HPC	FTC	ERTRAC
Forest-bnased	SmartGrids		euROBOTICS	ManuFuture	Waterborn
Plants	SNETP		NEM & NESSI	NanoMedicine	
TP ORganics	ETIPWind		NETWORLD2020	SMR	
	ZEP		Photonics 21	SusChem	

Table. 1. The structured table of the EUROPEAN Technology Platforms

The following list highlights those ETPs, that are relevant for the Manufacturing industry:

- ETPS related to Manufacturing;
- Advanced Engineering Materials EuMaT – A4M;
- Embedded computing ARTEMIS
- European Nanoelectronics ENIAC
- European Techn Platform on Smart System Integration (EPoSS)
- Construction Techn Platform
- European Steel Technology Platforms (ESTEP)
- European Textile and Clothing –ManuTex
- Food for Life – Foodmanufuture
- Robotics (EUROP)
- Industrial Safety
- ManoFuture
- Photonics
- ConXEPT
- Sustainable Chemistry(SusChem)
- Waterborme

The ManuFuture ETP recognized several involving small platforms, to serve as subdomains within the manufacturing, and these are called the SUB-PLATFORMS of the ManuFuture ETP.
- Additive Manufacturing- AM
- Agriculture Engineering and Technologies –AET
- Joining
- Zero Defect Manufacturing
- Micro-Nano Manufacturing –MINAM

When the expert group of ManuFuture ETP prepares harmonized summaries, all sub-platforms are requested to feed in their topic-related relevant requirements and specifics.

3. What activities are required from ETPs?

European Technology Platforms are industry-led stakeholder fora recognized by the EC as key actors in driving innovation, knowledge transfer and European competitiveness. [2]

ETPs develop vision paper(s), research and innovation agendas (SRAs) and roadmaps for actions at EU and national level to be supported by both private and public funding. They mobilize stakeholders to deliver on agreed priorities and share information across the EU. ETPs are independent and self-financing entities. They conduct their activities in a transparent manner and are open to new members.

ETPs are bottom-up driven expert groups, their roles are set in their constitution. Nevertheless, the EP and the EC declared a common set of requirements for ETP-s, to define a reliable source for information and Decision Support.

Three major documents are required from each ETP, to be fed to the EP, EC decision makers. They must be prepared in a straightforward sequence, in harmony with entities involved within the area in a very broad sense.

Preparing, developing a **VISION document**, with a time-domain of 10 or 10+ years, so that the members of that Platform can share the same view for the future, explaining it in a harmonized, detailed view.

Preparing, developing a **Strategic Research and Innovation (SRA) Agenda**; listing what are the missing knowledge and practice solutions building blocks, that are not yet ready, but are in need to apply rather soon in order to reach the Vision, the visional future environment by the end of the next 10 years.

Preparing, developing a **ROADMAP**, that has scenarios for possible best or worst estimates or most probable scenarios, by allocating financial support, manpower and infrastructure parameters together with the time-duration estimates.

ETPS are also responsible to establish a close, industry – academia- and educational partnership, to have balanced view from many domains.

4. Experiences at ManuFuture ETP and Hungarian National TP

From 2003 to 2004, the European ManuFuture Technology Platform [3] has been involved in the preparation and development of the Vision 2020document, followed by the SRA in 2006 [4], and finally deployed the ManuFuture Roadmap in 2013 together with the EC's relevant DGs. These docs had been the fundamental stepping stones for the EC and EP to launch the 7th Framework Program and the HORIZON 2020 for a pan-European joint research-development and innovation program.

As other countries, the Hungarian Government has also been pushed by the EC to help the establishment of National TPs. The Scientific Society for Mechanical Engineers (GTE) [5] had the privilege to be hosting the ManuFuture-HU. The NTP in Hungary had not just prepared the translations of the working documents, like the Vision and the SRA [6], but had also gone beyond that EU level, and had generated the possible National allocation of funds, resources, etc. as shown in Figure 1.

Fig. 1.   European and National (Hungarian) ManuFuture main documents.

5. Beyond Horizon 2020

The ManuFuture ETP [3] has continuously been very active even after the deployment of the ROADMAP in 2008, a large group of its members has joined the High Level Group, the Industrial Support Group, the Industrial Advisory Group, the Mirror Group, for strengthening the ETP, for establishing PPPs [7] as EFFRA [8] and for monitoring the progress along the implementations.

During the past 2 years, the new Version for a new Vision document could be developed, that has a foresight timeframe for 2030.

