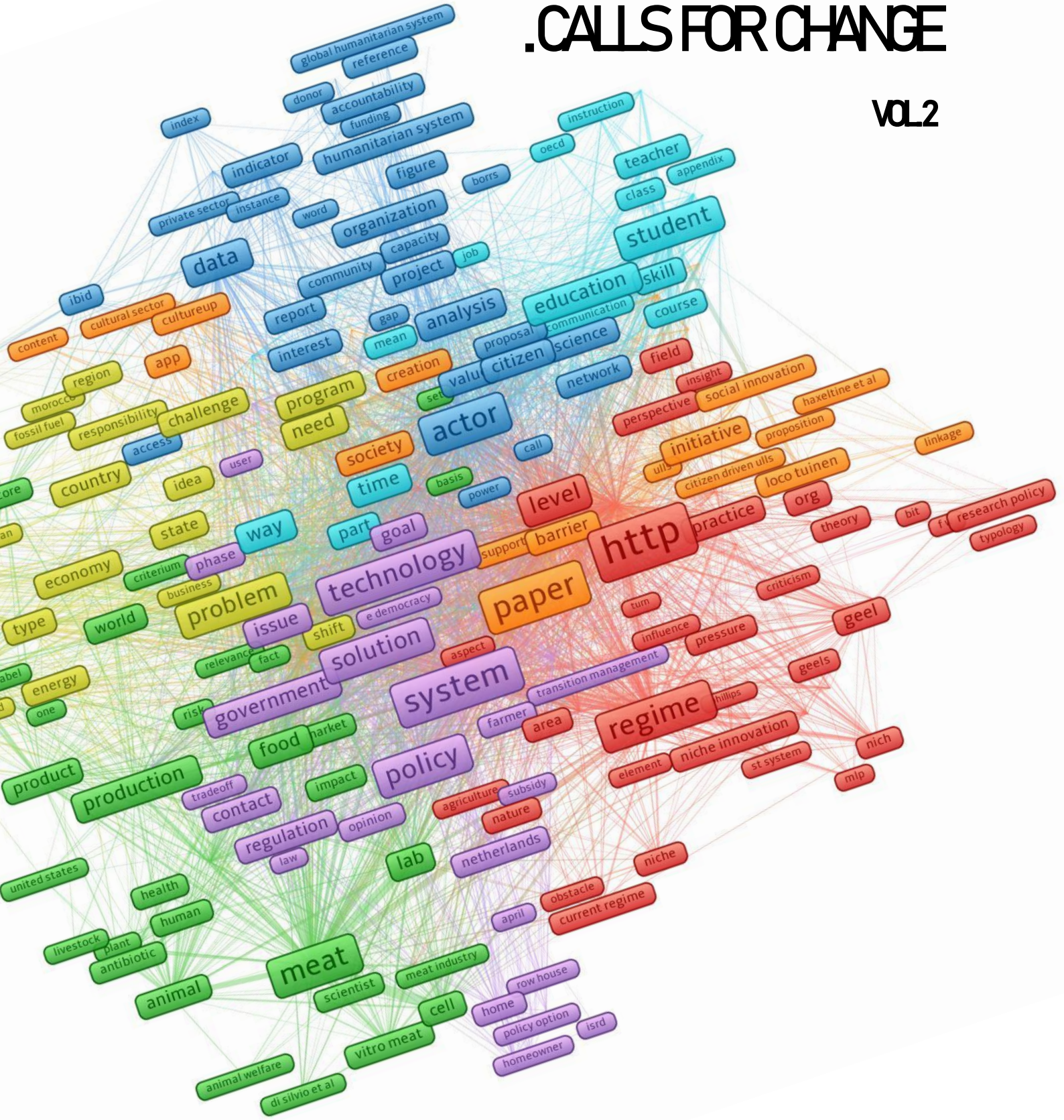
.CALLS FOR CHANGE

VOL.2



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Editorial Note

The second run of *Innovation Systems, Policy and Sustainability Transitions* class at University College Maastricht is over. We met bright minds and hearts joining the class of April - May 2020. It was an intensive learning period for them, and for us it is always interesting to listen, and finally, read about the environmental, social and economic sustainability issues that the participants want to see a positive change in. Other than only demanding solutions about these issues, they are being part of several individual solution proposals with their ideas and judgements on why, the purpose; what to master; and how to seed the change for each issue they autonomously picked. We think this second volume of open access digital compilation of "Calls for Change" will inform and inspire many people around the globe about the need for imagination and ideation in research, education and outreach, as well as the need for innovation, policy, and sustainability transitions in the systems.

Have a good read!

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Maastricht, the Netherlands

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COVID-19 Contact Tracing & Privacy: A Necessary Tradeoff?

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Introduction

The COVID-19 pandemic is severely disrupting the world's economies and people's lives; many companies are facing bankruptcy, employees are laid off, months of self-isolation are implemented, and lives are lost, ultimately driving the world to a near standstill (United Nations, n.d.; World Economic Forum, 2020). This crisis may be a breaking point for humanity that opens unimaginable pathways for innovation and development. Much of what was considered unimaginable few months ago has become the new normal, an example being universities taking their courses online.

Humanity, with its strong belief in innovation as solution to its problems, is pulling resources and talent together to fight the pandemic. Only two months after the outbreak, pharmaceutical companies are already testing medications and expecting a vaccine by the end of 2020 (Gallagher, 2020). Specific to the IT and tech sector, applications and software's are developed that enable contact tracing of infected people in order to contain the spread of the virus (Weaver, 2020). However impressive, and essential these developments may be for the health and survival of humanity, it is necessary to investigate and evaluate their potentially dangerous implications. It is particularly important to investigate the implications of contact tracing technologies as they may constitute a severe threat to personal privacy rights. That is, the data collected on the movements of whole populations may be necessary to fight a pandemic, but what will become of the technology afterwards? Which actors can access this data and how are users protected?

Therefore, this paper poses the following research question: To what extent is there a necessary tradeoff between contact tracing and personal privacy rights? Firstly, the value of data and current contact tracing technology will be introduced and evaluated. Secondly, the relevance and necessity of addressing contact tracing technology will be exemplified from a Multi-Level Perspective. Finally, recommendations will be made, and the conclusion drawn, that there will always be a tradeoff between contact tracing and personal privacy. However, that with proper product design and innovation, policy formation and the rule law such tradeoffs can be extensively minimized.

The Value of Data

Nowadays, personal information is highly valuable to both companies and governments. Personal information is extensively monetized within the larger framework of the marketization of every aspect of life by the current capitalist system and market society (Kemp et al., 2016). The best example is targeted marketing. Google and Facebook's 2019 advertising revenues were $32.6 and $16.6 billion respectively (Baca, 2019). These platforms seem "free", yet, each user has a personal advertising profile, created based on personal data; location, gender, income, relationships and career. These profiles are then sold to third parties for marketing purposes. Most people do not know that such intimate personal data is collected and monetized. Yet, Google stores every single online search, email and application ever downloaded and Facebook every message, picture or video sent, received or deleted (Curran, 2019).

Personal data can be abused and infringed by both companies and governments. A recent example is the Cambridge Analytica case in 2018, where 87 million Facebook profiles, without consent, were accessed. Personal data from these profiles was then used to create targeted and individually tailored psychographic political ads to influence voting behavior (Wired, n.d.; Baca, 2019). Also, governments have an interest in the increased collection of personal information about their citizen, for "national security" matters. However, such data collection often infringes personal privacy rights, examples being mass surveillances scandals[1] involving street camera usage, webcam hacking and phone monitoring by government authorities (Amnesty International, 2018).

What becomes clear is the value of personal information to companies and governments, their incentives to increase access to such data and how easily it can be misused. Therefore, in a world that is moving towards greater uses of technology, digitalization and data collection, privacy protection matters the most to me. Everyone should have the right to privacy, the control over their personal information and the protection from the misuse of personal data by the public and governments (Schwartz, 2004). Thus, any technological innovation gathering extensive personal data, such as contact tracing, must be vetted and its implications evaluated.

Contact Tracing

In 16th century Europe, in order to contain the spread of diseases, sick people were isolated and treated. Their recent contacts were noted down, searched for by medical staff, and if found, also isolated. Today, with large numbers of infected people spread around the globe, and many daily interactions, this process is no longer feasible without the assistance of technology, hence, contact tracing applications are being developed (Naughton, 2020).

Most contact tracing applications make use of low energy Bluetooth sensors that activate when in proximity of other devices. These sensors register every interaction a person has and notify his or her contacts (phones they have crossed in past 14 days) in case he or she is found to be infected. This process is supposed to be fully anonymized. Moreover, contact tracing applications may also inform users if they have already been in contact with a confirmed case of COVID-19. In the case one was exposed to the virus, the application would recommend two weeks of self-isolation (Weaver, 2020; Naughton, 2020). An initial problem with this technology was that various phone operating systems were incompatible, therefore, Google and Apple launched a new compatible operating system for both IOS and Android (Apple News, 2020). Governments and health authorities build contact tracing applications based on this technology, varying between centralized and decentralized systems and the extent and type of data collected. Google and Apple can be considered main actors as they control the basic technology on which individual applications are built and the extent of data that can be collected.

Decentralized applications keep all contact interactions and user's data on users' phones. This requires a lot of data processing, as all user's data is constantly up and downloaded to all phones. Therefore, fully decentralized systems are currently not feasible. In centralized systems all the data passes by one server. Most of the current contact tracing applications (Singapore, Australia and the UK) use centralized systems as they enhance the processing speed of information. This is so as only information pertinent to a phone's location is locally downloaded, and its server centrality makes data collection and analysis easier for health authorities (Kelion, 2020). Prof. Christophe Fraser, head of the Oxford University research team for contact tracing, stated that if a contact tracing application were

[1] Edward Snowden in 2013 and Wikileaks in 2006. Edward Snowden exposed that privacy rights were infringed by the NSA in 193 countries (Amnesty International, 2018).

implemented by sixty percent of the UK population the spread of the pandemic could be stopped (Oxford News, 2020).

The immediate implementation of such technology may seem desirable, however, there are implications. What will the role of the main actors such as Google and Apple be? These enable the basic technology and the extent to which governments can use it. They face a tradeoff, how much privacy of the users do they give up for health services and governments to use? Also, once they reduce privacy protections for one government they must do so for all governments (Hern, 2020). This could lead to severe mass surveillance in less democratic countries. Currently Apple and Google limit the data that can be gathered form its Bluetooth technology, however, France already requested the reduction of such privacy constraints to collect more specific user information (Hern, 2020). Moreover, the NHS in the UK already found a way to circumvent these restrictions (Kelion, 2020).

Another concern with this technology is user anonymity. Even if user codes are anonymous, the Bluetooth signals are not, as they can be traced back to a phone number or sever and hence reveal the identity of its users (Greenberg, 2020). Also, by using centralized servers a simple hack may reveal sensitive data of a large share of the population. Furthermore, if governments decide to disclose information about infected people, such as place and time a person has encountered them, their identity may be revealed potentially leading to stigmatization and discrimination. Hence, people might be reluctant to use such technology in the first place (Naughton, 2020). Additionally, once this pandemic is over, what will become of this technology? What information will be gathered and how can privacy and anonymity be ensured? What becomes clear is the necessity for a contact tracing application that addresses these outlined shortcomings. Unfortunately, there is a real danger that unsafe and privacy threatening contact tracing technology will be implemented, as will be demonstrated in the next section.

A Multi-Level Perspective

The Multi-Level Perspective (MLP) is most commonly used to evaluate innovation transitions, however, as we currently find ourselves in a time of transition, it will simply be used to point to the realistic possibility that unsafe contact tracing technology may be implemented. The MLP explains technological transitions based on the interplay of three different levels; landscapes, regimes and niches. Landscapes correspond to macro level changes, regimes to the current state of affairs, the meso level, and niches to the micro level, or protracted spaces where innovation can happen without being hindered by the regime. Innovation is seen as a multi-dimensional process and a result of the alignment of all three dimensions which may result in several pathways or typologies of innovation. From this perspective, landscape developments may create pressure on regimes, these in turn being de-stabilized giving the opportunity for niche developments to break through and challenge the regime (Geels & Schot, 2007; Geels, 2011).

The COVID-19 pandemic can be seen as a detrimental landscape development (macro level) which is de-stabilizing the current state of affairs, what we know as normal (e.g. economy, daily lives). As the regime is weakened and governments and civil society desperately seek to find ways of combating the pandemic, a window of opportunity is created for niches, in our case contact tracing technology. Contact tracing technology per-se is not new, however, under stable circumstances its implementation would not be warranted due to the stability of the regime. Contributing to this stability are privacy advocates, laws and regulations and the general awareness of civil society.

However, under circumstances of crisis, and with a destabilized regime, immature and dangerous contact tracing technology may be implemented. This may contain the pandemic, but also have severe long-lasting privacy

implications. Yuval Noah Harari (2020), warned about short term emergency fixes. He argued that such fixes tend to become fixtures of life that outlast emergencies. Hence, once a new technology is created, it is there for the long run. An example is the recent surveillance law passed by emergency decree in Israel. This permits intrusive COVID-19 patients' surveillance with technology used for anti-terrorism (Harari, 2020). It becomes clear how important for society as a whole it is to jointly evaluate contact tracing technologies and to be extremely cautious with its implementation in a moment of crisis. If rashly implemented and its shortcomings not accounted for, personal privacy may be under threat and prone to long-term abuse.

Recommendations

If contact tracing applications can stop the pandemic, they should be implemented. That is, there may be a necessary and desirable tradeoff between privacy and contact tracing in the case of the pandemic. However, technology companies, developers and governments must assure the maximum privacy possible for its users and consider long term privacy implications.

Firstly, contact tracing developers, such as Google, Apple and specific application designers should place privacy protection in the foreground of their developments. They should integrate extensive privacy measures in their product design and innovation. One innovative solution may be a fully anonymous gadget issued to every citizen that can only signal if a person is sick and their location. This would reduce privacy concerns with respect to who controls the data and limit the type of data that can be collected. Unfortunately, this solution is not feasible in the short run given the necessary product development and production times. Hence, a system that works via phones, which most people already have, would seem more practical. This however, as previously mentioned, may imply higher privacy risks.

As centralized contact tracing systems are insecure the ideal solution would be a fully decentralized system, circumventing data storage on any servers. However, this would require vast amounts of data to be downloaded on individual phones which is also not feasible. However, privacy and security risks can be greatly reduced with a system working on centralized servers with decentralized rotating randomness. Such a system would still use phone Bluetooth technology, and a central server, but extensively limit the information authorities could gather. This system is based on individual users broadcasting their (randomized) ID's, also called tokens, at a recurring frequency. The frequency is picked up by other devices in the vicinity and registered only locally on the devices. If a person were to be diagnosed positive, the user's token would be sent to a general server, which in turn broadcasts it to all devices. All devices receive the token and examine (locally) whether they were in contact with the infected person. This technology limits the information that passes on the centralized server, which is accessible to the government, whilst circumventing the fully decentralized systems shortcomings (Hart et al. 2020).

