Design for Next Thinking. Using Transformation Consequence Mapping to Improve Responsible Innovation Practices.

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Abstract: Generally, design is hugely beneficial to society; however, it has the ability to impact the world in unpredictable ways. Nowadays, with the wide range of techniques available, we have the ability to anticipate a more diverse range of consequences which our products will have on humanity. The aim of this paper is to explore the new concept of Transformational Consequence Mapping (TCM), which is being created as a result of an ongoing Ph.D. investigation involving a review of existing literature and the undertaking of a pilot study. Transformational Consequence Mapping (TCM) is a strategy designed to enable the production of more Responsible Innovation (RI) outputs within design-led organisations. More specifically, TCM looks to anticipate the consequences and future issues of products/services in order to make the outcomes of innovation practices more sustainable. The paper concludes by detailing the future actions planned for the proposed research project.

Keywords: Responsible Innovation, Transformational Consequence Mapping, Sustainable Futures, Unintended Consequences

1. Introduction

Since the beginning of the human race, our ability to thrive has been aided by man-made development, from clubs and fire, to smartphones and the Internet. The point at which this became formalised design is unclear and rather subjective, however; in reaching the industrial revolution, it was clear that design’s influence not only benefitted society but also impacted the world in unpredictable ways. One example which shows great benefits alongside dramatic consequences is the internal combustion engine. With 1.2 billion vehicles globally, engines have allowed mass access to healthcare, education and business and leisure opportunities but also contribute to over 1 million deaths annually. More recently, the 2015 United Nations Climate Change conference, gave further evidence that current human behaviours are negatively impacting the environment. Two degrees Celsius could now see irreversible damage to the planet: “Climate change presents an ever-growing
threat to development, poverty eradication efforts, and the welfare of their citizens” (United Nations, 2016). As a result, there is an increased urgency to consider potential consequences within innovation processes to reduce such unintended and irreversible socio-ethical or environmental consequences.

Nowadays, with our improved innovation practices, open access to information and a wide range of available approaches for gathering stakeholder insights, we have the ability to anticipate a more diverse range of these consequences. We can minimise the negative consequences of our outputs whilst adapting our products to create positive impacts. This paper intends to explore how this can be done through Responsible Innovation activities and responds to the statement that innovation has “not only produced understanding, knowledge, and value (economic, social, or otherwise), but also questions, dilemmas, and unintended (and sometimes undesirable) impacts” (Owen et al., 2013, p.27). This, therefore, opens up a complex debate, as to where responsibility begins and ends for innovators and spawns questions such as what is RI, what does it look like and how can it be measured?

These arguments centre around various branches of ethics. In reviewing existing sources, RI is one strategy which could be used to minimise the probability of humans having to encounter anthropogenic (man-made) and some non-anthropogenic existential risks: risks that threaten the premature extinction of Earth’s natural inhabitants and the permanent destruction of its ability to nurture future development. Because of the nature of the study, anticipating and adapting consequences, the general ethics concept which is relevant here is that of consequentialism which is the belief that right or wrong should be determined by a situation’s consequences. This results-based approach plays a large part in the small decisions we take every day whilst also being extremely appropriate to decisions made within commercial domains. In such decision-making processes, it is usual to make a decision by thinking about the results or impacts that this will produce. Several alternative ethical viewpoints are relevant in justifying the author’s undertaking of the research study including intergenerational ethics, environmental ethics and aspects of business ethics.

As well as having ethical importance, the paper has primary data to validate its relevance. The area of study was determined via a questionnaire which asked 18 Multidisciplinary Innovation postgraduates from Northumbria University about their perceptions of Responsible Innovation. The respondents had previously studied 15 different courses, covering 5 different cities in 3 countries and were deemed to be a representative sample of the population due to the diverse nature of the course.

| Theme                     | No. of Instances |
|---------------------------|------------------|
| Promoting Positive Impacts| 22               |
| Reducing Negative Impacts | 19               |
| Considering Consequences  | 19               |

Table 1: Findings from Pilot Study

Table 1 shows the findings from the pilot study in which the author found significant reflection on both increasing positive impacts and reducing negative impacts of innovation outputs when the participants were asked to define responsible innovation. The author saw little evidence that the students directly acknowledged these aims when undertaking live project work. In exploring the field
further through a literature review, this lack of a formalised method for consequence mapping, was reinforced.

