Responsible Innovation in ICT - Case study of 3D printing Technology Sector

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About / Parcours académique

BSc

- Bachelor of Science in 2009 at University of Mostar (Bosnia and Herzegovina)
- IAESTE (The International Association for Exchange of Students for Technical Experience)
- Research internship at Yeditepe University (Istanbul, Turkey)

MSc

- Master of Science in 2012 at University of Mostar (Bosnia and Herzegovina)
- Research internship in 2010 at Vienna University of Technology (Vienna, Austria)
- University of Groningen (Groningen, Netherlands) visiting student

PhD

- Started PhD in 2013 at University of Montpellier (2) as a member of MRM (Group IS)
- EURODOC Policy Research Workgroup Coordinator (European Council of Doctoral Candidates and Junior Researchers)

Theory framework / Cadre théorique

i) Definitions: *'Responsible Research and Innovation', 'Responsible Innovation', 'Responsible Development' (Von Schomberg, 2011; Pavie et al., 2013; Ingham, 2011; Owen, 2012)*

"Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)." "

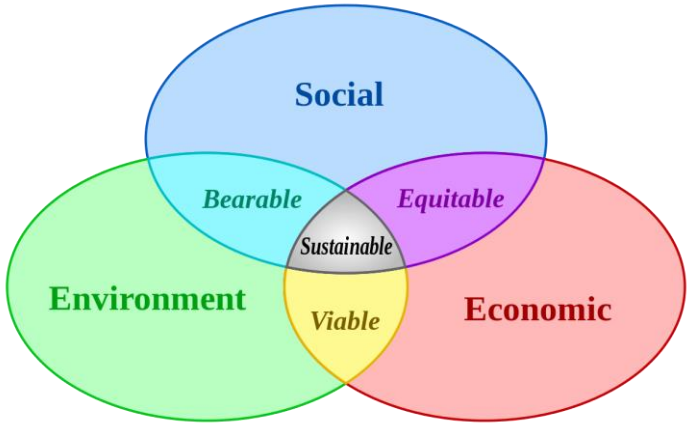
Von Schomberg, René (2011) 'Prospects for Technology Assessment in a framework of responsible research and innovation'.

"Responsible-innovation is an iterative process throughout which the project's impacts on social, economic and environmental factors are, where possible, measured and otherwise taken into account at each step of development of the project, thereby guaranteeing control over, or at least awareness of, the innovation's impacts throughout the entire lifecycle." (...)

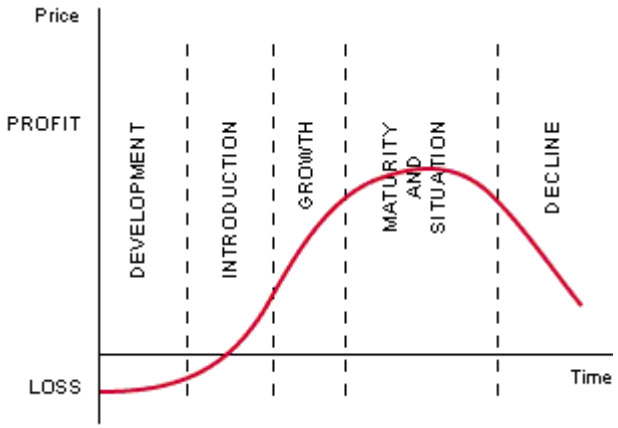
Pavie, X. and Carthy, D. (2013) 'Responsible-Innovation in Practice: How to implement Responsibility Across an Organization'.

ii) Responsible Innovation core elements *(KARIM Network, 2011)*

Sustainability



Product or service lifecycle



Stakeholders definition

- ✓ Policy makers *(international, national or regional policy makers)*
- ✓ Business organizations
- ✓ Civic organizations
- ✓ NGO's
- ✓ Others

Long term vision

"... anticipate (legal requirements, evolving markets, technologies, social and economic trends) to successfully detect potential obstacles to the development of the innovation."