At this point in time, centralized servers with decentralized rotating randomness seem to offer the best tradeoff between privacy and contact tracing. Hence, it is recommended that this form of contact tracing be implemented. This system should, however, be complemented by additional privacy features to prevent long term monitoring and abuse. Firstly, contact tracing applications that are downloaded on individual phones could be self-deleting, and all its information, after a specific period of time. This may work in two ways. First, as current medical studies found, the incubation period for COVID-19 is fourteen days (Ferretti, 2020), hence, collected data that is older than fourteen days should be self-deleting. Secondly, the application may propose to self-delete entirely on a monthly basis, the renewal being subject to user consent. The first feature eliminates the possibility of third parties making

use of user data (where one was and with whom) in the future. The second feature would protect citizens that simply forgot they downloaded the application, which may still be running in the background and collecting data. Having these features enables users to be in control of their data, and hence increase their likeness of using such technology.

Open source development is also highly recommended for the creation of contact tracing applications. Again, in the product development stage, open source development would increase transparency and privacy through international and cross sectoral cooperation. By openly and transparently developing the features of the technology, individual corporations and governments would be prevented from building back doors to the system and on deciding individually on what data is collected. This approach would make the technology transparent to all actors and parties (governments, businesses and society) and be open to public scrutiny, this ultimately leading to a safer technology. Not only will a superior product with better privacy protections be ethically more acceptable, but also people would feel more comfortable using it, consequently containing the pandemic more successfully.

Simply having the technology will not suffice in reducing privacy implications, hence, recommendations must also be made to policy makers and governments. Borras and Rosenquist (2013) outlined three main pillars of policy instruments; regulatory, economic and soft instruments. Regulatory instruments, laws and regulations, must be developed to hinder the release of premature technology but also to keep in check governments. In the case of Europe, the GDPR law prohibits the processing of citizen's personal data by third parties (European Commission, n.d.). However, states sovereignty may lead to the infringement of such rights, as in Israel, by emergency decree. Specific to western democracies, politics can be seen as a dialogue between a larger public and experts of a community attempting to solve communal problems (Hoppe, 2013). Hence, any rash decisions (emergency decrees permitting intrusive data collection) contradict core democratic values (Borras, 2012). Thus, governments must refrain from such actions.

Regulatory measures should also be complemented by specific soft instruments, such as ethical codes of conduct that protect user privacy. Governments and corporations such as Apple and Google could subscribe to a "COVID-19 Code of Conduct" pleading to make all their decisions and actions fully transparent. They may assure full transparency on what data is collected, how it is used, and what it means. Furthermore, they may keep the public informed on changes and progress via monthly reports or weekly online updates. Again, as with open source development, an informed public will feel safer and included, hence also be more willing to make use of contact tracing applications.

Finally, a recommendation is made to civil society, as the success of contact tracing requires large scale implementation (University of Oxford News, 2020). We need reciprocal altruism, paying an intimate cost for a non-intimate other, in cooperative cultures to improve group welfare (Levi, 2017). Therefore, this paper calls for civil societies' collective action in adopting this technology. However, to only do so once contact tracing is transparently developed and utmost privacy protection is assured by laws and regulations. Ultimately, and in answering the research question, there will always be a tradeoff between contact tracing and privacy, as no technological solution can provide full privacy protection (e.g. hacking). However, this tradeoff can be mitigated, as shown here, by the creation of safe and transparent technology and with its extensive regulation.

Limitations

As with any recommendations there are also limitations. The tradeoff that occurs between contact tracing and privacy may be mitigated in western liberal democracies, due to laws and constitutional rights, yet ignored in less democratic countries such as China. In fact, China is already monitoring its citizen by using face recognition, smartphone tracking and forced self-reporting of body temperatures (Harari, 2020). Hence, the tradeoff between privacy and contact tracing varies in relation to regimes as the role and importance of actors vary. Therefore, the recommendations made may not be generalizable. An additional limitation for contact tracing technology may be its required large-scale implementation. This may be problematic as not all people possess a phone or Bluetooth proximity-sensing systems (Naughton, 2020). Moreover, open source collaborations may prove difficult due to the variety and number of actors involved, these potentially having conflicting interests (e.g. more personal data wanted) leading to deadlocks. Additionally, the called for scrutiny and monitoring of contact tracing technology before its implementation requires time, and time is limited in crises. Finally, it was assumed that increasing privacy and reducing information accessible to third parties is required for successful large-scale implementation. This may not entirely be the case as people may still implement contact tracing applications if healthcare services had full access to their information, given their privacy was protected. Such a position may be an interesting point for further investigation and debate. Ultimately, more research is needed on contact tracing technologies and its shortcomings to comprehensively evaluate which tracing system and applications are the best, and safest ones.

Conclusion

A transition to the usage of contact tracing technology is happening and we are in time to shape and regulate its *modus operandi*. On the one hand, contact tracing applications demonstrate to have a great potential in fighting the spread of COVID-19, due to low battery Bluetooth technology and ease of implementation. On the other hand, severe implications include technology companies and governments' ability to decide the extent and use of data, giving rise to potential long-term privacy implications e.g. state surveillance and lack of user anonymity. The case was made that under normal circumstances contact tracing technology would be scrutinized and further developed, however, in a moment of crisis, immature technology could be implemented. This dangerous possibility was exemplified from an MLP perspective, highlighting the pressing relevance of this topic.

It was concluded that there will always be a tradeoff between contact tracing and privacy, as no technological solution can provide full privacy protection. However, this tradeoff can be extensively mitigated by the creation of safe and transparent technology and its extensive regulation. Hence, a contact tracing application was recommended that is openly and collectively developed, with self-deleting features which uses centralized servers with decentralized rotating randomness frequencies. Additionally, privacy tradeoffs can further be mitigated by the upkeep of current data protection laws and policies and their further development. Finally, more transparent and safe contact tracing will increase the willingness of people to use such technology, hence, also increase its likeliness of its success. Ultimately, this paper calls for change, yet, change with prudence. It calls for the implementation of contact tracing technology and for governments and technology companies to respect individual privacy rights, democratic values and laws and regulations. Global altruism and cooperation are also called for, as only with large scale cooperation contact tracing will become feasible and successful. The decisions that are taken today will shape the future of humanity, let us be hopeful that in a moment of crisis global cooperation can be placed above self-interest and profit maximization.

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In-Vitro Meat: A Replacement for Meat?

Amélie Grieco

Introduction

Since 1960 global meat production has three-folded (Kaur et al., 2015). Meat demand is increasing as the world is becoming more urbanized and population is growing (Ibid, 2015). Only in the European Union (EU) 10.8 kilograms (kg) of beef and veal were consumed per person in 2018. In the United States (US) the number were even higher with 26.1 kg of beef and veal per person in that same year (OECD, 2019). These figures highlight the importance of meat in our society. This is due to the Western meat culture. Firstly, meat is often associated with wealth and high social status, human supremacy over the natural world and masculine strength (Chiles, 2013; Swatland, 2010). Secondly, meat culture has deep roots in Western societies as it has been consumed since Roman and Greek times (Swatland, 2010). In the framework of this paper Western societies is used interchangeably with Europe and the US.

Despite meat importance in the West, it's production and consumption pose problems. Firstly, it is very polluting as livestock emit methane and nitrous oxide, which are the most polluting greenhouse gases (GHG). Secondly, even though meat has health benefits, it also contains saturated fats and dietary cholesterol which increases the risk of diseases (Kaur et al., 2015). Additionally, the consumption of meat has caused multiple disease outbreak such as Swine flu, Mouth disease (FMD) and possibly COVID-19 (Kaur et al., 2015; Readfearn, 2020). Furthermore, the use of antibiotics and drugs to promotes livestock growth in industrial farming has harmful effects on humans, by increasing antibiotics resistance (Kaur et al., 2015). Finally, animal welfare is not respected in factory farming. Animals are confined in hostile environments, do not travel in good condition and get injured due to wire meshes (Kaur et al., 2015).

Considering these negative implications of meat consumption, a regime transformation is required. In-vitro meat, also known as lab or cultured meat, can provide this change. Scientists created meat products from muscle cells. For example, Dr. Mark Post at Maastricht University created the first in-virto burger in 2013 (Alvaro, 2019). To do so muscle cells called myosatellite are harvested without harming the animal. These cells are then isolated which allows the myoblasts to proliferate. When the sufficient quantity of cells develops, they are assembled in groups of 1.5 million cells to form muscle tissues which are similar to muscle fiber in a 'normal' steak. With 10 000 muscle tissues and seasoning a hamburger can be created (University Maastricht, n.d.). However, this innovation is still at a niche stage (Ghosh, 2015; University Maastricht, n.d.). Hence the research question, how can in-vitro meat be incorporated and transform the meat-dominated socio-technical Western regime? This is a relevant question to ask as changing consumption and production pattern are necessary to avoid damaging the planet (NASA, 2014). Moreover, from an academic standpoint, previous research on lab-grown meat focused on why this innovation will not be a viable to meat (Alvaro, 2019; Chiles, 2013; Kaur, 2015). This paper will try challenge this idea by arguing that despite all the barriers in-vitro meat faces, it can transform the current regime by being paired with another innovation.

This paper first analyzes the Multi-Level Perspective (MLP) theoretical framework. Secondly, it applies the MLP to analyze which actors facilitate (driver) or hinder (obstacle) the transformation of the current meat dominated socio-technical regime. Thirdly, recommendations to overcome these obstacles are proposed and their limitation are highlighted. Finally, the paper concludes by answering the research question and give an insight for further studies.

Theoretical framework

In order to analyze what are the drivers and obstacles for in-vitro meat to challenge the current regime it is necessary to present the Multi-Level Perspective (MLP). This framework was chosen as MLP is suitable for analyzing socio-technical and environmental transitions. In-vitro meat is both a socio-technical transition and an environmental transition. It is a socio-technical transition as it requires a technological transition and changes in practices and institutions (Geels, 2011; Markard et al., 2012). Lab-grown meat is also an environmental transition as it requires the current regime to adopt a sustainable mode of production and consumption (Geels, 2011). To facilitate the entry of green innovation in the regime interaction between different actors are necessary (Geels, 2011).

The MLP explains transition with three main concepts; socio-technical regime, niches and landscape development (Geels, 2004; Markard & Trufer, 2008). The regime is a selective and stable environment which makes it hard for

radical innovations, also known as transformative or revolutionary innovations, to become part of it (Geels, 2004; Markard & Trufer, 2008). In-vitro meat is a radical innovation as it challenges existing links between markets and institutions and requires new knowledges and skills (Abernathy & Clark, 1985; Di Silvio et al., 2018).

Radical innovations struggle to disrupt the regime for three main reasons. Firstly, a stable regime is composed by cognitive, normative and regulative rules which shape actor's perception and action (Geels, 2004). Cognitive rules are shared belief and expectation system that dictate the perception of the future. Normative rules shape how one is expected to behave according to its role. Finally, regulative ones are legally binding and can be established by the government for example (Ibid, 2004). There are cognitive, normative and regulative rules which dictates how the meat industry should work which provides stability (Hao et al., 2020; Schneider, 2013). Therefore, these rules strengthen the meat-dominated regime by shaping actors' perceptions and actions.

Secondly, actors and organizations are interlinked, thus, stabilizing the regime. Geels (2004) argues that firms develop relationships with many actors. Together, they create culture, norms and ideology which makes it difficult to disrupt these relations. Moreover, firms have interests in keeping the current regime, hence they fight change through lobbying for example (Ibid, 2004). In the current regime, producers, suppliers and consumers have been interlinked for centuries, resulting in making meat eating a norm and part of the Western culture. Moreover, the meat industry developed powerful lobbies, especially in the US, to defend their interests (Heid, 2016). Hence, the connection between actors and organizations reinforces the current meat-driven regime.

Finally, the socio-technical regime infrastructures are already existing. Thus, making it difficult for a radical change to emerge as new infrastructures would be needed (Geels, 2004). In the case of meat production, this industry has for example, massive infrastructure to grow and store cattle and slaughterhouse (Lewis & Peters, 2011). Hence, this adds an additional difficulty for lab-grown meat to disrupt the current regime.

Even though the socio-technical regime is very stable, revolutionary innovations can still emerge (Geels, 2004). In the MLP framework, before innovations can challenge the regime, they need to develop in protected space called niches (Geels, 2011). Actors within the niche can be entrepreneurs, start-up or other kinds of actors which create something that is different from what is in the regime (Geels, 2011). Niche development is characterized by three processes. Firstly, it is necessary to guide the innovation activities. Secondly, building social network and involve different actors is crucial. Finally, social learning, through experiments, is essential to understand what the market demand is, which infrastructures are needed and what kind of policy instruments need to be implemented (Geels, 2011).

The last element of the MLP is the landscape development which cannot be influenced by the regime nor the niches. However, it can impact socio-technical regime and niches dynamics. The landscape usually takes a long time to change yet, when it does it can create pressure on the regime and destabilize it. If the niches are sufficiently developed, they can take this opportunity to enter or disrupt the regime (Geels, 2011). Based on the MLP the following section analyzes the drivers and obstacles for cultured meat to challenge the current regime.

Drivers and obstacles for cultured meat

This section analyzes how these actors are drivers and/or obstacles for a transition from the current meat-dominated regime to an in-vitro meat one. Drivers are defined as elements that accelerate or facilitate the transition, while obstacles hinder it. Before doing so it is necessary to identify the different actors on the different levels. In the technological niches the main actors are scientists and researchers. Investors are also necessary in order to fund research. In the Socio-technical regime the market, regulations and public opinion are important actors. The main actors in the landscape development are climate change and the meat culture.

a. Drivers

On the niche levels the main actors that work to create a transition are scientists and researchers and entrepreneurs. Researchers and scientists aim to develop meat that does not have negative effects on the environment, on animal's welfare and human's health (Chiles, 2013). Lab-grown meat uses 45% less energy, emits between 78% and 96% less GHG emission than the production of meat in Europe (Kaur et al, 2015). Moreover, it would require 99% less land and would reduce between 82-96% less water compared to European meat production (Di Silvio et al., 2018; Kaur et al., 2015). In term of animal welfare, scientist argue that to extract the muscle cell no harm is done to animals

(University Maastricht, n.d.). Finally, because scientists can modify the composition of the lab-grown meat they can reduce the amount of fats and cholesterol which are harmful for human's health (Schneider, 2013). Lab-grown meat would also reduce the food-born infections such as salmonella (Di Silvio et al., 2018). Moreover, for in-vitro meat to come to life, researcher and scientist need funds and partnerships. Hence, investors also made the development of lab-grown meat possible. For example, a partnership Stegman and the Dutch government combined offered 2.3 million of euros (Chiles, 2013). Moreover, thanks to Maastricht University's collaboration with a start-up company, Mosa Meat, it managed to develop in-vitro meat (Di Silvio et al., 2018). Thanks to researchers, scientists and investors' efforts lab-grown meat has been created which offers the possibility to challenge the regime.

On the socio-technical level the actor that could help the transition to in-vitro meat is the market. Even though alternatives made with plant proteins are increasingly common, they are not a viable substitute to meat (Hao et al., 2020). Mainly because they have not convinced consumer because of their flavor, look and price (Ibid, 2020). In-vitro meat would fill the market's gap by providing a sustainable and healthy product which has the same color, texture and flavor as meat (University Maastricht, n.d.). Hence, the market provides an opportunity for in-vitro meat as no other product this similar to meat is available.