The first public presentation, just as a summary of the work, had been given at the Tallin ManuFuture conference in 2017 October [9]. Prof H.Flegel president [10] and J.C.Caldeira [11] had given briefing on the new Vision doc.

The document reached its present version, referenced as 'Consultation Version' ManuFuture Vision2030, after the April 2018 HLG Working Conference in Graz. The following sections give a short overview of the 38 pages long document.

6. The structure and content of the of the Consultation Version of Vision2030

The first chapter shows the Manufacturing Industry Today, while Chapter 2 details the megatrends and drivers for manufacturing. Chapter 3 gives vision for scenarios and models for the future manufacturing processes. Vision and strategy are detailed in Chapter 4, and the Vision Building Blocks are described in Chapter 5. A short terminating Chapter deals with Manufacturing &Society relevancies in the vision. The document is a contribution for political, economic, ecologic, and social orientation from a European perspective.

7. European Manufacturing   -global challenges

This is the backbone of the European economy: with 2.1 million enterprises, employing 30 million workers. Industry 4.0 will impact at global level. Presently Europe is the global leader for the technology and also for its implementation. At international dimensions, Europe is the world's biggest exporter, but the decline of added value produced by the manufacturing sector is disturbing, so there is a need to give priority to European manufacturing. Regarding other global areas, most of them give high priority to digitization and Key Enabling Technologies, like USA, China, Japan, South Korea, but even South-East Asia.

Competition and cooperation both increase at a global level, and thus the complete manufacturing innovation ecosystem needs to be involved for a change.

Today, society and the world economy are undergoing major changes, driving a social transformation as important as the first industrial revolution. These changes are a global phenomenon, affecting the way we live, work and behave. An unprecedented increase in the speed of development in science and technology, a fast diffusion of knowledge, the scarcity of resources and new generation of consumers will pose challenges and opportunities for Manufacturing. This will lead to a new paradigm shift at a global level.

The following are the most relevant trends and drivers for the future of European Manufacturing:
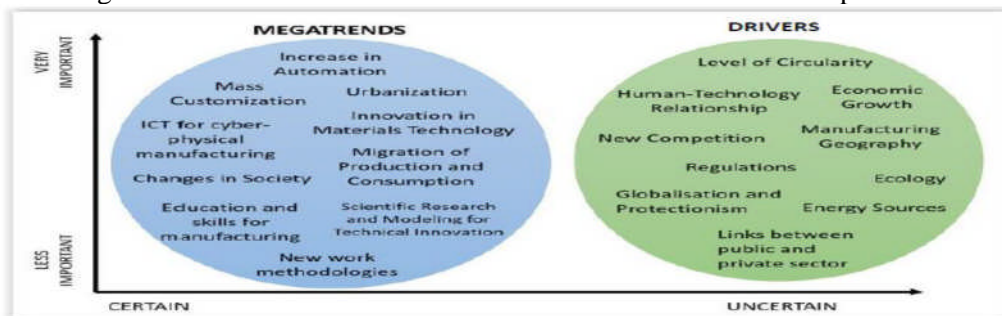

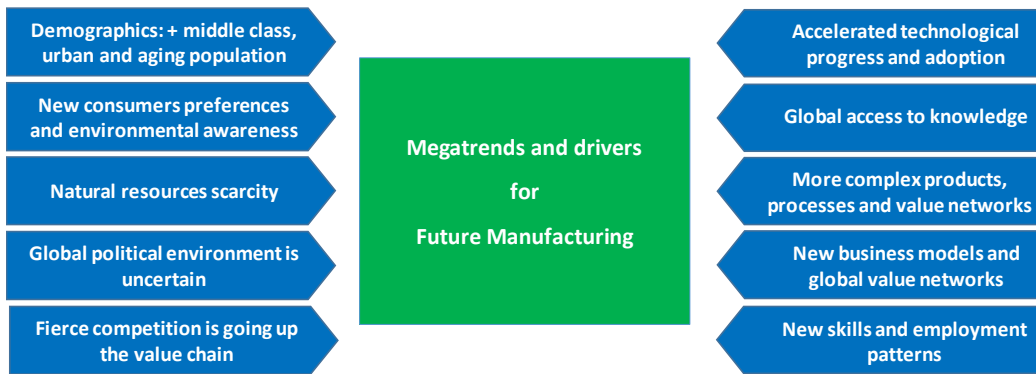**Fig. 2** Megatrends and drivers by importance and certainty.

Fig. 3 Megatrends and drivers for future Manufacturing.

Each block is detailed in the Vision paper.

