SMART·map

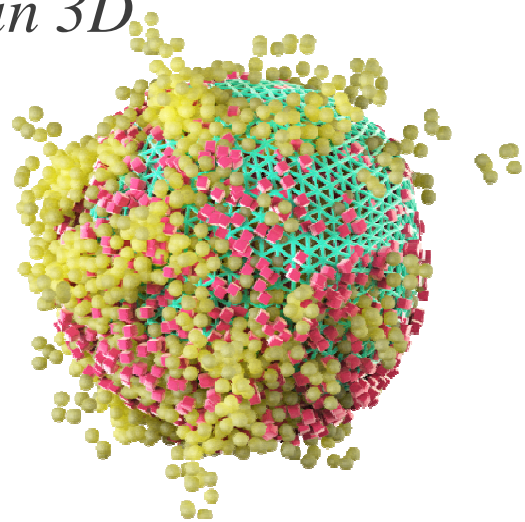RoadMAPs to Societal Mobilisation for the Advancement of Responsible Industrial Technologies

DELIVERABLE 5.1
List of Recommendations from the First Industrial Dialogue in 3D Printing in Biomedicine

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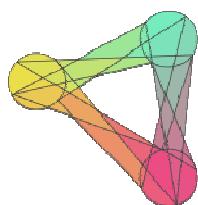**Delivery date**
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1. Introduction

The second *Industrial Dialogue in 3D Printing in Biomedicine* was successfully carried out on February 6th-7th, 2017 by the SMART-map consortium. The workshop took place at the Fraunhofer headquarters in Munich, Germany, with 18 participants coming from industry, research, civil society, and the public sector. The aim of the workshop was to generate ideas and create prototypes of tools and actions that help companies to develop new products and services in the field of 3D printing in biomedicine in a socially responsible way.

Just like the first industrial dialogue in precision medicine (January 16-17, 2017, Aarhus), the workshop had a duration of 1.5 days, and followed a purpose-built format for co-creation, which the SMART-map consortium developed under the guidance of the Centre for Social Innovation (ZSI Vienna). Each plenary and breakout session was facilitated by a moderator, and documented by note takers and observers. Furthermore, the SMART-map media partner Formicablu was in charge of the audio and visual recording of the workshop and interviewing selected participants.

Regarding the workshop process, the participants were initially informed about the SMART-map project. After the brief introduction, the keynote speech about current developments in the field of 3D printing in biomedicine was held by Professor Bilal Al-Nawas from the University of Mainz. In a next step, the participants introduced themselves by placing post-its with their name, organisation and stakeholder category on an 'innovation system' map (Figure 1). Then, the participants were briefed on the concept of responsible research and innovation (RRI) as well as the results of pre-workshop interviews conducted by the SMART-map partner Manchester Metropolitan University. Following this, participants interviewed each other (each participant interviewed and was interviewed by two other participants) concerning their backgrounds and experiences with responsible innovation. The participants then formed three groups to identify and discuss opportunities, needs, and challenges for responsible innovation in the field of 3D printing in biomedicine. Afterwards, in the plenary session, each group presented its key findings. The findings were clustered thematically and used as background information for the following sessions of the workshop. In order to meet the identified needs, the participants were asked to generate as many ideas as possible for tools by using a fast prototyping methodology. Ultimately, the participants framed three proposals and created concrete prototypes for them. The prototypes developed were presented in the last plenary session. After a short discussion and a wrap-up session, the workshop was closed.
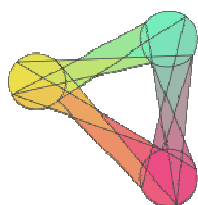
2. Participants

2.1 Recruitment

The identification and selection of participants for the Munich workshop was characterised by an extensive search for and mapping of relevant organisations and individuals from different angles. We started with an intensive search on the Web for relevant Germany-based stakeholders in the field of 3D printing in biomedicine. Then we collected information, for instance, on companies dealing with 3D printing, research institutions specialised in the field of 3D printing in biomedicine, and civil society organisations (CSOs). We also benefited from the participant lists of events related to 3D printing in biomedicine as well as from the broad network of the Fraunhofer Society. Finally, we put special emphasis on underrepresented stakeholder groups and tried to involve them with the support of the SMART-map consortium.

As a result of the search and mapping process, 200 relevant organisations and 220 individuals associated with them were added to our database. We categorised the organisations into three groups: industry, civil society and other stakeholders (e.g., financial organisations, regulators). Moreover, we subcategorised the organisations based on their relevance for the aim of the project. At the end of this categorisation, we

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established contact with potential participants via e-mails and phone calls to recruit them for the workshop. Our major goal was to involve an equal number of participants from each stakeholder group. In the first round of invitations, where we focused on the prioritised organisations, out of 33 people contacted, 9 agreed to participate, 8 declined and 16 did not respond. In the second round, where our focus was broader, out of 136 people contacted, 13 agreed to participate, 12 declined and 121 did not respond.