Theory framework / Cadre théorique

iii) Responsible Innovation Network

Governing bodies

- European Commission (Horizon 2020)
- UK (Engineering and Physical Sciences Research Council (EPSRC))
- Netherlands (Responsible Innovation Program (MVI))
- Germany (NanoKommission)
- Japan (Nanotechnology in Society)
- USA (National Science Foundation)

Projects

- Observatory for Responsible Innovation
- Virtual Institute for Responsible Innovation (VIRI)
- Global Model and Observatory for International Responsible Research and Innovation Coordination
- KARIM Network for Responsible Research and Innovation
- FARINN project (Facilitating Responsible Innovation Program in SEE countries)
- ETICA
- EGAIS
- IDEGOV
- ResAGorA (Governance framework for RRI)
- GREAT (Governance for Responsible Innovation)
- ProGReSS
- Responsible Industry

Research Institutions

- ECCIS Business School (France)
- Mines ParisTech (France)
- IFRIS - Institute For Research and Innovation in Society, Université Paris Est (France)
- Arizona State University (USA)
- De Montfort University Leicester (UK)
- University of Namur (Belgium)
- DELFT University of Technology (Netherlands)
- Fraunhofer Institute IPK (Germany)
- TU Berlin (Germany)
- University of Oxford (UK)
- University of Sienna (Italy)

iv) Application scope

- **nanotechnology, genetically modified organism, nuclear power** *(von Schomberg, 2011)*
- **Responsible Innovation framework in ICTs is interesting study focus** *(Pavie et al., 2013; Guston, 2011; Van der Hoven et al., 2011)*
- **ICTs marked as key drivers that promote Research and Innovation in other areas** *(RICT)*
- **3D printing is evolving industry sector** *(McKinsey & Company, 2014; Wohler's Report, 2014; 3D printing market by technology, 2014)*

Study focus / Domaine de l'Etude

- ***Definition: 3D printing is a technology that uses an additive process for manufacturing three-dimensional objects from a digital model.*** *(Birtchnell, 2013)*
  - **Initial use in automotive, aerospace and military use – architecture, healthcare and entertainment** *(Conner et al. , 2014; Petrovic et al., 2011)*
  - **Augmenting traditional business models and manufacturing**
  - **Compared to Internet and home computing** *(Tucker, 2013)*

- **Market share reports show obvious promise for the future in 3D printing** *(McKinsey & Company, 2014; Wohler's Report, 2014; 3D printing market by technology, 2011)*

- **Few studies** *(Gebler et al., 2014; Le Bourhis et al., 2014)* **tackling the implications of advancing 3D printing industry sector and**
  - **i) Environmental issues;**
  - **ii) Societal issues;**
  - **iii) Ethical and legal issues.**

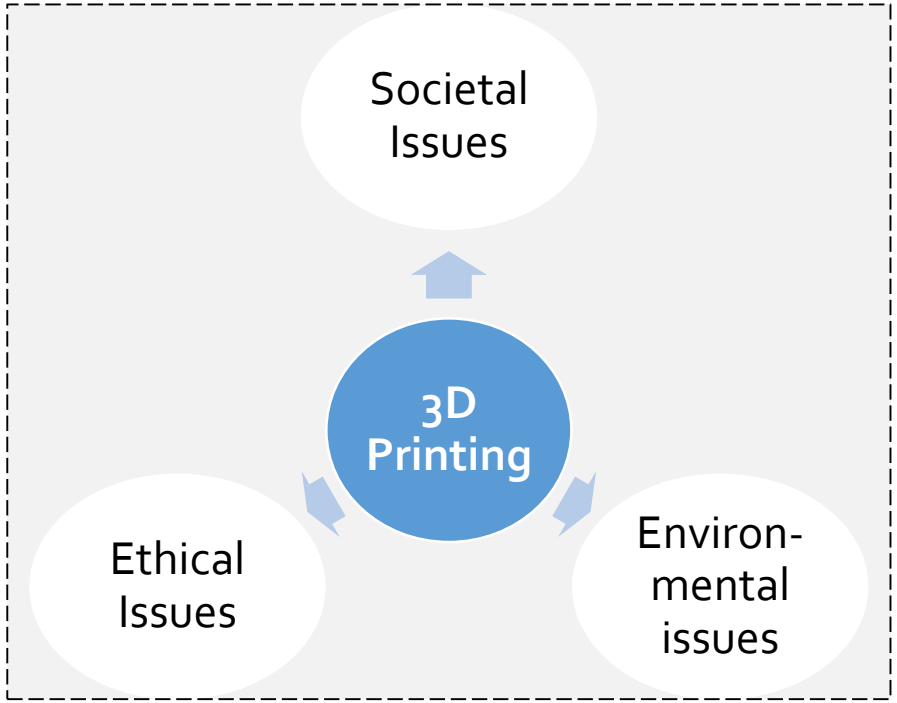


Figure 1. Illustration of research approach

Research Method / Méthodologie

- **Qualitative research approach** *(Eisenhardt, 1989; Myers, 1997)*

- **Encompassing three phases – systematic literature review** *(Kersten et al., 2014)*, **survey's and Interviews** *(AIS, 2013)* **and DELPHI method**