Finally, on the landscape level the actor facilitating lab-grown meat introduction to the regime is climate change. This actor is pressuring the current status quo which gives the opportunity for lab-grown meat to destabilize it. Climate change accelerated over the past decades because of man-made GHG emissions (NASA, 2014). The current production and consumption pattern are unsustainable on the long term (Kaur et al., 2015). The acceleration of GHG emissions will lead to the melting of glaciers, ocean-level rise and more extreme and frequent natural catastrophes such as hurricanes (NASA, 2014). Hence, the landscape is already pressuring the regime which can create an opportunity for in-vitro meat to leave its niche. Scientist and researchers, investors, the market and climate change facilitate the transition to a system that could be dominate by lab-grown meat

b. Obstacles

Even if there are actors facilitating the regime transition, other hinder it. On the niche level, scientists and researchers prevent the transition as they need to further develop in-vitro meat. Geels and Schot (2007) identify two elements that impact the transition from the niche to the regime: timing and nature of the interaction. If there is landscape pressure on the regime but the niche is not fully developed, then it is very likely that it will not take the opportunity and will stay in the niche. In term of nature of interaction, if the niche innovation is in competition with the regime then it aims to replace it. Some other niche innovation will be just added to the regime and enhance it (Geels & Schot, 2007). In this case, lab-grown meat is not ready to leave its niche. Scientists and researchers at Maastricht university claim that the invention still needs time to develop. Three or four years of research are still required before in-vitro meat appears in restaurant and special stores and another two to three years to enter supermarkets (Maastricht University, n.d.). Moreover, scientists have not found how to produce lab-grown meat in quantities that would satisfy the market's demand (Kaur et al., 2015). Another issue related to the development of lab-grown meat is that in order to grow cells in laboratories, blood from calf fetuses is needed. In addition to be very expensive, it harms animals (Ibid, 2015). This product does not respect animal welfare yet, hence why not consume meat then if animals get hurt. Finally, the last obstacle that hinders the transition is that scientist have not found a way to make the product more affordable. The Dutch lab-grown burger currently cost $330 000 (Zaraska, 2016). More research is needed to find ways to reduce this innovation price. Hence, because in-vitro meat is not ready to leave its niche and compete with the market, it is unlikely to generate a transition in the regime.

In the socio-technical regime actors that hinder the transition are regulations and policies and the Western public opinion. Firstly, there are no regulatory pathways for in-vitro meat (Di Silvio et al., 2018; Schneider, 2013). Regulations are essential to have a transition (Geels & Schot, 2007). In the United States (US), some claim that Genetically Engineered (GE) regulations could also be applied to in-vitro meat (Schneider, 2013). However, Schnierder (2013) argues that GE regulations were developed in the 1980s and therefore are too old to encompass the power of biotechnology. However, the author points out that some systems such as the Food and Drug Administration (FDA) could be modified to regulate in-vitro meat. This is possible if a new regulatory scheme is created to ensure safety for consumer in the production and distribution of the 'meat' (Schneider, 2013). Similarly, in the EU no regulations have been issued for in-vitro meat (Di Silvio et al., 2018). If in-vitro meat is genetically modified it could be included in the regulations and legislations concerning this type of food (Di Silvio et al., 2018).

Hence, depending on the production processes in-vitro meat needs a comprehensive regulatory framework (Di Silvio et al., 2018; Schneider, 2013). However, as there are no regulations for in-vitro meat in the West, it hinders the change of regime.

Secondly, Western public opinion is a major actor that limits the change of regime. Even though there are no study on consumers' responses, some researched the public's opinion on cultured meat (Chiles, 2013). The results demonstrate that the overall opinion is divided (Di Silvio et al., 2018). For example, while a study in the US show that 80% of the American population would not eat in-vitro meat, 68% of interviews in a British study show that they would be willing to eat this kind of meat (Chiles, 2013). As public opinion is divided, there is uncertainty about how people would respond to this innovation if it was one the market. If the Western public opinion is not ready yet to welcome lab-grown meat it will be more difficult to gain the public's support in case of transition (Geels, 2011).

On the landscape development level, the main actor hindering the regime's transformation is meat culture. In the West meat have been consumed for centuries and became a norm (Alvaro, 2019; Swatland, 2010). Despite scientific studies proved that eating meat is not good for human's health, meat consumption in the West is rising (Alvaro, 2019; OECD, 2019). The perseverance of this norm connected to the previous argument. Because eating meat is the norm Western consumers will be more reluctant to buy in-vitro meat (Di Silvio et al., 2018). Hence, this norm is very powerful as it sustains the meat-dominate regime and hinders the emergence of lab-grown meat. By having different actors at different levels hindering the transformation of the Western meat regime, it makes it difficult for lab-grown meat to bring change. Therefore, what could be done to facilitate the regime transition to in-vitro meat?

Recommendations and limitations

Even though there are multiple drivers, in-vitro meat has still many obstacles to surpass before being able to transform the regime. This section explores two ways in which lab-grown meat could be paired with another innovation which would facilitate its entry in the regime. Then limitations are presented.

Firstly, to help the regime shift, lab-grown meat could be paired with innovations in hospital food. Hospitalized patients are more sensitive to eventual food-borne diseases breakout (Brougher et al., 1989). Introducing lab-grown meat to hospitals would reduce, if not eliminate, the possibility of getting food borne diseases. This product's production is very controlled and sanitized which results in very low risk of having dangerous bacteria (Di Silvio et al., 2018). Hence, in-vitro meat could make hospitals foods safer which would convince the government to support it and promote the emergence of regulations. Hereby, it would accelerate the regime shift.

Secondly, digitalization of food could be paired with in-vitro meat. Digitalization of the food industry consist of having consumer communicating with producers, so that the production fit the consumers' demands (Demartini et al., 2018). Lab-grown meat would complement this innovation. In-vitro meat could be modified to meet consumers' dietary requirements (Schneider, 2013). The combination of these two innovations could help lab-grown meat to gain professionals, such as nutritionist, support. As most consumer trust professionals, it could facilitate the public's acceptance for in-vitro meat which in turn would help it to transform the regime (Pettinger, 2018). Moreover, producers could highly benefit from positive consumer's experience with the product on popular hubs online. This could transform the public opinion on lab-grown meat and facilitate the product's acceptance in Western societies.

Even if these recommendations would facilitate the inclusion of in-vitro meat in the regime, they have some limitation. Firstly, hospital food and the digitalization of food will be very likely directed to wealthy consumers. Even if in-vitro meat will be much cheaper than it is now, it is still expected to cost around $10 per burger, which is much more expensive than a normal burger patty (FAQ). Therefore, it will not be accessible to everyone which means that meat consumption will continue to rise.

Another issue with these recommendations and especially the digitalization of food is data protection. Companies will have access to sensitive and private information regarding consumers that they will be able to sell. Unless, there are changes in data protection policy this might become a challenge.

Finally, there is the issue of social acceptance and change the norm of eating meat, as mentioned above. Even if lab-grown meat will be made available hospitals and on app to customize food demand, it does not necessarily mean that people will choose this food. Moreover, there is the risk that lab-grown meat will never replace meat but will just be an option that people will be able to choose from (Alvaro, 2019). Hence, even if these recommendations

should facilitate the transition towards a new regime, they might still be not enough to push lab-grown out of its niche.

Conclusion

Meat production and consumption has been very damaging for humans' health, the environment and animal welfare. Hence, scientist have developed in-vitro meat. This innovation is still in its niche. Yet, thank to scientists and researcher work combined with entrepreneurs, lab-grown meat could challenge the regime. Moreover, the lack of meat alternatives on the market and climate change are two other drivers that help in-vitro meat to disrupt the regime. However, obstacles such as need for further research, lack of policies and the public opinion and meat culture prevent this innovation to transform the current meat-dominated regime. Hence, to incorporate and transform the regime, lab-grown meat should be paired with another innovation such as hospital food or the digitalization of food.

This paper is a call for change. Climate change is pressuring us all, and something must be done before its effects become irreversible. Humans' way of producing and consuming must be transformed. Hence, lab-grown meat must challenge as soon as possible the current regime, by being paired with another innovation, in order to avoid the irrevocable.

If in-vitro meat manages to challenge and transform the regime, it would be necessary to analyze consumers' response. Further research could study if lab-grown meat will attract buyers. Moreover, analysis on the evolution of meat culture and the establishment of having in-vitro meat as the new norm would be indispensable to evaluate customers' response.

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Cell-based Meat: A Regime Changing Innovation Still in Its Infancy

Babette van Giersbergen

Introduction

In 2018, one out of nine people on earth suffered from hunger. Although the level of undernutrition started to reduce in 2000, the past five years this reduction turned into a rise again (FAO, IFAD, UNICEF, WFP, & WHO, 2018). These numbers are disturbing, considering the fact that the world population is rising fast and is expected to grow to 9,7 billion by 2050 (United Nations, 2017). The pressure that the current and future world population will exert on our world's ecosystems must not be underestimated. Deterioration is already evident in our agricultural systems, with climate variability and extremes as one of the main barriers in achieving sustainable development goal 2 of zero hunger (SDG2) (FAO et al., 2018). The current way of producing, consuming and distributing food is unsustainable and can't be upheld in light of the sustainable development goals of 2030 (United Nations, nd). According to the United Nations and the Food and Agricultural Organization (2009), the current status of the livestock industry forms one of the main challenges to meet SGDs 2, 12, 13 and 15. This sector contributes to 13-18% of human caused greenhouse gas emissions (Pitesky, Stackhouse, & Mitloehner, 2009).

Considering this high impact, this paper investigates a possible transition of the status quo in the meat sector to one that is more sustainable and can tackle the problems of undernutrition as well as the earth's ecological degradation. It proposes cell-based meat as a niche development that could trigger a transition towards more sustainable ways of producing and consuming meat. Consequently, this paper aims to answer the following research question: how can cell-based meat stimulate a transition of the current meat industry to make it more sustainable? To address this question, the first section of this paper discusses the problems associated with the current meat industry and suggests cell-based meat as a solution. The second section proposes the multilevel perspective as a theoretical framework that serves to answer the research question. Then, the third section investigates the possibilities of triggering a socio-technical transition by applying the multilevel perspective and exploring drivers and barriers of cell-based meat. The fourth section then proposes a solution to overcome certain barriers after which a conclusion is made, and limitations mentioned. This paper concludes that a transition to a more sustainable meat industry can only happen when the innovation is sufficiently developed and supported by a shock from an exogenous environment.

The Problems

Currently, a multiplicity of problems is associated with the production and consumption of meat and its prospected future. These issues involve overconsumption of meat in western countries, undernutrition in developing countries due to unfair distribution of animal-based proteins, exploitation of animals, health issues caused by antibiotic residue and bacterial contamination in meat and the massive amount of greenhouse gases emitted by the livestock industry (Theurer, Lazar, Jeffrey, & Ackerman, 2019). Although cell-based meat forms a solution to all of these issues in some way, this paper aims to prioritize a proposed solution to the most pressing problems in the author's personal view: that of feeding a hungry world and combatting climate change.

With the world population on the rise, global meat consumption is expected to rise by 73% in 2050 compared to current levels. This means that even more mouths have to be fed in the future and that even more of our natural resources have to be depleted to fulfill this goal. Currently, the production of 1 kilogram of meat requires 15.000 liters of water, while global livestock farming accounts for 7,1 trillion kilograms of CO2 emissions per year. Researchers found that, considering these numbers, the livestock sector will occupy the majority of the 'safe operating space' for humanity in 2050. Therefore, the growth of this sector must be slowed down, or we will cross our planetary boundaries (Pelletier & Tyedmers, 2010).

The Solution: Cell-Based Meat

Proteins are an essential part of the human diet. They constitute about 20-30% of one's daily recommended food intake and provide us with amino acids that are necessary for growth and repair. The most essential amino acids are

found in animal proteins, which provide those amino acids that plant-based proteins lack in a sufficient quantity to keep the human body healthy (Forum for the Future, 2017; Smil, 2002). Thus, humans can't solely rely on proteins from plants. Especially in the west, but with developing countries following up on the trend, meat consumption is highly popular and not likely to be replaced by non-meat alternatives soon. This is where cell-based meat starts to play an important role.

Cell-based meat is an alternative to meat taken from a full-grown animal. It is made from cells extracted from an animal, which grow into a high-quality cut of meat. A scientist starts by taking cells from a living animal and brings it to a lab. Those cells are then placed in a fluid that helps the cells to multiply, mimicking the role of blood in a living animal. These cells are then placed in a bioreactor to convert them to muscle tissue. This results in a piece of meat that has the same taste and texture as conventional meat, although it accounts for much less environmental damage and uses fewer resources (Theurer et al., 2019). The image below shows the efficiency of cell-based meat compared to that of conventionally farmed meat products:

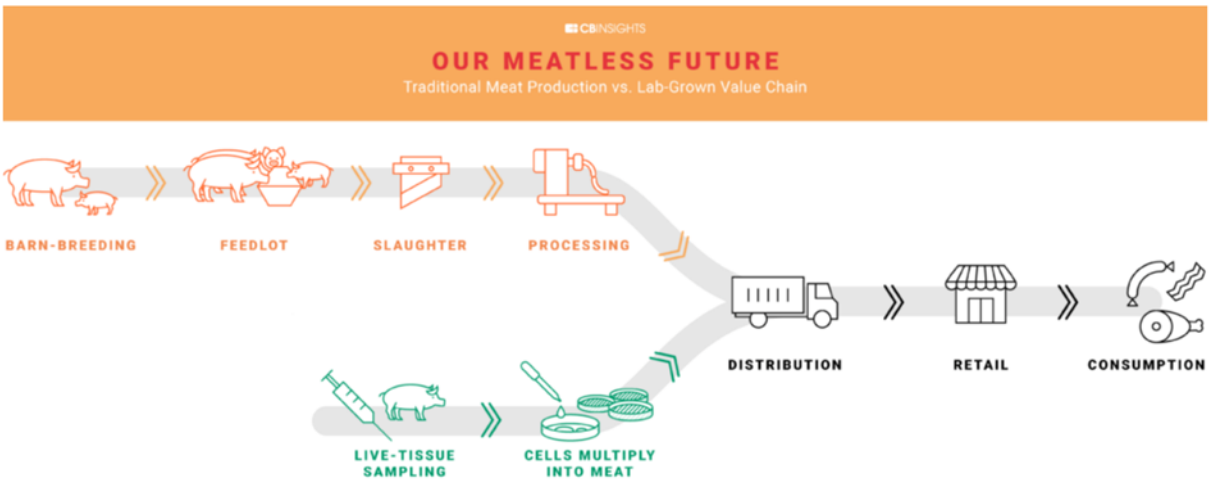

Figure 1: Traditional meat production vs. lab-grown value chain (CBInsights, 2019)

Lab-grown meat could form a great relief on our natural systems and a big contribution to combat climate change. Although the ecological footprint of lab-grown meat is not fully known yet, it is clear that it's use will result in significantly less pressure on the environment. It results in 7-45% lower energy use, 78–96% lower greenhouse gas emissions, 99% lower land use, and 82–96% lower water use depending on the product compared. This is a promising prospect in light of achieving sustainable development goals 12, 13 and 15: 'responsible consumption and production', 'climate action' and 'life on land' (Tuomisto, Ellis, & Haastrup, 2014). In regard to sustainable development goal 2, 'zero hunger', cell-based meat forms a solution as well. Once produced on a large scale, it can provide the world population with those necessary amino acids and decrease the level of worldwide malnutrition (Cameron, O'Neill, Specht, Derbes, & Szejda, 2019).