2. Responsible Innovation

Within the current RI literature, a scientific emphasis dominates despite its relevance in design. The most widely accepted definition of RI 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, 2011, p9)

This definition acknowledges several key aspects including the participation of multiple stakeholders, issues surrounding sustainability and ethics, and the suggestion of desirability and marketability. It does however lack focus within the design field, where activities always encompass future-oriented thinking, whether outputs are designed for use within five minutes or five years. Though Pavie, Scholten, & Carthy (2014), have published one of only a few sources which considers RI as a more holistic concept, by encompassing design, business and technology, a definition is still yet to be widely accepted within the field, despite its obvious benefits.

By employing more responsible strategies, design can help to minimise the negative impacts, and promote the positive consequences, of all innovation outputs. In the words of John Thackara: “If we can design our way into difficulty, we can design our way out.” (Thackara, 2005, p1). The definition of Responsible Innovation in terms of this paper is as follows: Responsible Innovation involves deliberative and transparent collaboration between multidisciplinary stakeholders towards ethical and sustainable transformation. RI utilises a holistic approach towards a more preferable future and incorporates the anticipation and equal consideration of societal, environmental and economic impacts throughout the innovation output’s full life cycle.

Framework of Responsible Innovation

Eminent researchers within the RI field include Jack Stilgoe, Richard Owen and Phil MacNaghten, who in collaboration with the Engineering and Physical Sciences Research Council (EPSRC) came up with the Framework of Responsible Innovation (Stilgoe et al., 2013). Again, this framework was designed for scientific use, however its overriding values could fit within the design industry to promote a socially democratic model of moral and ethical innovation. Here, four dimensions are cited: Anticipation, Reflexivity, Inclusion and Responsiveness.

The first, Anticipation, is very relevant to the proposed research, as it acts as a vehicle to enable innovators to mould the impacts of products/services and to protect the future using present actions. This aspect raises awareness of Pile’s (1979) argument that designers have a responsibility to anticipate the effects of their design activities and the consequences that their decision-making processes may have on society. Amara (1981) justified the viability of using anticipation in this way, in the Three Laws of the Future, which state that the future is not pre-determined, it is not predictable and that future outcomes can be influenced by our present choices. Though designers
have started to use speculative foresight in their work, there is still a lack of formalised methods which aim to manipulate the consequences of products/services towards more responsible outputs. The work of Dunne & Raby (2013) holds significance here, in their exploration of different types of future. The most relevant here are preferable futures defined as the futures we want to happen. This holds particular importance within Simon’s work (1969) where he describes design as looking at the current situation and finding a way to get to the preferred state or position. The author hopes the proposed mapping method will act as a catalyst for change within organisations by encouraging a re-conceptualisation of norms, values and cultures and a move towards a more sustainable, peaceful and fair world for all.

The second dimension of the framework is reflexivity which Sangiorgi (2011) stresses should be priority within innovators’ practices and can be achieved by envisioning impacts and by building a better understanding of how the project will shape the future. Reflexivity can be taken from a first-order perspective which deals with the immediate issues of a project or from a second-order view where the fundamental value systems that shape the innovation practice are reconsidered. By considering the underlying assumptions, values and knowledge, it is possible to gain in-depth insight required to make valuable progress in the most responsible manner. Busch (2011) and Von Schomberg (2013) both see the value in this second-order reflexivity because of its required connection between external stakeholder value and internal practice. Porter & Kramer (2011) also argue that reflexivity fosters more careful and critical consideration towards action which could be beneficial to increase the value proposition, positively impact the triple bottom line and to ensure that motivation goes beyond profit.