8. Future Manufacturing Scenarios and Models

In this part, only short comments are extracted from the vision documents:

Understanding the challenges and the foreseen opportunities, European manufacturing will have to evolve to exceed the customer's expectations in design, quality and service, and become even more flexible and adaptable. It must be user-centric, the customers will have a central role in the value creation. Bionic manufacturing will enhance and augment relevant human capabilities. Nature inspired manufacturing can lead to new frontiers.

Circular economy is a large collaborative endeavor and manufacturing is at its core. Education and life-long learning will become a critical functions, and the new concept of learning factories will offer new challenges.
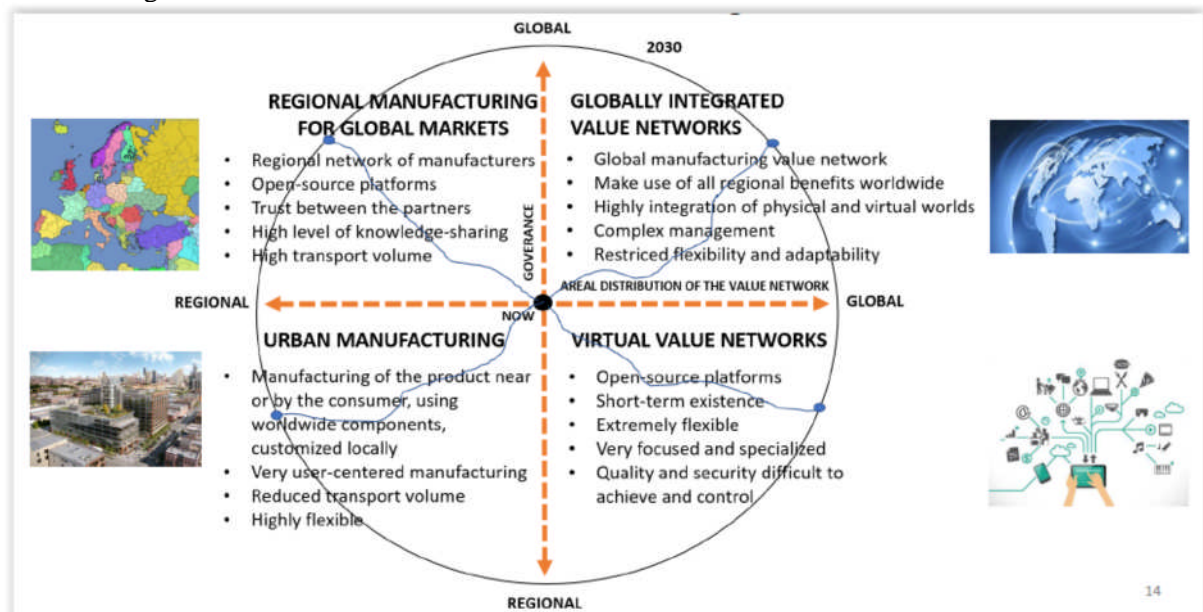

Fig.4. Scenarios for future manufacturing

Aligned with the foreseen evolution of manufacturing towards 2030, MANUFUTURE ETP developed four models for the development of value networks and manufacturing systems: Globally

Integrated Value Networks (Model 1); Regional Value Creation for Global Markets (Model 2); Regional Value Creation for Regional Markets (Model 3); Regionally Regulated Virtual Value Networks (Model 4). Companies will adapt and combine these generic models to optimally address specific market requirements, product characteristics and manufacturing resources availability.

Model 1: Globally Integrated Value Networks

This Model encompasses a further development from today's global supply networks. It will comprise a globally harmonized regulation and governance and will exploit the use of technologies. This is supported by systems predominantly based in artificial intelligence (AI), within or external to the value network, which monitor the potential customers, identify needs and wishes and interact with product design and a high and real-time integration of physical and virtual worlds.

In this context, globally acting companies such as vehicle OEMs operate and orchestrate a global supplier network, including highly automated assembly factories in the most relevant markets, with high cost, speed and flexibility pressures. Companies have full control of market access of their products.

Challenges for the development of Model 1 are:
• Complex management – governance, coordination, collaboration – possibly supported by AI-based systems;
• Development of novel digital/physical architectures from the factory to the networks (digital twin, factory as a product, etc.) to allow for vertical and horizontal integration and more flexibility and responsivity;
• Optimization of cost and quality: standardization at the highest technological level, zero failure, minimization of the use of resources.