Theoretical framework

In order to determine how cell-based meat can encourage a transition towards a more sustainable meat industry a theoretical framework that takes into account all necessary variables is needed. Before identifying such a framework, it needs to be established what kind of system and what kind of possible transition will be dealt with in this paper. Once this has been established, this section moves on to introduce the multi-level perspective as applied transition theory.

a. Type of system, transition and innovation

There are many different types of systems, one of which is the socio-technical system. In socio-technical systems, different elements including networks of actors, institutions and knowledge interact with each other and together

constitute a system (Geels, 2004). When one of these systems transitions into a new one, or causes a transition within another system, it is called a socio-technical transition. A social-technical transition is defined as "a set of processes that lead to a fundamental shift in socio-technical systems" (Markard, Raven, & Truffer, 2012, p. 956). The difference between a socio-technical transition and the 'traditional' technical transition is that the former does not solely challenges the prevalent technology but also changes the material, organizational, institutional, political, economic and socio-cultural dimensions of the system. Thus, socio-technical transitions encompass shifts to new types of infrastructure, user practices and cultural values (Markard et al., 2012). As the meat industry is a system that involves many different companies, organizations, regulations and norms as well as knowledge, it can be considered a socio-technical system. Therefore, we assume that a change in this system will present itself as a socio-technical transition.

Considering the multiplicity of actors involved in socio-technical systems, it can be established what type of innovation cell-based meat is and consequently, what type of transition model is necessary to investigate a possible shift in the industry. Figure 2 shows four types of eco-innovations. A distinction is made between innovations that are technologically radical or incremental and institutionally radical or incremental (Kemp, 2011). When considering all types of innovations, it can be concluded that cell-based meat is a transformative innovation. First, because its technology exists of a radical shift in knowledge skills and competences compared to traditional meat cultivation. Second, because cell-based meat creates new rules and regulations and user practices, thereby disrupting existing linkages in the meat sector (Kemp, 2011). Now that it has been established what type of system, transition and innovation cell-based meat involves, the following section moves on to explaining the model that describes such transitions.

b. The multi-level perspective

The multi-level perspective (MLP) is an effective model to explain how socio-technical transitions can evolve. It considers three different levels of socio-technical processes that are hierarchically organized. These playing fields interact with each other and can trigger a change of the current system. The levels, as described by Geels (2002), are the socio-technical regime, socio-technical landscape and technological niches. A transformation of these processes is embodied in a regime shift and can take different forms. Besides analyzing the different levels, the MLP evaluates the drivers and barriers of an innovation in order to determine how a regime shift can occur.

The first level, the socio-technical regime, refers to the current state of the industry. Thus, it is the 'status quo' of normalized institutions, actors, and practices. The rules of this regime are widely accepted, and it is thus difficult to challenge or replace this current order. The second level consists of technological niches, these are 'protected spaces' where new innovations can take form without interference from the current regime. The innovations made in these 'incubation rooms' are radical and developed by only a small group of actors (Geels & Schot, 2007). The third level in (2007) framework is the socio-technical landscape. This level functions outside of the influence from niches and regimes and can therefore be considered an exogenous environment. Although changes on this level materialize slowly, they put pressure on the current regime and create 'windows of opportunity' for the technological niches to materialize (Markard et al., 2012).

Figure 3 illustrates how transitions can occur from each of the levels (Geels, 2011). Each transition is determined by its nature and timing. This results in four pathways in which transitions can occur. These are transformation, reconfiguration, de-alignment and re-alignment, and technological substitution. These pathways illustrate that transitions do not necessarily start from the bottom, but can come from a multiplicity of actors and agency (Geels & Schot, 2007).

Applying the MLP to the Meat Industry

The former sections have introduced cell-based meat as a means towards achieving sustainable development goals 2, 12, 13 and 15 and proposed a theoretical framework with which a future transition in the meat industry can be explored. This section moves on by applying the MLP to the meat industry, in order to answer the research question 'how can cell-based meat stimulate a transition of the current meat industry to make it more sustainable?'

a. Exploring the current regime, niche innovations and landscape developments

The current status quo of the meat industry is reflected in the way in which meat is being produced, promoted, consumed and distributed now. Over 40% of the world meat production comes from confined animal feeding operations (Nierenberg & Mastny, 2005). This system is unsustainable, as it confines and kills whole animals in order to consume only a part of it (Cameron et al., 2019). Moreover, eating meat is still considered a luxury in many parts of the world. Therefore, the current user practice and mindset is to rely on diets that include a lot of animal-based proteins (Smil, 2002). This regime is involved with rich and powerful companies and other stakeholders, which makes is very rigid and difficult to change the system.

In light of this regime, the development of cell-based meat is the technological niche innovation. This niche is the place where cell-based meat initially got the chance to develop while being too small to gain real opposition from the meat industry. Cell-based meat, for example, got financial support from several more sustainable companies, 'the outsiders', that saw an opportunity in this novelty and thus exerted external influence (Theurer et al., 2019). The landscape developments that exercised pressure on the regime are two-fold. On the one hand, the growing world population and the fear that hunger will remain a major problem in the future forces humanity to review the status quo of the current meat industry (FAO et al., 2018). On the other hand, the increased attention for climate change and the growing evidence of its dangers cause major actors to demand action. Although the meat industry is strong and rigid, these landscape actors include national and global governors that demand change. Therefore, they exert pressure on the current regime, for example through the sustainable development goals (United Nations, nd).

Cell-based meat as niche innovation is currently following the transformation pathway. Cell-based meat is not yet sufficiently developed, as it cannot financially compete with conventional meat (Cameron et al., 2019). Once it is price efficient, it can lead to more disruptive changes of the status quo (Geels & Schot, 2007). Now, however, does the pressure from the socio-technical landscape only lead to a change in perception by some of the insiders from the regime. This is reflected in big food companies investing in cell-based meet R&D, and people starting to shift towards a more vegetarian or vegan lifestyle (Nierenberg & Mastny, 2005). On the other hand, the increasing pressure also leads to opposition by the current industry. They try to oppose the distribution of cell-based meat by filing lawsuits relation to labeling and regulations and spread wrong information about the health implications of their own products (Nierenberg & Mastny, 2005; Theurer et al., 2019). For now, cell-based meat only functions to create a new regime by slowly adjusting and reorienting the current industry. No major changes in user practice or production will be present. Once cell-based meat is more developed, it has the potential to disrupt and replace the existing regime with the help of a sudden and specific shock from the landscape (Geels & Schot, 2007). Such a shock could be embodied in climate disasters or wars triggered by famine, that give cell-based meat the final push to transform the regime once and for all.

b. Drivers of cell-based meat

One of the drivers of clean meat is the fact that there is an increasing awareness of the power and importance of proteins. With a growing world population, key players in the food industry, governments and societies start to understand the need for action. They recognize the important role animal-based proteins can play in this regard, as these provide the full range of essential amino acids needed by humans in sufficient quantities. Therefore, the innovation of clean meat could drive these actors to support and popularize the idea. This is already seen in undertakings such as 'The Protein Challenge 2040', 'Beyond Meat', and 'the Good Food Institute' (Cameron et al., 2019; Forum for the Future, 2017).

Another driver of the innovation is the increased attention that climate advocacy groups around the world get. Although they don't necessarily promote the production of clean meat and might even oppose the use of animals for food, important stakeholders do increasingly realize that climate change is a real and pressing problem. This realization in combination with a partial solution to the problem could spark the popularization and investment in clean meat. Moreover, the cell-based meat industry has seen an increased amount of funding to its research and development. $73.3 million has so far been invested and investments have grown exponentially over the last years. These investments show that companies really see a future in lab-grown meat (Theurer et al., 2019).

Furthermore, every new technology has the risks that consumers won't like it once it is available. However, a 2018 survey across Indians, Chinese and Americans shows that cell-based meat already has a relatively high acceptance rate. Although it depends on many variables such as one's culture and one's familiarity with the product, most

participants were likely or extremely likely to consume cell-based meat once it comes out for the public (Theurer et al., 2019). Here, people are motivated by cell-based meat health benefits compared to conventional meat, as well as its low ecological footprint and lack of animal harm (Haagsman, Hellingwerf, & Roelen, 2009). Another factor is the realization that conventional livestock farming is much more receptive for the spread of diseases such as the avian flu, but also recent examples like Covid-19. People start to recognize the benefits of a world wherein these diseases cannot be carried by livestock and spread among humans any more (Nierenberg & Mastny, 2005).

c. Barriers of cell-based meat

However, there are also several barriers to the innovation. First of all, clean meat comes with high research and development costs. As mentioned earlier, the production of a piece of cell-based meat is now much too costly to be profiting. Although the technology is expected to be economically feasible in the future, funds have to keep on increasing in order to get these costs down (Cameron et al., 2019). Currently, cell-based meat R&D receives much less funding than plant-based food. It accounts for only 6% of the total investments in plant-based and animal-based food (Theurer et al., 2019). A possible stagnation of investments could result in a failed attempt to change the current regime with this innovation.

Second, there is the possibility that regulations by food and health authorities in the United States and Europe pose a threat to its distribution and labelling. This opposition is likely to be sparked by the conventional meat industry. The American Food and Drug Administration and the U.S. department of agriculture have already announced to closely monitor the production and distribution of the cell-based meat, but many questions regarding the rules around the product are still unanswered. One possible issue that could arise is that conventional meat producers will claim that cell-based meat cannot be labeled as 'meat'. This problem of labelling is still being debated in court over the labelling of plant-based 'milks', but could also form a threat for the labelling of meat produced in a lab (Theurer et al., 2019).

Conclusion and Recommendation

This paper showed the need for a regime shift in the meat industry and identified cell-based meat as a viable solution. It explored the possibilities of such a regime shift and found that a certain shock from the landscape or a quicker development of the niche innovation is needed in order to replace the current regime. It also identified several drivers and barriers of cell-based meat as a niche innovation shifting towards a new regime. As landscape development happen slowly and are less likely to change the status quo in the meat sector soon, this paper proposes a solution to one of the barriers in order to quickly develop the niche innovation of cell-based meat. In that way, it can cause a technical substitution of the conventional meat industry instead of only slowly changing parts of it (Geels & Schot, 2007).

To overcome the barrier regarding high research and development costs, animal activist organizations could start a sharing platform in collaboration with cell-based meat researchers. Such a platform could try to create awareness on animal rights while asking people for donations by means of crowdfunding. These organizations will be able to use their public support and popularity to encourage a transition to cell-based meat by sharing the donations with researchers of cell-based meat. The central idea is that animal activists and supporters of clean meat inherently have a similar goal: both aim to protect animal's rights and support a more sustainable food industry. Several big animal activist groups such as PETA have already advocated for the production of lab-based meet as they see it as a possible alternative to vegetarianism or veganism in the current society (Haagsman et al., 2009).

Of course, several skills and infrastructures are necessary for such a protect. These include the skill to mobilize a great amount of people, as well as the skill to build such a platform and get animal activists enthusiastic about the plan. Moreover, the way in which people think about eating meat still has to change, as overconsumption is still possible once clean meat becomes widely available. Although many obstacles lie ahead, this platform could form a starting point from where more R&D into clean meat can result in lower production costs and eventually a transition of the regime. In doing so, several of the world's biggest problems could tried to be tackled to the largest extent possible.

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Innovation for Global Plastic Waste Policies: Combatting Marine Plastic Pollution

Ceel Poels

Introduction

Plastic makes up a big part of our existence. Not only in the visible ways, through objects we use in our daily live, but also in non-visible ways; floating around in the ocean in the form of 'waste patches' or in our blood in 'microplastics'. Although plastic is a human invention, it nowadays can be found in every corner of the world. In an attempt to innovate the way, we are handling our plastic waste, it is necessary to look at a sustainability transition.

The aim of this paper is to investigate current policy programs revolving plastic waste management, and to set up a framework for an innovation of the current policy regime. The way this will be done, is by first describing the motivation for innovating the system, then looking at the current situation regarding the system in a quick review, and finally using the multi-level perspective approach for setting up the innovated system. The main idea behind the innovated system is a policy program in which there is both a shared and an individual responsibility for managing plastic waste, in which the biggest driver is the health implications of marine plastic pollution.

Motivation

The motivation behind the innovation has multiple dimensions. First of all, a great motivation is that the sustainable use of the ocean incorporated within the sustainable development goals. Specifically, sustainable development goal (SDG 14), commonly named 'life below water'; which aims to 'conserve and sustainably use the oceans, seas, and marine for sustainable development (United Nations, 2015, p. 26). Meaning that, first and foremost, by 2025 it aims to prevent and reduce marine pollution of all kinds, in particular form land-based activities. The pollution of the ocean by plastic obviously falls under this category. Another sustainable development goal that captures the need for this innovation is SDG 15 which aims to 'protect, restore and promote sustainable use of terrestrial ecosystems … and halt biodiversity loss (p. 27). Since in the ocean there is also the case of an ecosystem, the degradation and biodiversity loss within these, caused by plastic pollution, should not be neglected. The fact the problem of marine plastic pollution is covered by two sustainable development goals makes it a seemingly 'trending' theme of innovation, however it apparently is not 'trending' enough because the amount of plastic ending up in the ocean is only increasing (Borrelle et al., 2017). Also, as my review of the current policy program of the life cycle of plastic will reveal, there is a lot of progress that can still be made in the policy making. Overall, I think that, although the problem is covered by the SDG's, because there is no specific goal for marine (plastic) pollution, it does not get the attention that is needed to solve the problem.

Personally, I have the opinion that it should get a lot of attention. Marine plastic pollution is not only affecting the undersea ecosystem and sea life, but also the health of the human population (Cózar et al., 2014). Making this not only a problem that most people would be willing to neglect, because it seems to not affect them directly, thus is a false assumption. This false assumption is a driver for my own ambition, because I think that that awareness can make a change in this world and looking at how this mean can be used for innovation is crucial. Overall, I think this environmental problem having direct implications is the reason why it should be fairly easy to convince people of its importance, and thus it should be relatively easy to convince people there is a need for change.

Looking at the problem from an academic perspective, there is a relevant need for innovation, because there is no centrally recognized global scientific or political authority that aims to address the plastic problem (Nielsen, Hasselbalch, Holmberg, & Stripple, 2020). Overall, there is no common agreement of how the problem should be defined, which makes the problem further complicated to find a suitable solution, which is also sustainable.

Tragedy of the commons

The tragedy of the commons as formulated by Hardin, is the given that when rational individuals are faced with decisions, they will always choose the option that would benefit themselves, even when this would put a stress on the commons (Dryzek, 2013). This is also what is the situation when looking at the way the marine plastic pollution is caused. All states and individuals want to use plastics, but none of them want to deal with the waste that eventually ends up in the common good, in this case the ocean. Therefore, my approach in innovating will follow

the discourse of sustainable development in environmentalism. I chose this discourse because it deals with the tragedy of the commons by advocating a change in which the exploitation of resources and other ways the order of the global system is managed is in harmony and enhances the Earth's potential to meet human needs. Next to that, it currently is the widest accepted discourse in environmentalism.