The third dimension of the RI framework is inclusion which is described as moving beyond engagement with traditional stakeholders towards the inclusion of the wider public. Lawrence (2010) describes the result as “transdisciplinary” design which creates a holistic skill set applicable to many diverse problems facing the 21st century by intertwining multiple disciplines. Transdisciplinary design involves more effective dialogue for solving complex problems from a local and a global level, and can improve sustainability and promote systemic health (Wahl & Baxter, 2008). Dervojeda et al (2014) actually reported several commercial benefits of inclusion including increased speed to market, lower costs, increased product/service quality and a reduced risk of the innovation not meeting the customer needs. Despite such positive results, and significant evidence that shows ongoing participation with citizens can have positive social and environmental impacts, there is a lack of literature specifically looking at using citizen engagement for consequence mapping in Responsible Innovation. Wilkinson, Mayer & Ringler (2014) are among only a few to consider the combination of inclusive practice, design and ‘transformational foresight’, which they state could produce better outcomes for the future through collaborative innovation and co-creation. An additional argument here is that organisations also have a moral responsibility to involve end-users in designing products and services which they will be affected by (Holmlid, 2009).

The final dimension is responsiveness or taking action based on knowledge, perspectives and values as they emerge (Pellizzoni, 2004). This may involve the needs and desires of consumers, the changing circumstances with respect to the environment or the requirement to keep up with technological advancement. This relates back to the aspect of ‘inclusion’. A combination of these two dimensions can be seen in the practice of Human-Centred Design which IDEO describe as “a creative approach to problem solving and […] a process that starts with the people you’re designing for and ends with new solutions that are tailor made to suit their needs” (IDEO, 2016). A similar concept is suggested by Woelfler (2015) in the form of Value Sensitive Design (VSD), which has not yet crossed over into the innovation field but holds significance to RI in its underlying values of social change and participatory
engagement to ‘strengthen the voices of those who have not been heard’. Friedman (1996) infers this link between VSD and RI in clarifying the shared objective to design particular ethical values into innovation outputs.

**Triple Bottom Line**

In reviewing the existing literature, a reoccurrence of three concepts has been prominent, coined the three pillars of RI by Pavie & Carthy (2013). These three concepts include society, the economy and the environment, or the Triple Bottom Line (TBL) as defined by Elkington (1997). Here, he proposed that business practices should be extended beyond simply desiring to make a profit and should also focus on sustainability from social and environmental perspectives. Within RI, it is essential to ensure that the “economic, socio-cultural and environmental aspects are balanced” (Blok & Lemmens, 2015 p.20), otherwise innovators can produce an outcome which is extremely beneficial to one pillar but disregards one of the other elements. This seems to reflect the state of existing practice, as a recent Deloitte Millennial Survey (2016) documented in its findings, focus is currently on taking action for monetary gain. Due to the constant reoccurrence of these three principles throughout the literature, and their implied importance in responsible practice, the TBL will be used within the initial creation of the Transformational Consequence Mapping method.

**The Axes of Responsible Innovation**

The Axes of Responsible Innovation model, by Pavie, Scholten & Carthy (2014) involves three steps toward implementing RI. The first step questions the solutions in order to design in response to individual needs. This requires the inclusion and responsiveness aspects of the framework due to the need for deliberation between citizens and organisation so that action can be taken in a responsible way whilst also satisfying individual needs. The second and third axes involve monitoring and managing both the direct and indirect impacts of innovation respectively. This ensures that both the short and long term consequences that products/services have on the wider ecosystem, i.e. the environment, the economy and society, are considered. In doing this, the innovation can be assessed in terms of its contribution to global issues and wicked problems. These stages provided vital information concerning the design of the method set out below.

**3. Transformational Consequence Mapping**

As well as the framework of RI, other relevant practices have been used to develop the thinking behind the proposed method of ‘Transformational Consequence Mapping’. From a macro perspective, it is intended that the method will be the first rung in the ladder to achieving Tony Fry’s (2009) concept of Redirective Practice where the aim is to achieve true sustainability. The intention of this is to enable all activities on the earth to become fully sustainable.

The first set of underlying values here are those of green business which promote organisations to make minimal negative impacts on the TBL. This, however, only provides half of the overall objective in that it supports the ‘doing less bad’ angle. ‘Doing good’ is the more challenging aspect of the method and brings in knowledge from the circular economy, eco-design and socially-responsible principles. Here, positive transformation is the key ambition.