- **DELPHI is not novelty research in Responsible**
- **Innovation** *(Responsible Industry, 2014)* **and it has been commonly used in different fields of technology forecasting** *(University of Pretoria, 2009)*

- **Study groups (2nd phase):**
  - i) **Students and professors** (Université Montpellier)
  - ii) **Entrepreneurs (business incubators), hobbyist (ex.** *FabLab***) and online communities**
  - iii) **DELPHI method expertise group**

- **Tools:**
  - **Google Forms / Survey Monkey for survey design**
  - **NVivo for interview's data analyses**

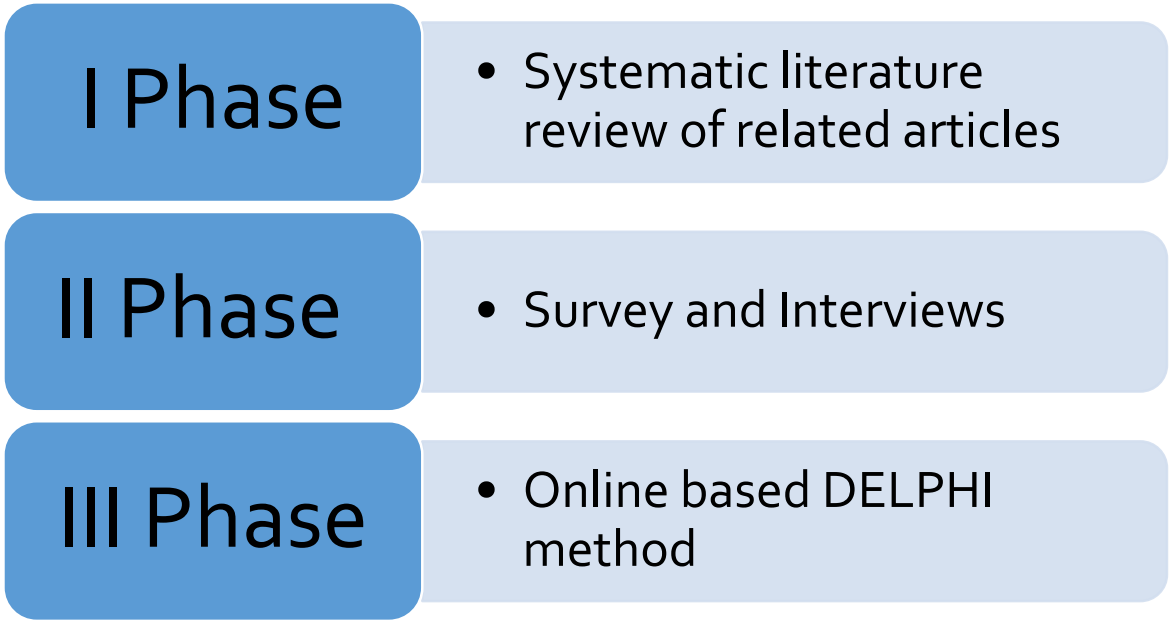


Figure 2. Illustration of research plan

Expected results / Résultats Attendus

Confirmation of potential hazardous concerns related to societal, environmental and ethical issues

1 **Berman** *(2012)* **mentions that when compared to traditional methods, 3D printing can reduce waste by 40% in metal machining for example; Travers** *(2015)* **discusses about CO_2 emission advantages of lower need for transportation under localized production.**
Fallery and Rodhain *(2011)* **presented a study about negative role of ICT and environment, envisaging assumptions opposite to those made by several studies** *(Berman, 2012; Travers, 2015)*

2 **Inevitable eradication of the craft ships and skills of traditional manufacturing under rapid development of 3D printing** *(Conner et al., 2014; Metal Powder Report, 2014)***; augmented manufacturing, localized production** *(Birtchnell, 2014)* **– everything leading to raise in concerns about labor force. Moreover, 3D printing could be the way of equal share of knowledge and development between Northern and Southern countries, topic discussed in *décroissance* movement members** *(Latouche, 2008)***, as well as issues of social equity discussed in Vitari** *(2013)***.**

3 **Raising ethical concerns on filament's** *(Athala, 2014)* **in medical use; open source (blueprints) concerns on growing online community** *(Thingivers, RepRap, ARC Group)***; legal concerns on standardization of technology** *(Metal Powder Report, 2014)* **and security risks** *(Goodman, 2013; DailyMail, 2013; BBC, 2014)*

Discussion

Thank you for your attention!

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