Review

In order to be able to set up the best innovation for global plastic regime, it is crucial to start by investigating and reviewing the current plastic life cycle. This will be done by looking at the different stages of this cycle separately and their implications for the environment during these stages, and the visible trends within the stages.

Production

The production of plastic, of which 99% from fossil-fuel, is in itself not a sustainable material, and asks for a large global demand of resources due to its large-scale consumption, however, because the material is relatively cheap and easy to produce, is not very likely to be neglected as a widely used material (Hopewell, Dvorak, & Kosior, 2009). Only 1% of the global plastic production currently is biodegradable, mainly because of relative high production costs and low awareness although the technology is there.

Consumption

After this environmental costly production process, the plastic is often used for a very short term, since a large share of the production is aimed at single use plastic, for example plastic packaging, bags and bottles (Hopewell, Dvorak, & Kosior, 2009).

Waste management

After this only short term of actual usage of plastic, the reuse and recycling of end-of-life plastics is very low, particularly in comparison with other materials such as glass, paper and metals (Ellen MacArthur Foundation, 2016). In Europe, which is actually one of the better managing regions, only 30% waste is collected; and much of that is shipped to third countries to be processed (European Commission, 2018a). Insufficient waste management is framed as the key issue behind plastic pollution; however, it is doubtful whether increasing the amount of recycling can keep up with the speed at which plastic is produced.

Current policy programs

When looking at emerging trends in the current policy programs regarding plastic management there is a main trend that defines the global policy response to the problem of marine plastic pollution. This of policies promotes the idea of a 'circular economy'; meaning that the plastic that is produced is aimed to be recycled. The problem with this idea, however, is that the link from circular economy to sustainability is too weak to function satisfactorily (EMA, 2017). This link is weak because a circular economy main aims to attain economic prosperity, something which is not easily reached when other and less sustainable options are cheaper. Next to that, the main problem with the current policy programs is that the connection between different parts of the world is lost. For instance; a program may cause there to be less plastic waste in Europe, but this is done by shipping the waste to Asia, where the waste is not properly handled, and still ends up in the ocean.

When looking at the progress that is reported by the United Nations in the context of the sustainable development goals, there is only reported progress on other things that have to do with the ocean, but nothing on the plastic pollution specifically. Although one on the main targets of the goal is to prevent and reduce plastic pollution, this goal has not yet booked any progress. This situation shows how the aim to combat plastic pollution set up by this sustainable development goal has not initialized any progress yet.

The only existing programs regarding plastic waste include only a couple of states together (mainly programs set-up by the EU) (Nielsen et al., 2020). The reason why this is not sufficient is because it is evident that European countries ship their waste to Asian countries, where it is often poorly managed due to a lacking infrastructure, and still ends up in the ocean.

Policy Innovation

Sustainability transition

When trying to identify what type of transition is necessary for the problem of marine plastic pollution, it becomes clear that this needs to be a sustainability transition. Such a transition has three main characteristics; they aim to address a persistent environmental problem, do not offer obvious users benefits, and are most needed in the domain of large firms (Geels & Schot, 2007). The first characteristic is met because the marine plastic pollution is a environmental problem, since it interferes with the ocean's ecosystem and sea life, which is persistent, because the plastic is accumulating in the ocean and can stay around for up to a thousand years (Hopewell, Dvorak, & Kosior, 2009). The second characteristic is also met, because there are no obvious users' benefits to solving the problem of plastic pollution. This an important characteristic because the solution not giving 'obvious' benefits is greatly emphasized within this problem, since there are direct health impactions caused by the pollution. As I explained in my motivation and will now emphasize again; this makes that the solution gives even more actual benefits than people would expect, compared to other environmental solutions. The last characteristic is also fitting, because the marine plastic pollution is a problem mostly revolved around the production and waste management by large firms. However, within this problem there is also a big responsibility for consumers, because they have the ability to make a choice; to recycle or specifically use biodegradable plastics.

Overall, the characteristics of sustainability transitions are what make them hard to implement in a society. Therefore, looking at the ways this transition could differentiate from these characteristics is what would make them easier to implement.

Multi-level perspective approach (MLP)

The MLP approach is an approach that goes beyond studies of single technologies, which is needed in both aspects that come with an environmental transition (Geels & Schot, 2007). These aspects, being multi-dimensional and structural change, are involved in an environmental transition. There is a need for a change in the established system to make a change at every level of the problem, and there is a need for multidimensionality due to the multi-dimensional nature of environmental problems. Overall, while using this approach, I will follow the analytical 'levels' that the approach imposes, and what changes in these levels are possible and will result in a multi-dimensional and structural innovation.

The socio-technical regime forms the deep structure and 'imposes a logic and direction for incremental socio-technical change along established pathways of development (Markard, Raven, & Truffer, 2012)'. This regime is built up out of separate sub-regimes; which I will follow in order to explain the complete regime as holistic as possible. However, I cannot rule out some overlaps between these regimes, since they are also interactive.

- The technological regime is built upon the idea that plastic is a relatively cheap and effective material and therefore the most practical material for the means it is currently used for. The alternative is the use of a biodegradable plastic.

- The science regime is built upon available knowledge about the health effects of plastics inside the human body, which is very limited.

- The policy regime sees the oceans as a 'common good' which is a shared responsibility and therefore no state is solely responsible for the accumulating waste. The policy regimes that available are national programs or only combine certain states (such as programs inside the EU).

- The socio-cultural regime is that there is that most people do not see their own responsibility when it comes to making an effort in separating their plastic waste from their general waste. Next to that, there is a large socio-cultural dependence on the consumption of plastic, making our societies very reliant upon the production of plastic.

Niches provide the seeds for systematic seeds. Since the use of plastic lies within the benefits of most consumption companies, I do not think they would be a realistic seed-actor. However, the actors that would be realistic differ in most sub-regimes. I will now explain who these actors would be and how they could provide a change in the socio-technical landscape.

Within the technological regime; technical researchers could plant the seed for innovation. Of course, finding a cheap alternative for plastic would be the ideal solution, however this is not a realistic view on research. What is realistic, however, is finding a way to clean up the ocean. Since only more plastic in being produced, generating more and more plastic every day, the plastic in the ocean is accumulating. Therefore, in order to completely innovate in the system, the waste that already is in the ocean needs to be reduced. It is a realistic option, because there are already some initiatives, but they still need more research to work properly (Ocean Clean Up, 2019).

Within the science regime; there needs to be a lot more research on the health implications of microplastics on the human body. When more research becomes available the implications directly caused by the intake of microplastics and the origin caused by marine plastic pollution, will be revealed. Therefore, a raised awareness, and a raised emphasis on research on this topic, could implement a changed belief among both civilization and institutions. The niche-actors in this innovation would be the researchers.

Within the policy regime; there needs to be a shift away from seeing the ocean's as a shared responsibility, since that approach is currently resulting in no one taking responsibility due to the given of the tragedy of the commons. This shift would mean that a transnational policy program gets set up which would implement a global managing of plastic waste. This prohibits the occurrence of plastic being moved from places where it is consumed, to places where it cannot properly be managed, which is currently the case. The set-up of a transnational program would entail responsibilities for individual states in managing their own waste but also in managing the waste that is already in the water surrounding their property. This is realistic because states already have property rights over water, when it comes to using it for their resources, meaning that it is possible for them also being responsible for the waste going to these waters. When it comes to finding a suitable niche-actor within this sub-regime, it becomes more complex. Naturally, states will not be very likely to participate in such a program when it is not beneficial for their economies and will probably try to 'free-ride' on other states' efforts. However, I am hoping that research on the health implications of plastic waste are sufficient to motivate states in taking responsibility for their citizen's health.

Within the socio-cultural regime; I am hoping that the same research will motivate individuals to make an effort to separate and recycle their waste, or even chose for biodegradable alternatives.

Barriers and drivers

As explained before, an important barrier in this innovation is the problem of the tragedy of the commons and the incentive to free ride that comes with it; therefore I will not go into further detail about this barrier. Another barrier, however, is the complexity of the plastic problem. It is clear that a lot plastic ends up in the ocean due to lack of infrastructure, but it is often more unclear where the plastic exactly is coming from. In other words, within the innovated policy program, it can be claimed that the state with the lacking infrastructure is responsible for the plastic waste, but often the plastic is not solely originating from the same country.

When it comes to a driver, I am hoping that the biggest driver will be the results of more research on the effects of microplastics on humans, which I also earlier discussed. However, it is not completely clear whether the evidence of health implications will be enough for a change. For instance, most people are aware that smoking kills, but still a lot of people smoke, and therefore affecting their own health. In the end, however, I still think that more awareness on the topic can make the much-needed difference.

Concluding remarks

This paper examined the problem of marine plastic pollution, by using the multi-level perspective approach, for setting up a sustainability transition in the form of a transnational policy program. The main implications of this program are that states have responsibilities for managing the waste in the water surrounding them, but also the waste that is originating from their consumption. The biggest driver for states being motivated to participate in the program, is first of all to make an effort to reach the SDGs, which the previously were lacking in, but also the driver of an emphasized role of health implications caused by marine plastic pollution. These implications would be revealed by more research on this topic, which would also be integrated in the policy program. There are still doubts, however, whether this will be enough motivation for states to participate, and whether better management of plastic is enough to combat the already accumulated plastic in the ocean. In an attempt to make this less likely, the program would also entail more research on cleaning up the ocean.

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From Trash to Cash: A Smarter Reverse-Vending Machine

Eeva Massi

Introduction

Nowadays we are surrounded by tons of packaging invading our everyday life. We have become used to throwing away packaging as if it were thrash. The problem is we throw away too much and disregard the potential of waste. This often leads to hazardous disposal of waste with nefarious effect on our health and environment. However, with a mind shift and the help of modern recycling techniques, trash becomes a valuable source that can be put back into the cycle of consumption. Since 1991, manufacturers and retailers become responsible for the recycling of packaging they produce and sell under the German Packaging Ordinance (Packaging Ordinance, 2019). The German Federal law installs an "obligation to accept returned packaging, charge deposits and recover packaging" (ibid., p.5). The most recent Packaging Ordinance of 2019 obliges manufacturers and retailers to recycle at least 95% of packaging waste (ibid.).

One challenge to recover packaging is the collection after the usage. As mentioned above, manufacturers and retailers are obliged to charge deposits on packaging. The deposit-refund scheme is a reconfiguration of waste collection. It involves the participation of consumers, because they are economically influenced to bring back their packaging at collection points. If they do not bring them back, consumers lose the money of the deposit. In Germany, collection points take the shape of reverse-vending machines, a socio-technical innovation (Sambhi & Dahiya, 2020). These machines become a key element to the deposit-refund scheme. They have the advantages to automatically sort, shred and store returned packaging, as well as calculate and refund consumers' deposit.

The reverse-vending machine does not sort, shred and store every type of packaging, yet. How can we expand the usage of the reverse-vending machine to reduce packaging pollution? This paper aims to investigate potential packaging that could be inserted into the reverse-vending machine. First, we look at the current deposit-refund scheme, its relevance and its efficiency. Second, we describe the reverse-vending machine's design. Lastly, we look at the implementation and challenges of other materials and potential packaging in order to expand the range of accepted packaging.

The Deposit-Refund Scheme

To understand the deposit-refund scheme, we first look at the cycle between the involved parties, then the relevance of the scheme and lastly its efficiency.

The Deposit-refund Scheme Cycle

The deposit-refund scheme involves five actors: producer, retailer, consumer, operator and recycler. The producer pays the operator for its service which includes the deposit and the services charges to collect packaging. Then, the retailer pays the same deposit to the producer. The consumer pays this deposit to the retailer. A full refund is granted to the consumer if they bring back the packaging. Otherwise the money of the deposit will go to back to the operator. Examples of operator include governmentally owned DPG Deutsche Pfandsystem GmbH or private initiatives such as Aldi or Lidl's refund-scheme (Dace & Pakere & Blumberger, 2013). Operators' role is to collect and sell packaging to a recycler. The recycler transforms used packaging into reusable materials to create new products. The relation between the five actors is further illustrated in the figure below (ibid).

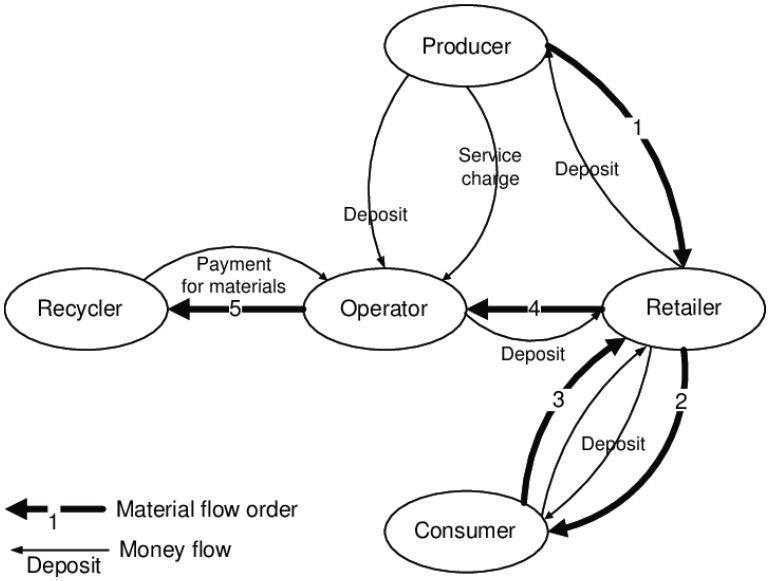

Figure 1. The simplified scheme of material and money flows of deposit-refund system

The Deposit-refund Scheme's Relevance

The aim of the system is to increase the level of recycling of packaging and transform trash to cash. Recycling's goal is to reduce pollution. Since packaging is a main contributor to global pollution, it is important to limit its waste and avoid harmful consequences (Fishbein, 2007). Many surveys show benefits of recycling packaging to conserve energy, create jobs, lower the amount of waste, of greenhouse gases and of pollution rates (Dace & Pakere & Blumberger, 2013). Over time, the implementation of the deposit-refund scheme has increased the recycling of packaging, while the quantity of waste has decreased generating a positive environmental impact (ibid.).

In order to achieve the goal of reducing pollution, recycling techniques uses the cash-from-trash approach. Some examples include transforming plastic bottles/containers for water, milk and shampoo into new bottles, clothes and furniture. Plastic bottle caps are recycled into car batteries, clothes and carpets. Aluminum or steel tins and lids can be transformed back into their original material. Glass bottles are washed and used again. Additionally, Tetra Pak bricks recently became part of recyclable materials (Nkwachukwu & Chima & Ikenna, 2013). There are many other recyclable materials (electronics, compost, cardboard, toxic chemicals, etc) but the paper focuses on the above-mentioned packaging, because they are used in everyday life and could be easily disposed of in collection points under the deposit-refund scheme.

The Deposit-refund Scheme's Efficiency

The advantage of collection points, that take the shape of a reverse-vending machine, is to reduce the transport of waste. Instead of having garbage trucks collecting waste in front of each citizen's door, they mostly collect waste at central hubs. Since the consumer is economically and perhaps environmentally motivated to bring its waste in these hubs, garbage trucks reduce their ride frequency (Geels, 2004). Conveniently, these hubs are usually within retailers. This allows the consumer to buy and throw at the same spot.