**Transformation Economy**

Before defining the method, it was essential to understand the value economy within which the method is likely to be implemented. The transformation economy is set to become the newly emerging economy where value propositions are combined with ethical business practices and
multidisciplinary citizen participation. Within the transformation economy, value is said to be extracted from individual transformations rather than from bought products, consumed services and one-off experiences, on the premise that “All other economic offerings have no lasting consequence beyond their consumption” (Pine & Gilmour, 2011, p252).

This most likely signifies a change for the role of consumers, from being passive purchasers, to proactively engaging with a company to shape the value offering (Mermiri, 2009). This is particularly relevant in the 21st Century as millennials are starting to become “economically active and independent are more interested in meaningful work than in the pursuit of wealth or material status” (Brand & Rocchi, 2011 p13). The transformation economy fosters an emphasis on morality and is predicted to see a shift towards more responsible consumer choices. A design practice which is currently moving towards this comes in the form of Transformation Design.

Transformation Design
Transformation Design was first coined within The Design Council’s RED project; and is defined as “a human-centered, interdisciplinary process that seeks to create desirable and sustainable changes in behavior and form – of individuals, systems and organizations – often for socially progressive ends” (“Transformation Design”, 2016). Though, academics seem to generally shun definitions taken from Wikipedia, this definition is cited by multiple sources and has successfully synthesized the thinking of Sangiorgi (2011), Burns et al (2006) and Cottam & Leadbitter (2004).

Sangiorgi (2011) sets out six different characteristics for transformational design. The majority of which are very relevant in creating the method. ‘Defining and Redefining the Brief’ brings attention to both the responsiveness and the preferable futures sections mentioned above. Innovators should be modifying their brief to fit the emerging context and should consider the more preferable futures which the products/services should satisfy at the start of a project. ‘Collaborating between Disciplines’ and ‘Employing Participatory Design Techniques’ sit within the inclusion dimension of the RI framework and ‘Designing beyond Traditional Solutions’ sets out the need to tackle problems using a more holistic approach.

Within her work, she also acknowledges seven key principles of transformational design. The problem here is that she leaves ‘Evaluating success and impact’ until last which seems to show that this principle is done retrospectively rather than enabling impacts of innovations to be assessed and adapted throughout the project. The above principles were put in place in a first attempt to envisage what Transformational Consequence Mapping could look like, the methodology that the author is following is described below.

Methodology
The proposed study will be conducted in two halves. The first research phase will involve development of the method and is where this paper is relevant. The second half will involve testing the method within both education and industrial setting and will look to gaining feedback from a wide range of organisations.

The development stage of the research will be undertaken within educational settings where students carry out live project work with external organisations. This is viable within the time constraints of the study because these students generally work with existing products and services. The author has decided that it would be best to start by designing the method under these circumstances and to then do further work to see how it can be adapted for use in new product/service development. The choice to start testing the method within an educational context
is justified by the desire to primarily embed the method within educational curricula in order for it to then be disseminated into industry, via students, in a bottom-up fashion. Once the method has been tested in this ‘safe’ environment, the author then aspires to assess its viability in industrial settings. In order to do this, it will be tested within an organisation and a peer review will also be conducted with a wide range of organisations of different size and sector to allow feedback to be gathered.

**Transformational Consequence Mapping**

When considering the quality of an output of innovation activities, the current approach seems to be to use retrospective assessment. This includes assessment of the product/service within either a testing period or after it has been implemented and generally happens at a late stage in the project, when critical resources have been used and when it is unlikely for major changes to be made. This approach does not follow the reflexive nature that is described in the Framework for RI. In continuing to work this way, we can assume that we will continue to place products onto the market and implement strategies which are going to have some unintended consequences and that are not going to perform to their potential.

Though designers do naturally consider some consequences of their decisions during the design process, for example in design for social consequence or using environmental impact assessment, there is still no formalised procedure to use these within everyday design practices.