The primary obstacles to reaching a higher number and a more balanced set of participants were as follows:
1) As the key members of the Munich team have not been involved in 3D printing in biomedicine so far, most of the invitations were first-time contacts. This disadvantage was partially compensated by the help of colleagues at Fraunhofer ISI who are well connected in the field and the larger network of the Fraunhofer Society.
2) As in the first Industrial Dialogue in Precision Medicine, it was difficult to elucidate RRI, the underlying concepts, and the specific problems that RRI addresses, as these are very abstract. Although a 'living example' that embodied the RRI-specific aspects was presented, there was a lack of understanding among some of the participants. Moreover, some participants did not see the full spectrum of benefits of RRI for their organisations.
3) There was only scant interest from the side of CSOs. We assume that the workshop was perceived as having been designed primarily to meet the requirements of the industry and not so much to address the interests of CSOs. Therefore, additional efforts were made to clarify the role and value of the workshop for CSOs.
4) There were some last-minute scheduling conflicts. Some participants would have only been able to attend the second day of the workshop, which would not have made much sense as the individual parts of the workshop built upon each other. One participant got sick on the first day of the workshop.

It takes time and necessitates major efforts to build networks, and to convince individuals and to bring together organisations from various sectors to contribute to an RRI initiative. Therefore, it is highly recommended to cultivate existing contacts and widen networks that can be exploited for future events. Last but not least, the participation of CSOs should be encouraged by propounding more clearly the significance of their contribution to building roadmaps for industry.
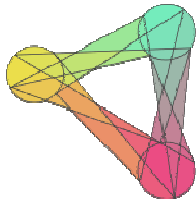
2.2 Participation
The selection of participants was guided by the aim to ensure that different perspectives are represented. In total, 18 participants (3 women and 15 men) were recruited to represent a diversity of viewpoints. However, we did neither achieve a balanced participation of women and men, nor an equal distribution of participants across all stakeholder groups. "Industry" and "Extra-industrial Research & Education" were the two best represented groups with 8 and 6 people, respectively (Figure 1). While 3 people represented "Societal Actors", only 1 person represented the "Financial & Service Sector" group. The "Intermediaries" group was also underrepresented with only 2 participants. Nevertheless, in their feedback, the participants praised the diversity of viewpoints and backgrounds of participants. They missed, however, the presence of representatives from patient organisations and health insurances as well as lawyers.
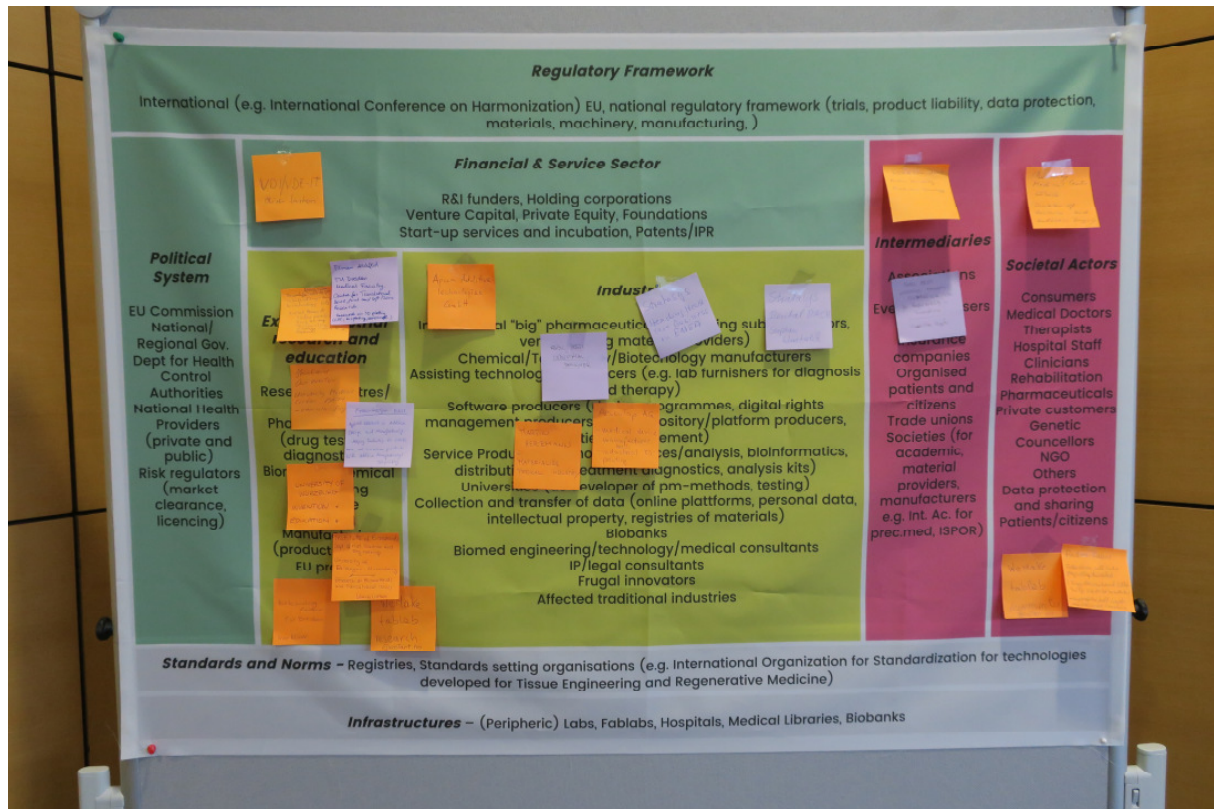
Figure 1: Participants placed post-its on an 'innovation system' map after introducing themselves.