Additionally, these collection points sort, shreds and store automatically different types of packaging. When the waste is brought by operators from collection points to the recycler, it is already in a convenient shape and size. Sorting is crucial for recycling. For example, mixing different types of plastic can lead to a new plastic with poor proprieties. Fortunately, research is done to solve the issue and evaluate the processability and compatibility of different plastic (Hon & Buhion, 2014). Nevertheless, it is useful to sort in the first place and avoid resorting to an additional resourceful step in recycling. Another advantage of the reverse-vending machine is its technology to store waste. One way to store is to shred packaging to reduce its volume. The machine has integrated shredders which can cut paper, plastic and metals. The reduced volume is necessary to store a large amount of packaging and transport it efficiently.

Unfortunately, there are limitations to the reverse-vending machine. For example, it does not recognize every type of packaging. It is yet not possible to differentiate types of plastic. It is even harder for a machine to separate wraps of plastic that covers the entire packaging. This is problematic since the mixing of plastic leads to additional steps in the process of recycling. Another limitation is that plastic is made off many colors. When colors are mixed, the recycler loses the ability to decide of the color (Lavee, 2010). This is limiting the process of creation. On top of that, recycling shows limitations too. For instance, glass bottles can be washed and used again up to 50 times (Numata, 2009). Plastic bottles can be shredded and molded into new bottles up to 20 times. Nevertheless, for a sustainable transition it is more environmental-friendly to reuse a bottle, even once, than throwing it right away. It is important to acknowledge the limitations of the reverse-vending machine and recycling when we evaluate the possible expansion of the range of accepted packaging. To find potentially accepted packaging, first we need to understand the reverse-vending machine's design.

The Reverse Vending Machine (767)

Its Evolution

The first patent for a reverse-vending machine, the "Empty Container Return and Handling machine" with a coin return mechanism was created in 1920 (Soete & Verspagen & Ter Weel, 2010). In the last 1950's, the first reverse-vending machine was manufactured (ibid.). Since then, more than 100.000 have been implemented (Borrás & Edquist, 2013). Over time, they have taken numerous shapes and proprieties. The paper focuses on the German reverse-vending machine. One difference with the original machine, is the coin return mechanism. In Germany, the deposit takes the shape of a voucher. One can use this voucher to purchase goods or they can exchange it for cash. A voucher is advantageous, because the machine does not need to have access to physical money. Additionally, the voucher can be exchanged for cash which means the consumer is not forced to spend it on designated products (which is the case in other deposit-refund schemes).

Additionally, Germany is different to other reverse-vending machines because it does not accept tin cans. Hence, there exists patents of machines that accept tin cans; but these machines, like most of them, are costly to make and maintain (Breznitz, 2009). One reason is that the German Packaging Ordinance favorizes packaging that are used within hours of its purchase (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2018). In the next section, we explore the possibilities of adding tin cans to accepted packaging. For now, it is sufficient to say that metals are valuable materials that need to be considered into the deposit-refund scheme and it remains unclear why Germany does not include aluminum can or lids (ibid.). To understand what materials and packaging can be potentially added to the range of accepted items, we describe the reverse-vending machine design.

Lastly, it is worth mentioning that the evolution from a manual to an automatic sorting system has led to some inconveniences. For example, highly polluting packaging, such as plastic bottles, have higher deposit than glass bottles. This difference is to cover the cost of producing a bottle and motivate the consumer to bring back highly polluting packaging. Before, an employee had determined if the packaging is part of the deposit-refund scheme by looking into a register and calculate and refund the deposit. Now, engineers have to program a machine that recognizes the packaging and refund the appropriate deposit. The latter is a simple task because the reverse-vending machine has the advantage to make calculations automatically. Nevertheless, the question remains how does the machine recognize different packaging?

Its Design

A reverse-vending machine can automatically sort, shred and store automatically some types of packaging. It is an integration of sensors, a data acquisition system (DAS) hardware, a computer running DAS software, pneumatic technology and shredders (Awasthi & Shivashankar & Majumder, 2017). Sensors measure physical proprieties. Some physical proprieties include temperature, force and light intensity (ibid.). The DAS samples the physical data collected by sensors to categorize the type of packaging. For example, glass does not have the same weight or temperature as plastic. Therefore, the machine can sort different materials. Collecting physical data about the packaging can determine the type of packaging. However, some materials are too similar to the machine for them to be sorted accurately. For example, polyethylene terephthalate (PET) and high-density polyethylene are both plastics used in most drink, food, cosmetics and chemical packaging. The problems are that it is difficult to differentiate PET and HDPE and sort accordingly, as well as differentiate chemicals from non-toxic products. For example, PET is recyclable, but HDPE is not. Mixing them leads to a downcycled material with poor proprieties. The problems of sorting types of packaging are investigated in the following section. After determining the type, series of actuators and pneumatic technology separate the package in different bins. Increasing the number of bins increases the sorting possibilities. Germany's reverse-vending machine has two bins, one for PET and one for glass. Bins are necessary to store sorted packaging. Lastly, the packaging is shredded. This is true for plastic and aluminum. On the other hand, glass is kept intact because it will be washed instead of shredded (German Federal Government, 2019).

Since the most recent Packaging Ordinance, the reverse-vending machine has been adapted to accept a larger range of packaging. Nowadays, plastic (PET) water, juice, nectar bottles, as well as green, brown and transparent glass bottles for water, beer constitute the full range of emptied packaging (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2018). An emptied packaging is "packaging of which the contents have been exhausted in the designated manner" (ibid, p.21). The next step is to look at other types of materials, shapes and contents and how they can be sorted, shredded and stored in order to expand the range of accepted packaging.

Expanding the Range of Packaging

To explore potential packaging, we first look at materials that are most frequent in households. A table sums materials and packaging that are accepted by the machine (grey), as well as those that are not yet accepted (white). This section is divided into challenges and solutions for each packaging. Challenges occur during the sorting, shredding and storing.

Table 1: (Potentially) accepted materials and packaging by the reverse-vending machine

Material	Aluminum	Glass	Plastic
Packaging	Beer caps	Water, beer and wine bottles	Water and juice bottles
	Cans	Jars	Shampoo bottles
	Jar lids		Toothpaste tubes

Aluminum

As mentioned previously, other countries have set up reverse-vending machine that accept aluminum. Usually, there are different machines, one for aluminum, glass and plastic. It would be ideal if one machine could accept all packaging instead of constructing different ones. This requires the DAS to sort packaging accordingly. Fortunately, the machine has integrated sensors. These can determine the temperature, voltage and shape of the packaging. Cans usually have standard shapes made out of aluminum easily identifiable by a machine. Aluminum has specific physical proprieties. It is lighter than glass, but heavier than plastic. It is a great electrical and heat conductor compared to glass and plastic which are isolators. Therefore, the existing German reverse-machine could sort and differentiate aluminum cans from the rest of packaging. However, jar lids and beer caps are harder to differentiate. The problem is that they can be made out of steel or aluminum. Steel and aluminum share very similar physical proprieties that are hard to differentiate for a machine. These materials should not be mixed in the recycling process. One way to avoid downcycling materials would be to use a magnet since steel is magnetic while aluminum is not. If the lid or cap is magnetic, it is sorted with steel.

Cans, lids and caps are easy to store since they can be shredded in small pieces. However, cans can contain residues of food that are perishable. To slow down the process of decomposition, operators could use ashes (Tan, 2015). It is useful because packaging is stored at retailers for about a week. To conform to sanitary measures, it is necessary to find ways to keep trash clean. Washing it would demand another range of machines or manual work. This is resource consuming. Instead, ashes offer a sustainable alternative, because it would not be thrown away but rather be used to slow decomposition.

Glass

Since the machine can sort glass bottles, we assume that it can identify glass jars. Therefore, sorting glass jars is not the main challenge to include them in the range of accepted packaging. Here, we need to focus on solutions to store and reuse jars. For example, glass bottles for wine, water or juice are washed and refilled. This is possible because the glass is thick enough to endure high pressure when transported or refilled. On the other hand, glass jars are made out of a thinner layer of glass. There is a risk that they break rendering them unsuited to be refilled. This is problematic because making new glass out of shredded used glass is highly energy demanding to recycle (Tomari, 2012). Nevertheless, it remains less energy consuming to recycle than making new jars out of raw materials.

To store used jars, we need to consider the possibility of food residues. Here, we can apply the same idea we applied on aluminum cans. If we pour ashes on stored glass, we can slow down the process of decomposition. Further research should evaluate the rate of decomposition and compare it to national sanitary indications. Furthermore, experimental research should evaluate different methods to pour ashes. If a jar, or can, is turned upside down then the ashes won't penetrate the inside where the food is and consequentially the process of decomposition won't be slowed down.

Plastic

Sorting plastic from glass or aluminum is a task that the reverse-machine is capable of executing. Sorting out different types of plastic is more complicated. Plastic share similar physical proprieties. Some are denser than others which makes them lighter or better electrical isolators. But the difference is too small to be detected by sensors and sort accordingly. Therefore, the German reverse-vending machine accepts one sort of plastic (PET) and color (transparent) to avoid mixing different materials (Hon & Buhion, 2014). With 15% of household waste being plastic out of which 50% is plastic bottles, it is necessary to accept different types to reduce our waste. Table 1 includes shampoo bottles and toothpaste tubes. Usually these packaging are made out of HDPE. A few years ago, HDPE became recyclable. It is time to include them to the range of accepted packaging. The question remains how do we differentiate PET and HDPE? Since they do not possess specific physical proprieties, it is necessary to add indicators that can be read by the machine. A color or shape can be printed on the bottom of the bottle. For example, a green dot could indicate PET plastic. A color code could become mandatory at the production of bottles so that the deposit-refund scheme could include many plastics. Another problem remains the vast range of colors found on shampoo bottles. We need to ensure that colors are sorted in a few categories. For example, separate whites, blacks, reds, blues and greens. Since the reverse-vending machine is equipped with light intensity sensors, they can color-categorize. However, it remains unclear how a machine would sort bottles of several colors.

To store shampoo bottles or toothpaste tube, we can apply the same shredding applied to PET bottles. Their content is non-perishable; therefore, it can be stored for a long period of time. Since PET and HDPE are sorted in different bins, and because PET contains edibles and HDPE does not, we do not need an additional step to separate packaging made for edible and non-edible packaging contents. If the same plastic could contain toxic chemicals and edibles, we need to ensure that the plastic is treated to avoid food poising.

Conclusion

The deposit-refund scheme shows numerous advantages to optimize the collection and recycling of packaging. Operators, producers, retailers, consumers and recyclers become responsible to render the transformation from trash to cash possible. The reverse-vending machine facilitates this transformation by sorting, shredding and storing of packaging. In Germany, PET and glass bottles containing water, juice or alcohol can be brought in these machines.

This paper's objective is to explore potential packaging to could be accepted by the machine. It explores materials such as plastic, aluminum and glass to evaluate packaging such as jars, shampoo bottles and toothpaste tubes. Some challenges encountered are the sorting of similar materials such as PET and HDPE, the shredding of aluminum and the storing of perishables, jars and toxic chemicals. Some solutions include the expansion of the DAS, a color-code to differentiate plastics and the usage of ashes to slow down the process of decomposition. Therefore, shampoo

bottles, toothpaste tubes, jar lids and caps seem to have the potential to be integrated into the deposit-refund scheme.

The reverse-vending machine has the potential to expand its range of accepted packaging. Further research could explore packaging such as Tetra Pak bricks, cardboard, but also items such as compost and electronic devices. They are often wasted, and their possible expansion is disregarded. Trash is a useful resource. It is necessary to become aware of the waste we produce and hold actors responsible to avoid a negative social and environmental impact.

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How Antibiotic-Resistant Diseases are related to the Food We Consume

Eleanor Payne

Introduction

Antibiotic resistance (ABR) is becoming a growing public health threat for the achievements of modern medicine. There is a major gap in knowledge about the magnitude of the problem and therefore further research is required. Resistance to common bacteria has reached alarming levels in many parts of the world. A growing list of infections such as pneumonia, tuberculosis, blood poisoning, gonorrhea, and foodborne diseases are becoming harder and sometimes impossible to treat (WHO, 2018). The World Health Organization has named antibiotic resistance as one of the three most important public health threats of the 21st century. Therefore, it is extremely concerning that there are significant gaps in surveillance, and a lack of standards for methodology, data sharing, and coordination regarding antibiotic resistance. Antibiotic resistance has the potential to affect people at any stage of life, making it one of the world's most urgent public health problems. Moreover, "a lack of effective antibiotics is as serious a security threat as a sudden and deadly disease outbreak" states Director-General of WHO, Tedros Adhanom.

However, this paper will focus on antibiotic resistance and its direct relation to animal agriculture. The reason why I am so devoted to wearing awareness about the misuse and overuse of antibiotics in animal agriculture is due to my passion for animal welfare. Moreover, the well-being of non-human animals evidently affects the quality of human lives throughout the consumption of animal products. Furthermore, epidemiological studies have demonstrated a direct relationship between antibiotic consumption and the emergence and dissemination of resistant bacteria strains. Besides, the Food and Drug Administration (FDA) released its annual report on antibiotics sold for use in food-producing animals. The report revealed a 9 percent increase in the sale of antibiotics important to human health—also known as medically important antibiotics—for use in food-producing animals (Hoelzer, 2020). According to the FDA, more than 20 million pounds of medically important antibiotic drugs were sold for use on livestock farms in 2014, which concluded being 80 percent of all antibiotics sold in the United States.

The estimates of the total annual global consumption of antimicrobials in animal production vary considerably. This is due to poor surveillance and data collection in many countries, for example, only 42 countries in the world have a system to collect data on the use of antimicrobials in livestock (FAO, 2020). The magnitude of the problem worldwide and the impact of antimicrobial resistance (AMR) on human health, and on costs for the health-care sector and the wider societal impact, are still largely unknown (WHO, 2014).

Without urgent action, we are heading for a post-antibiotic era, in which common infections and minor injuries can once again kill millions of people. The lack of suitable data collection and incompetent policies which address this major issue in public health reflects the importance and relevance of this paper. Therefore, it is crucial that I first explain what antibiotic resistance is and how it is related to animal agriculture. Then I will take a critical approach towards animal welfare standards in animal industries. Finally, I will indicate why current policies are incompetent and insufficient and will present a variety of policies which I believe without a shadow of a doubt best addresses a global health catastrophe.

The design of the paper will be purposeful, focussing on the American population. As for the collection of data the qualitative method seemed more appropriate as I will be focussing on how the animal welfare standards are absurd and disappointing taking a critical approach towards current policies in force that fail to address such a major issue. However, there were certain limitations that I came across during this investigation. The main problem was obtaining a compilation of data from national official sources. When data from national official sources were unsuitable or insufficient, other sources (i.e. non-official networks and scientific journal articles) were sought. Given the lack of agreed global standards for ABR surveillance, the reported proportions of resistance should be interpreted with caution. To provide a solid argument, I will be questioning and debunking theories that state that there is no correlation between the consumption of animal products and the increase of ABR.