The author has decided that the method should be used within the primary stages of a project due to the ability to really focus the brief and the ease of which it is possible to implement change. Thackara (2005) justifies this thinking when stating that 80 percent of the environmental impacts of today’s products and services are determined within the initial stages of the design process. It may be possible to adapt the method to act as an analysis tool in further stages of a project; however, because of the time constraints placed on the Ph.D. study, this will be considered within future research investigations.

This proposed TCM method is split into four stages as detailed in Figure 1 below:
At each of these stages, a multidisciplinary team involving representatives from each stakeholder group, will undertake a workshop to complete the following steps whilst concentrating on all aspects of the triple bottom line to continually redefine the brief towards a more responsible output.

**Current Consequence Mapping**

The first step here will be to gain a crucial understanding of current practice and any existing impacts, using holistic life cycle assessment which Karakoyun (2015) suggests is a combination of life cycle assessment, social life cycle assessment and life cycle costing. For the purposes of the initial investigation, the Triple Bottom Line will be used as a framework for analysis here; however, in the future more complex frameworks such as PESTLE (political, economic, social, technological, legal and environmental) analysis could be use. This first step will allow organisations to assess both the direct and indirect impacts that they are having on the TBL whilst providing opportunities to see where improvement is possible.

**Imagining Preferable Futures**

Once consequence mapping is complete, the team will have the opportunity to explore any potential issues found by attending a co-creation workshop where they will work together to envisage the most preferable future for the organisation. Specifically, this offers chances to investigate how negative consequences can be reduced, where opportunities lie for positive transformation and encourages the innovation to be reconsidered by using the information to negotiate a refined brief.
Refined Concept Ideation
The third step involves ideating a new concept in an attempt to work towards the preferable future set out in step 2.

Consequence Visioning
Once a new concept has been created, ‘consequence visioning’ will be used. This new concept involves the use of foresight to anticipate both the positive and negative consequences of the proposed concept and encourages further ideation where improvement is deemed to be required.

In using the TCM method, innovation teams may find that it could turn into a rather cyclical process or may need to be carried out for several different ideas. The ideal situation would be that the multidisciplinary team of stakeholders would continue to redesign until there are no predicted negative consequences and there are several positive impacts.

4. Going Forward
In summarising, the research so far mirrors Davies & Horst’s (2015) findings, that there are few practice-based studies concerning the implementation of RI-specific strategies, especially within industrial settings. Where literature does exist, it is generally theoretical or based upon previously undertaken case studies rather than taken from a primary perspective.

When attempting to find existing practical studies surrounding these issues, the closest study available was that of Sussex University’s Kidney Gap (Ross & Stirling, 2004). Sussex University’s study looks at providing policy-makers with citizens’ and specialists’ preferred solutions and although some direct consequences are used during deliberative processes, there is no attempt to re-conceptualise these solutions in order to remove unintended negative consequences or create positive transformation. Their strategy simply looks to identify consequences to determine which solution in its current state would be most suitable. The proposed research therefore plans to focus on using co-creation to map the current consequences of products/services and to then redesign the outcome to be as responsible as possible. It specifically aims to promote an increase in positive impacts, following McDonough & Braungart’s (2002) warning that we should be focussing on ‘doing good’, as well as doing less bad. This coupled with consideration of short and long term impacts throughout the innovation life cycle will hopefully lead to more responsible innovation outputs. This demonstrates an additional way that the proposed research differs from existing studies and provides strong justification for its undertaking. Findings also suggest that this study could provide the basis for solving longer term global issues and could help organisations to manipulate megatrends for the better. The author additionally hopes to provide innovators with the ability to transform the future into a more preferable state and aims to provide significance within the predicted transformation economy. The method also makes commercial sense by providing organisations with a competitive advantage and offers perceived value from a customer perspective.

In taking this study further, the author plans to refine and test the above mapping method by implementing it within both educational and industrial contexts. This testing period will allow the author to assess the viability and generalisability of the method from a practical perspective. This stage will be written up and disseminated to organisations of different size and sector in order to gain feedback and suggestions for improvement via a peer review.
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