- Industry: 6 representatives from companies dealing with 3D printing, 1 FabLab representative;
- Civil society: 1 representative from an NGO, 1 representative from an industry association;
- Other stakeholders: 8 representatives from universities and research institutions, 1 foundation/start-up service representative.

3. Proposals and Recommendations

3.1 Outcomes in terms of tools

The participants at the workshop were very active. The large number of creative ideas, that emerged during the fast prototyping sessions and the design sessions, was very impressive. The proposals included multi-stakeholder information workshops, discussion fora, a legal check along the product lifecycle, quality seals, RRI certifications for 3D printing, a platform for trial recruiting, an innovation platform, a patient data reservation tool and an RRI platform for 3D printing.

The three proposals that were further developed by dedicated working groups are:
a) an RRI platform for 3D printing
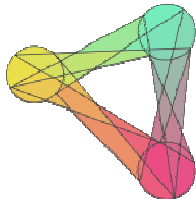b) an RRI certification tool
c) a legal check tool

3.2 Recommendations

A) Recommendations for future industrial dialogues

1. Better explanation regarding the role of industry and why the SMART-map project puts emphasis on developing roadmaps for industry.
2. Especially at the introduction part of the workshop, explain the target of the workshop more clearly, give more concrete information about the desired outcomes and highlight explicitly the significance of the presence and involvement of various stakeholder groups.
3. The process of the dialogue, follow-up activities (what happens after the dialogue, how are the results used), and the impact of the workshop output on the decision-making process of the European Commission were briefly explained to the participants at the beginning and the end of the workshop. Nevertheless, in future events, more time should be devoted to explaining the dialogue process to the participants.
4. Gender balance should play a greater role when recruiting participants.
5. The description of a 'living example', as an embodiment of RRI in practice, helps participants to understand the RRI concept much better. Therefore, putting more emphasis on such examples would be beneficial.
6. The communication with different stakeholder groups should be better adjusted to their specific needs, especially regarding CSOs. Moreover, existing contacts should be regularly cultivated.
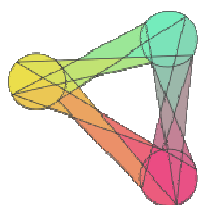
B) Recommendations for the development of roadmaps
7. Just like at the first industrial dialogue in precision Medicine, also in Munich the RRI concept was not discussed as an abstract concept. The workshop participants preferred to design tools for the specific challenges in 3D printing in biomedicine instead of generating tools for the industry to deal with those challenges in a societally responsible way. Notwithstanding this, the proposed tools, developed by mixed stakeholder groups, touched most of the RRI dimensions. Hence, the RRI perspective of the participants should be taken into account when drafting the roadmaps.
8. The Munich industrial dialogue demonstrates that the implementation of tools by the industry needs accompanying structural measures, which can be taken by the other stakeholders. It is therefore significant to highlight the role of other stakeholders in the development of the roadmaps.
9. The value and significance of the co-creation method and the contribution of participants from different stakeholder groups to the dialogue process should receive greater emphasis.

Appendix I: Workshop program

Day 1: February 6, 2017

09:00	Registration and coffee
09:30	Welcome and introduction
09:35	Introduction of the SMART-map project
09:50	Keynote on current developments in 3D printing in the biomedical field
10:15	Participants introduce themselves and their organisations
10:40	Introducing Responsible Research & Innovation (RRI) as its relevance for 3D printing
11:00	*Coffee break*
11:30	Participants interview each other on their views on responsible innovation
11:50	Breakout session I: Discussion on common needs, challenges and opportunities for responsible innovation in 3D printing in the biomedical field
12:30	*Lunch*
13:30	Plenary discussion to define the core needs of industry regarding the responsible development of 3D printing in the biomedical field
14:15	Briefing on innovation system
14:25	Breakout session II: Brainstorming on what actions could foster responsible innovation
15:15	*Coffee break*
15:30	Breakout session III: Fast prototyping of ideas for tools to meet needs in terms of responsible innovation in 3D printing in the biomedical field
17:00	Exhibition of results
17:15	Wrap up of day 1
19:00	*Dinner*

Day 2: February 7, 2017

09:00	Opening of day 2
09:05	Gallery walk: Reviewing ideas from day 1 for further development
09:35	Breakout session IV: Developing a tangible prototype of a tool for responsible innovation
10:30	*Coffee break*
11:00	Breakout session V: Assessing and testing the tools
11:30	Breakout session VI: Improving the tools
11:45	Presentation of prototypes
12:15	Discussion of prototypes
12:45	Feedback and reflection & workshop closure and outlook
13:00	*Lunch*