Antibiotic Resistance and its relation to Animal Agriculture

Antibiotic resistance does not mean the body is becoming resistant to antibiotics; it is that bacteria have become resistant to the antibiotics designed to kill them (CDC, 2020). It means that germs are not killed and continue to grow. Infections caused by antibiotic-resistant germs are difficult and sometimes impossible, to treat. In most cases,

antibiotic-resistant infections require extended hospital stays, additional follow-up doctor visits, and costly and toxic alternatives. Microbial resistance to antimicrobial agents is not a new phenomenon; it has been going on in soil microorganisms since the dawn of time, as competitive/survival mechanisms by microorganisms against other microorganisms (Scott, 2017). Immediately, the following question arises. How does this resistance occur and how is it related to animal agriculture?

The resistance occurs when there is a high number of bacteria and only a few of them are resistant to antibiotics. However, when antibiotics are introduced into a system, the drug kills the bacteria causing the illness as well as the good bacteria that protect the body. The resistant bacteria now have preferred conditions to grow due to the good bacteria being killed. Now, the bacteria that is resistant to antibiotics can transfer the resistance to other bacteria in the system. Antibiotic resistance is accelerated by the misuse and overuse of antibiotics, as well as poor infection prevention and control (WHO, 2018). Although antibiotic resistance also occurs in nature and is an inevitable consequence of even prudent antibiotic use, it is clear that overuse and misuse of antibiotics is the main determinant of the increases in antibiotic resistance.

Antibiotics are added to animals' feed, accelerating their growth and preventing them from getting sick in crowded barns and feedlots. Possibly three-fourths of all the antibiotics dispensed in the world are used this way—which is not at all how they are used in humans, where the point of the drugs is to cure infections, not prevent them. For decades, the U.S. meat industry has fed medically important antibiotics to chickens, pigs, and cows to accelerate their growth and weight gain.

Nowadays, there is a strong scientific consensus that accepts that increased antimicrobial resistance (AMR) in bacteria affecting humans and animals in recent decades is primarily influenced by an increase in usage of antimicrobials for a variety of purposes, including therapeutic and non-therapeutic uses in animal production (FAO, 2016). According to the FDA, more than 20 million pounds of medically important antibiotic drugs were sold for use on livestock farms in 2014, which concluded being 80 percent of all antibiotics sold in the United States. Antibiotics have been used in livestock feed since the 1940s when studies showed that the drugs cause animals to grow faster and put on weight more efficiently; by killing off the bacteria in the animals' guts, the antibiotics make more of the energy in the food available for the animals themselves (Dibner & Richards, 2017). The FDA effectively banned this practice in the United States as it was considered that it was being used for growth promotion in healthy animals instead of treating diseases. Nevertheless, this policy is still not addressing the issue as well as it should. This is due to the fact that although it has been prohibited to use antibiotics for growth promotion, factory farming breeds animals in such horrific conditions that it would be practically impossible for them to survive without these antibiotics.

Animal Welfare

Initially overlooked, this phenomenon has become a real reason of concern for myself due to the treatment of animals as production units rather than sentient creatures. However, if this is something that does not disturb and perturb yourself, it has now become evident that the mistreatment of animals is not only affecting these sentient beings but will catastrophically affect the public health worldwide when antibiotics are not effective in treating common illnesses. The following demonstrations which explain what occurs in factory farming reflect my distress when it comes to animal welfare standards.

According to the Animal Welfare Institute, four or more egg-laying hens are packed into a battery cage, a wire enclosure so small that none can spread her wings. Being held in such close confines, the hens' peck at each other's feathers and bodies. Pregnant sows spend each of their pregnancies confined to a gestation crate—a metal enclosure that is scarcely wider and longer than the sow herself. Unable to even turn around, sows develop abnormal behaviors and suffer leg problems and skin lesions. Growing pigs are confined to slatted, bare, concrete floors. Stressed by crowding and boredom, they frequently resort to biting and inflicting wounds upon their pen mates. In factory dairies, cows spend their entire lives confined to concrete. To boost production, some cows are injected with the growth hormone rBGH, leading to lameness and mastitis, a painful infection of the udder. In order to facilitate confinement of these animals in such stressful, crowded, unsanitary conditions, painful mutilations like cutting off the horns of cattle, cutting off the beaks of chickens, and docking the tails of sheep, pigs, and dairy cattle are routinely performed, and of course, antibiotics must be applied constantly as intensive farming operations housing tens of thousands of animals in close quarters serve as ideal incubators for disease. "Animal and manure

management on confinement operations, animal transport, conditions, and meat processing can also contribute to food contamination and foodborne illness like E. coli and Salmonella. A 2013 study by Johns Hopkins Bloomberg School of Public Health found an association between living near high-density pig operations or crop fields fertilized with manure from high-density pig operations and methicillin-resistant Staphylococcus aureus." States the Animal Welfare Institute.

It seems like there is a growing list of negative consequences deriving from animal agriculture. However, I will continue to focus on antibiotic resistance, stemming from the use of antibiotics to promote growth, and suppress disease within confinement operations, presents a serious health concern. This is extremely relevant to public health as "Everyone talks about antibiotic resistance in humans, but no one has been talking about antibiotic resistance in animals. Yet there are far more animals than humans on the planet, and they are essential for livelihood across the developing world. If we are not able to treat sick animals, that will have a huge impact on global poverty," says Ramanan Laxminarayan, the director of the Center for Disease Dynamics, Economics & Policy in Washington, DC. Given these negligible impacts on the industry and the potentially catastrophic human and economic costs of a "post-antibiotic" world, it is imperative that governments and industry take swift action to curtail the overuse of these critical drugs.

Why are current policies incompetent?

Ending the routine use of antibiotics in animal agriculture is critical for maintaining the ongoing efficacy of drugs that have saved many millions of lives. It is also possible and economically feasible. If action is required by all stakeholders, including governments, surely it is clear that the following policies barely address the magnitude of the problem. The policies in the U.S are not the only issue. Global policies are also far from satisfactory.

According to the Antibiotic Resistance Action Center, the U.S Food & Drug Administration has asked drug companies that make and sell antibiotics for use in food and animals to voluntarily stop selling the drugs to grow animals faster. It seems that by solely recommending a company to stop using antibiotics for growth promotion is obviously not enough. In 2014, the White House announced the National Strategy for Combating Antibiotic-Resistant Bacteria. The plan outlines five main goals for combating antibiotic resistance. Each goal has accompanying milestones to be achieved by 2020. The goals of the National Action Plan include: Slowing the Emergence of Resistant Bacteria and Prevent the Spread of Resistant Infections, strengthen National One-Health Surveillance Efforts to Combat Resistance, advancing Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria, accelerating Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines and finally, Improving International Collaboration and Capacities for Antibiotic-resistance Prevention, Surveillance, Control, and Antibiotic Research and Development. However, its primary purpose is to guide activities by the U.S. Government, public health, healthcare, and veterinary partners. The problem with simply providing guidelines as a policy is that it is not a big enough effort when addressing such an urgent and serious drug resistance which would not only affect people in the U.S but all around the world.

Although, California has been the first to pass legislation that requires a veterinarian's prescription for use of antimicrobial drugs. This policy is an important step in the right direction, however, it is still severely insufficient. This particular policy suggests that if there is any kind of bacterial disease in the flock of animals, antibiotics will still be used in enormous amounts to prevent these diseases from reaching humans. Therefore, this policy would not apply to factory farming as explained before.

When it comes to global policies, the WHO launched new guidelines on the use of medically important antimicrobials in food-producing animals. However, this global policy does not satisfy current needs when it comes to tackling a possible bacterial disease outbreak. Again, the WHO, who insist on urgent action to help preserve the effectiveness of antibiotics, simply recommend that farmers and the food industry stop using antibiotics routinely to promote growth and prevent disease in healthy animals.

Policy Solutions

Effectively addressing AMR requires the livestock sectors to join others and not only commit to implementing better practices but for the following practices and policies to be binding. There seem to be two pathways when applying stronger policies. The first avenue would imply that human beings want to reduce antibiotic resistance in

their systems that derive from animal products. However, the second avenue would require human beings to eliminate from their diet the possibility of gaining bacteria that is antibiotic-resistant which emerges from animal products.

The first option would reflect a reduction of the risk. Therefore, to curb the systematic spread of antibiotic-resistant bacteria one policy that comes to mind would be to oblige factory farms to close down. By making factory farms illegal, meat and poultry could be purchased without non-therapeutic antibiotics. Supermarkets would then have the obligation to provide sustainably raised meat. This meat would be raised under standards of third-party certifiers such as Animal Welfare Approved, American Grassfed Association or USDA Certified Organic. The label "no routine antibiotic use" generally indicates that the animal was raised without the use of non-therapeutic antibiotics. Therefore, policies could include the obligation of applying good husbandry practices while handling the animals, in the animal production establishments and during animal transport, improving animal welfare (e.g. ensuring good air and water supply quality, appropriate ventilation rates and space allocation) during all phases including production, transport, and slaughter, applying rigorous disease control measures (e.g. vaccination), targeting primary production in specific value chains and highlighting practical actions that can be taken to reduce the need for antimicrobials and to control the dispersal of antimicrobials and resistant microbes in the environment or even better, ensuring good hygiene, biosecurity measures, and general conditions on farms to prevent the need for any medicines in the first place.

The reason why I believe that the second pathway regarding appropriate policies is much more effective is that it directly eradicates the possibility of obtaining resistant bacteria from animal products. The following policies suggest that it would be much more efficient to switch to a plant-based diet if society wants to erase one of the three most important public health threats of the 21st century. One policy that comes to mind would be encouraging more plant-based provisions in the public-sector institutions. This could be done by lowering the costs of plant-based products. If all supermarkets or other forms of services lower the prices of these products, it would be much more accessible for people with lower incomes. Furthermore, these products call for higher investment to improve their quality. An interesting fact is that Bill Gates was one of several high-profile investors to back Impossible Foods - plant-based products - with a 75 million dollar investment in 2017 and a 90 million dollar investment in the startup of Motif Ingredients. Another interesting policy could include securing more support for plant protein crop productions. This could be done by elevating the taxes on meat production and consumption. By making the meat industry an expensive investment with a small profit, the producers would start to turn to alternative options such as crop industry or plant-based options which would not only benefit the whole society regarding healthier alternatives but would ease the pollution worldwide. Not only would it be to tackle antibiotic resistance, but we would also be reducing some of the most deadly diseases that are directly related to consuming animal products such as cancer, diabetes, and heart disease. German politicians from the Social Democrats (SPD) and the Greens proposed raising the value-added tax (VAT) on meat from the standard rate of 7% to 19% to fight climate change.

Although these policies seem far-fetched and some theories go against a plant-based diet due to fruits and vegetables due to the risk of also being exposed to antibiotic use, I strongly disagree as we can clearly analyze that the use of antibiotics in fruits and vegetables account for less than 0.5% of total antibiotic use. Therefore, I am convinced that this second pathway is the only solution that can abolish the antibiotic-resistant crisis that public health is rapidly facing.

Conclusion

Antibiotic resistance is one of the three most important public health threats of the 21st century and it is directly linked to animal agriculture. Therefore, it is crucial that policymakers address the misuse and overuse of antibiotics whilst also focussing on animal welfare. It seems like there is a growing list of negative consequences deriving from animal agriculture. However, this paper has exclusively focused on the excessively negative effects that animal agriculture has on modern medicine and consequently the public health worldwide.

The investigation conducted for and throughout this paper has analyzed what antibiotic resistance entails and how it is directly linked to animal agriculture. Accordingly, the welfare of animals has also been evaluated and critically discussed as this was the true motivation for writing the current paper. Additionally, I have also reflected why the current policies that address the misuse and overuse of antibiotics in animal agriculture are dangerously ineffective for public health worldwide. This unsatisfactory opinion of the current policies has motivated me to develop a series

of policies that could truly help reduce the impacts of a post-antibiotic era. Furthermore, this paper has supported that there is still a significant gap in knowledge as the degree of the problem is not being acknowledged appropriately. This paper has used the United States as an example of the overuse and misuse of antibiotics in animal agriculture to wear awareness on the issue affecting public health regarding antibiotic resistance. The importance of this paper has helped shape the relevance of such a meaningful obstacle for all of us as a society. The main limitation for this paper was obtaining a compilation of data from national official sources. When data from national official sources were unsuitable or insufficient, other sources (i.e. non-official networks and scientific journal articles) were sought.

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Higher Education Innovation: A 21st-century Challenge

Emma Olyff

Introduction

According to the VISIR Consortium report (2012), society attaches three roles to Higher Education Institutions (HEIs); firstly, to train students for professional competencies, secondly to raise autonomous individuals, and lastly, to grow responsible citizens. Over the years, whether it is HEIs' responsibility to raise autonomous individuals and grow responsible was debated. However, its role in training students for their future employment has always been evident (Luna Scott, 2015). Today, however, HEIs face essential challenges to match the reality of what our world has become (Luna Scott, 2015). Due to the improvement in information and communication technologies (ICT), the spread of information has grown exponentially in the past decades, rendering knowledge obsolete much faster than before (Wilpert, 2009). Studies argue that in any sector, knowledge of standard practices is now outdated after only ten years (Arntz, Gregory, & Zierahn, 2016). Additionally, as employment tasks became more diverse and complex, most jobs today are now not only dependent on subject-specific knowledge but often require individuals to juggle interdisciplinarity (Wilpert, 2009). However, more worrying for specific industries, is that automation starts to take over a massive amount of jobs, threatening a critical portion of the world population with unemployment (Frey, & Osborne, 2017). Finally, studies estimate that about 85% of the jobs in 20 years do not exist yet (Frey, & Osborne, 2017). While all these changes occur in the job market, higher education systems mainly remained unchanged for the past decades (Luna Scott, 2015). This inconsistency creates significant problems for society: incompetent workers, graduate students unsure of their abilities, and a workforce simply unprepared to face the challenges of the coming century.

These challenges raised in me the question that this paper will address: "how could Higher Education Institutions (HEIs) innovate their curricula to prepare students for the 21st-century job market?". Firstly, this topic is relevant for societal reasons because the threat of inadequate education should be addressed. In 2015, the United Nations set 17 sustainable development goals, including providing quality education worldwide. If the already established educational institutions are not currently fulfilling their role, it is of utmost importance to offer potential solutions to help them reach it. For academic reasons, this paper is relevant as it might fill the gaps that previous literature did not address. Numerous reports highlight the need for educational innovation for the 21st century; others explain how to initiate such changes; others again address the barriers to these solutions. This paper is an attempt to provide an overview of all these different perspectives to give a practical but informed answer to the research question. Finally, this paper is relevant to me personally. While studying at an innovative University, I still feel that numerous actors of the intuition do not perceive how HEIs should fundamentally innovate in the years to come. Therefore, I hope that this paper could trigger some of its readers' interest, and possibly at its small scale, initiate a reflection on the question.

This paper will firstly present the solution it argues for; offering compulsory soft skills courses to HEIs students. Then, using a multilevel perspective, the paper will explain why this solution should be preferred considering the landscape pressures HEIs are facing. Afterward, the paper will provide examples of technological-niche innovations that might inspire others. Finally, the paper will highlight the barriers to such a solution.