Model 2: Regional Value Creation for Global Markets

As Model 1, this Model targets global markets. Dominating the production side are regional networks of design and manufacturing companies, including SMEs. Manufacturing systems are built according to frugal principles, cost and effort optimised and conformant to all relevant regulations. Digital platforms support product design and development, possibly including the end consumer, and operations management. These networks are unique and world leading and are based on the appropriate norms and standards, taking into account the regionally available manufacturing capabilities and services. According to the principle of the Regional Smart Specialization, the regions specialized on specific successful products, deliver them to the global world. These regional networks are highly flexible and dynamic.

In the described context, highly specialized companies such as factory equipment and automation suppliers have a high ratio of in-house production while controlling complete customer-specific value chains.

Challenges for the development of Model 2 are:
• Regional intelligent specializations
- Regions with many leading protagonists, in relevant technology fields;
- Flexible structure of medium-sized enterprises with high specialization (hidden champions);
- Focus of efficiency and intelligence;
- Capabilities for customer-specific system integration.
• Regional technological centres, including digital service centres (cooperative society models)
- Safety and security mechanisms supported by mutual trust in the region;
- Regional innovation hubs.
• Policy tasks: to create supportive conditions, infrastructure and a regulation framework
• Focus on highly specialized and complex products

Model 3: Regional Value Creation for Regional Markets

This prototypic Model has an even stronger regional focus than Model 2, by encompassing regional manufacturing for local customers. Due to the Urbanization Megatrend, manufacturing will be increasingly realized in urban areas, as cities have strong economic and social assets. An example of this paradigm is Urban Manufacturing, but manufacturing in more rural areas is alike. Sourcing of elements and components is done at a global level, while the final assembly or personalization is mainly performed near or even by the consumer.

In a context of urban manufacturing, the complete production, the final assembly or personalization takes place on demand for products such as shoes, clothes and food, as well as furniture or household equipment. Urban manufacturing is also applied to craftsmanship oriented small industries that produce specialized products for niche markets, including maintenance, personalization and product lifecycle services industries. The close-to-service manufacturing model is also managed under these circumstances.

Challenges for the development of Model 3 are:
- Emission-free factories (zero emission, zero waste);
- Flexible work organization and flexible automation;
- Local service centres;
- Compact design of factories and availability of affordable estate in urban areas;
- Customer driven and individual personalization
- Responsive environment and cost effective goods transportation in urban areas.

Model 4: Dynamic Virtual Value Networks

Complementing the centrally controlled value networks of Model 1, Model 4 is completely decentralized. Platform-based ad-hoc value networks emerge spontaneously for the production of specific lots of specific products. Manufacturing companies of different sizes and service providers offer their competences and capacities on the platform. Each person with a business idea can set up a manufacturing network to produce and sell a defined lot of a specific product. Professional platforms support the management of the ad-hoc manufacturing value network of regional manufacturing service providers, including the legal and financial transaction. The network maybe global.

An example of an application within this context are temporal companies, which operate in a platform economy model. Platform providers assemble temporal limited process chains, while each authorized user can have access to the platform.

Challenges for the development of Model 4 are:
- Logistics and sales platforms for supply, manufacturing services and end market products, supporting interoperability and open standards;
- Highly flexible, adaptive automation throughout highly networked value network partners, including legal contracting and money transfer;
- Demanding, complex and unique products;
- New business logics, business intelligence and advanced decision-making;
- Total quality and safety assurance.

9. Detailing the value of RESILIENT manufacturing

From the 2010-s the main priority of manufacturing was set to have **competitiveness**. During the 2015-to 2020, the focus was set to have **sustainability**. In our 2030 vision, we estimate to achieve **resilience** in manufacturing, having the following qualifications:

- GLOBAL: changes in markets, technology, politics, etc.,
- FLEXIBLE: adjustable to changes (small or disruptive),
- FAST: information and proactivity,
- MODULAR: matching demand (geography and capacity),

•NETWORKED & COLLABORATIVE: integrated value chains, shared risks,
•INDEPENDENT: resources; knowledge; circularity,
•SUSTAINABLE: use less resources with less impact,
•COMPETITIVE: last but not the least!!!

10. Summary
This conference paper gave a summary of the European Technology Platforms, highlighting the very active role of the ManuFuture ETP. Present activity is to produce the VISION, the SRA – and later on the ROADMAP for the VISION of European Manufacturing in 2030.   The paper could only highlight some messages from the VISION document, e.g. the 4 scenario models, so interested readers are suggested to have a look at the full VISION document downloadable from the web.

Acknowledgements

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