Suggested solution

In 2019, OECD issued several reports on educational innovations regarding the goals that education systems should aim for by 2030 (OECD, 2019). These reports led to creating a learning compass (see Appendix 1), which describes all the critical determinants of the future of learning. In this compass, the core foundations of learning are four competencies: skills, knowledge, attitudes, and values. I would like to argue that HEIs should specifically focus on skills development to better match the changing job demand. More specifically, HEIs should offer compulsory soft skills courses to their students. Soft skills, which are also sometimes referred to as generic skills, include general qualities, personal behavior, and attributes possessed by individuals. Soft skills are also defined in contrast to hard skills, which are technical skills needed to work with specialized equipment, data, and software (Laker, & Powell, 2011). Therefore, soft skills do not relate to specific job skills but rather to life skills (Majid, Liming, Tong, & Raihana, 2012). The list of soft skills is immense, but they can generally be grouped into sub-categories;

interpersonal or intrapersonal, or cognitive (e.g., critical thinking, problem-solving), social (e.g., intercultural communication, teamwork), or emotional (e.g., empathy, emotional regulation) (OECD, 2019). Ideally, this paper should define the specific set of soft skills that HEIs should focus on. Unfortunately, the scope of this paper did not allow me to understand the topic in such depth. However, a practical example will be given later in the paper, which may point the way forward.

Why is this solution? Multilevel perspective

Now that the paper introduced a suggestion for HEIs, this section will explain why HEIs should focus primarily on soft skills rather than other skills or competencies, using the multilevel perspective model (MPL) developed by Geels and Schot (2007) (see application schema in appendix 2).

Theoretical framework

The MPL explains that innovations result from the interaction of processes at three different levels: (1) the sociotechnical landscape, (2) the sociotechnical regime, and finally (3) niche innovations (Geels & Schot, 2007). Geels and Schot (2007) defined the sociotechnical regime as the meso-level set of economic, political, and social institutions and practices that establish the prevailing rules and procedures of a specific time. Sociotechnical regimes are under pressure from the sociotechnical landscape and niche innovations. The sociotechnical landscape combines macro-level trends, ideologies, patterns, and phenomena. These macro-level components pressure regime to innovate because they correspond to the changing reality of the world, to which regimes have to adapt to (Geels & Schot, 2007). In turn, niche innovations represent innovation micro-level poles capable of creating breakthrough innovations because they remain relatively protected from the market. They pressurize the regime institutions and practices to innovate to stay competitive (Geels & Schot, 2007).

In the context this paper addresses, HEIs are social organizations belonging to the sociotechnical regime. Since HEIs attempt to train students for real-world job demand (Luna Scott, 2015), changes in the sociotechnical landscape create a new reality that HEIs need to consider. Changes in the sociotechnical landscape, therefore, pressure HEIs to innovate their practices. Additionally, since HEIs' survival depend on their competitiveness (Luna Scott, 2015), niche innovation also pressures them to adopt the new best practices. The following section of the paper explains why HEIs should focus on developing mandatory skills courses to respond to landscape pressures.

Landscape pressures & HEIs

Two significant landscape pressures can explain why teaching soft skills courses might be the right solution to better match today's job demand: technological innovations and globalization. Technological innovations are pushing HEIs to offer soft skills courses because such technologies increase the automation of jobs without soft skills; jobs that machines can replicate, and open the market to jobs requiring soft skills. Information and communication technologies improved considerably in recent decades, which led to fundamental changes in the labor market (Arntz et al., 2016; Tytler et al., 2019). In the past, after each significant technological innovation, routine jobs - jobs with highly standardized practices - have either been fundamentally transformed or replaced by machines (OECD, 2019). Artificial intelligence and intelligent ICT that are increasingly emerging threaten to exacerbate this trend in the years to come (Arntz et al., 2016). However, in the past, such changes also increased the demand for non-routine or relationship-based jobs (see Appendix 2) (OECD, 2019). According to OECD (2019), this tendency will also be enhanced in future years. OECD (2019) argues that especially soft skills, rather than domain-specific knowledge and hard skills will become increasingly important in the job demand.

According to OECD (2019), individuals that will possess creativity or problem-solving skills, for example, will be advantaged. Jobs requiring such skills, such as fashion designers, art directors, and even microbiologists, for example, are jobs that machines will unlikely replace in the upcoming years. The new fields of 3D printing, biomimicry and aestheticians provide examples where such skill will be increasingly demanded, and it seems like even more traditional jobs such as teachers or marketers, due to the complexification of their field, will increasingly need to possess these skills (Tytler et al., 2019). OECD (2019) also explains a similar pattern for a job requiring social and emotional skills. For example, caretakers or psychologists seem, once more, unlikely to be automated yet because machines are unable to perform empathy, active listening, or emotional support (Arntz et al., 2016). On the

contrary, jobs in these fields seem to grow and diversify themselves; in the future, it can be expected to see more health shapers, mindfulness coaches, or lifelong educationists (Tytler et al., 2019).

Globalization, in turn, is a macro-level pressure that encourages HEIs to offer soft skills courses because faster and more international environments require individuals competent not only in their work but also in developing interpersonal skills. As our world is becoming more globalized today, industries see more inter-cultural competition which results once again, in routine jobs disappearing to be off-shored to lower costs in other countries (Lucio, 2013). Moreover, due to globalization, remaining industries are characterized by increased employee internationality, more common interpersonal exchanges, and faster information transfers. To work in such an internationalized environment, employers today highlight the fundamental need for communication skills, active listening, empathy, active learning, coordination, self-reflection, and teamwork (Bakhshi, Dowing, Osborne, & Schneider, 2019). Additionally, as information exchanges exponentially increase, jobs require developed critical thinking skills, communication, and adaptivity skills. Tytler et al. (2019) even explain that by 2030, all the soft skills aforementioned will comprise up to 70% of all work activities.

From these perspectives, it can be understood that the future of jobs is highly uncertain, but that tasks relying on soft skills will be highly demanded. Different studies supported the claim that soft skills should be the focus of universities, arguing that while graduate students detain the specific knowledge necessary for their job, they are unequipped to perform it properly because they lack all the generic skills that should go along with it (LeBlanc, 2018; Majid et al., 2012; Tytler et al., 2019). Finally, research asses that soft skills will also help individuals dealing with the uncertainty coming with changing job demands, in a way that neither domain-specific knowledge nor hard skills could (Couse manual Improv(e) yourself! 2018-2019, 2019; Tytler et al., 2019).

How can the solution be implemented? Multilevel perspective

While it is now understood why soft skills should be preferred to other competencies, how to apply such a solution might be unclear. This section of the paper will explain how HEIs can practically implement mandatory soft-skills classes using examples of niche innovations.

Niche innovation: University College of Maastricht:

The first niche innovation that might exemplify the solution the paper proposes is the University College of Maastricht (UCM). This example does not provide so much of a specific plan of action, but rather, it demonstrates that this niche survived to implement mandatory skills courses, highlighting its viability for other institutions. UCM is a bachelor's program in Liberal Arts and Sciences situated in Maastricht. The program offers an open-curriculum to its students, who can choose their classes. One of the only restrictions students have is that they should choose three skill courses (Student handbook 2019-2020 2019) (see the course list in appendix 4). Most of the classes relate to cognitive skills training, such as argumentation, presentation skills, or discourse analysis. Other options reflect skills that might belong to social skills, such as strategy and negotiation or language training.

I would like to argue that UCM provides an example of successful niche innovation, but that improvements should befall to match today's job demand properly. On the one hand, UCM sets a model for other HEIs by making the skills course mandatory, demonstrating the importance of building such competencies. Additionally, the specific skills offered do not only correspond to a particular field of study but allows the students to acquire knowledge beyond their field.

On the other hand, UCM is not a meaningful example for other HEIs because it does not offer a sufficient amount of social and personal skills to its students. UCM explains training its students for academic and professional skills (e.g., communication, research skills) and personal and social skills (e.g., collaboration and intercultural skills); however, it offers only a few courses teaching personal and social skills explicitly. It could be argued that social and personal skills are not part of the curriculum because their learning is embedded in other courses. For example, UCM does not teach any classes on problem-solving; however, since its pedagogy revolves mainly around this skill, it can assume that its students acquire problem-solving skills during their course of study. I would like to argue against such assumptions, and for the fact that soft skills teaching should be part of the formal curriculum instead of being embedded in other classes. According to the theory of constructive alignment, to teach an intended learning

outcome, it is necessary to align the teaching methods and provide assessments that will test the competency (Biggs, 1996). In this sense, if one desires to teach soft skills in university, it is of prior importance to design learning activities that will foster such soft skills and assess students to demonstrate whether or not they acquired the skill at hand. Thus, if social and personal skills are not part of the formal curriculum at UCM, nothing can ensure that students acquired such knowledge. The following section will provide an example of how this problem can be addressed.

Niche innovation: Maastricht Faculty of Psychology and Neurosciences:

The other niche innovation might better exemplify how to offer soft skill courses in HEIs practically. In 2019, the faculty of psychology and neuroscience (FPN) in Maastricht offered an elective course named 'Improv(e) yourself! Using improvisation theater to improve your soft skills'. According to the course description, this class trains soft skills amongst students through theater improvisation. The class topics revolve around the skills of trust for oneself, tolerance of uncertainty, self-esteem, self-efficacy, authenticity, trust in others, empathy, collaboration, conflict management, problem-solving, and creativity (see appendix 5). In the course, students were required to practice different types of activity. Firstly, they participated in the usual problem-based learning (PBL) sessions, in which each student has to read academic articles, and then re-explain them to their peer student. Secondly, students prepared presentations explaining an essential concept of the course, applying it to real-life examples, and inventing practical exercises for their peers. Thirdly, the students followed two times four hours of workshops of theater improvisation focused around the topics they previously theoretically studied. Finally, the students were evaluated on a final reflection paper about their personal development on two competencies they chose at the beginning of the course. The students were required to explain how they improved these objectives based on their own experience and academic literature (Couse manual Improv(e) yourself! 2018-2019, 2019).

This solution seems more successful in teaching soft skills. Following the model of constructive alignment (Biggs, 1996), the course 'Improv(e) yourself!' successfully incorporates not only theoretical knowledge on soft skills but also train them. Additionally, through presentations, students' exercises, and final self-reflection paper, the course can assess whether the students acquired the intended skills. Soft skills shifted from implicit potential knowledge to explicit learning material. In such an aligned course, it becomes much easier to ensure that students achieved the intended learning outcomes and, if not, to improve the course.

These two niche innovations show that mandatory skills courses are viable as part of a university curriculum and that practical implementations already took place (the course's interruption was simply due to the coronavirus pandemic). As Maastricht University is highly ranked internationally (Student Handbook 2019-2020, 2019), and is gaining interest in their practices, it can be hoped that other HEIs might feel pressured to adapt and similarly innovate their practices.

What are the limitations of the solution?

While different niches implemented soft skill courses, the fact that it remains rather rare hints that several barriers oppose to its mainstream acceptance. This section of the paper will identify three of these barriers; administrative or structural, organizational, and cultural.

Firstly, HEIs face an essential barrier of legislative and structural nature when attempting to implement any type of innovation. Due to the heavy dependence of HEIs on administrative authorities in all their management decisions, implementation of changes is arduous (Lašáková, Bajzíková, & Dedze, 2017). Administrative powers and the state regulate HEIs practices through norms of excellence and standardized requirements. For example, in many countries, self-regulated programs are not recognized as national programs ae, are not considered official (Mora & Villarreal, 2001). Such requirements strongly disempower HEIs to innovate. Additionally, the internal organization in HEIs impedes on the spontaneity to follow trends of innovation. Due to the high centralization of management in HEIs, communication, decision-making, and resource allocation tend to be lengthy, limiting innovation initiatives (Lašáková et al., 2017). To implement mandatory skills courses, HEIs would, therefore, need to receive national and administrative approval. As the importance of soft skills within education remains doubted (Armstrong, 2016), ican t be imagined that HEIs are reluctant to initiate the process.

The second barrier that HEIs may encounter when trying to offer soft skills courses is at the organizational level (Lašáková et al., 2017). Due to their ever-growing population, HEIs today are massive in size, use highly standardized procedures, and rely heavily on teacher-centered learning (Chan, Fong, Lyk & Ho, 2017). Chn, et al. (2017) explainr, that teaching skills or competencis, is a gradual proce that requiresng regular practice and feedback from learners to teachers. In large universities where teachers and students are rarely in direct contact, such a process is hardly imaginable. Therefore, even if they wished to provide soft skills courses, HEIs might consider themselves unable to do so. This could explain why smaller, younger, and more student-centered programs, such as Maastricht University, succeeded in setting up such courses, while more traditional programs have not.

Finally, HEIs face a huge cultural barrier to innovation, observable at both the organizational and individual levels. At the organizational level, the cultural barrier to innovation stems from the accreditation system on which HEIs rely (Armstrong, 2016). Because of universities' historical competence, standards of excellence are deeply rooted in past achievementsTherefore, c Changes accepted by accreditse, tend to maintain the previous status quo rather than disrupt it, and thus, innovations that suggest significant changes in practice are more often than not unpopular (Armstrong, 2016). Interestingly, individuals also appear to reproduce this resistance to change. Once again, as universities prospered for many decades, traditional practices became fully integrated into HEIs organizational culture (Caliskan & Zhu, 2020). Chn, et al. (2017) explain that trying to implement soft skills courses in HEIs is a challenge because senior managers, but also teachers, students and parents do not understand the crucial importance of learning generic skills and, as this was never done before, do not believe it is the role of universities to teach them. As a result, teachers are not adequately trained, and students are not encouraged to take courses that could foster the acquisition of such skills even if they had the opportunity to do so (Chn, et al., 2017).

Conclusion

In conclusion, this paper addressed the question of "how could Higher Education Institutions innovate their curricula to prepare students for the 21st-century job market?". The paper argued that HEIs should provide compulsory soft skills courses because such skills best respond he future job demand, shaped by the sociotechnical landscape. Additionally, the paper explained how the University College of Maastricht and the Faculty of Neurosciences could be considered as successful niche innovations that might inspire other HEIs to innovate their practices. Finally, the paper discussed structural, organizational, and cultural barriers to the implementation of soft skills courses in HEIs.

This paper contains several limitations. Firstly, the paper failed to provide a specific set of soft skills that HEIs should focus on. Literature demonstrated that the general inability to specify what exactly are soft skills and which onem are the most important to lean, is a substantial barrier to their implementation in HEIs (Chn, et al., 2017). Secondly, the paper might be limited in its relevancy because it seems that today, more and more institutions find the teaching of soft skills critical. Therefore the innovative character of the solution offered might be debatable. Finally, the beginning of the paper mentioned that society attaches three roles to HEIs; to train students for professional competencies, to raise autonomous individuals, and to grow responsible citizens. While the paped extensive discussedly the role of HEIs in providing adequate professional training, it did not mention the need for HEIs to finally understand their responsibility in raising autonomous individuals and grow responsible citizens. However, this paper named elements that could be used for this purpose, such as the 'values and attitudes' mentioned in the OECD Learning Compass (2019)

Further research could first attempt to identify how to provide a practical list of useful soft skills for HEIs to teach. Additionally, future research could analyze how soft skills might be co-dependent with learning about attitudes and values of the 21st centuy, and attempt to create courses taking all of them into consideration. Altogether, even if this paper does not provide all answers to the question it aimed to address, I hope that it has, at least, sparkled a light of interest for its reader, and could, potentially, initiate further research and potential attempts of innovation in higher education institutions.

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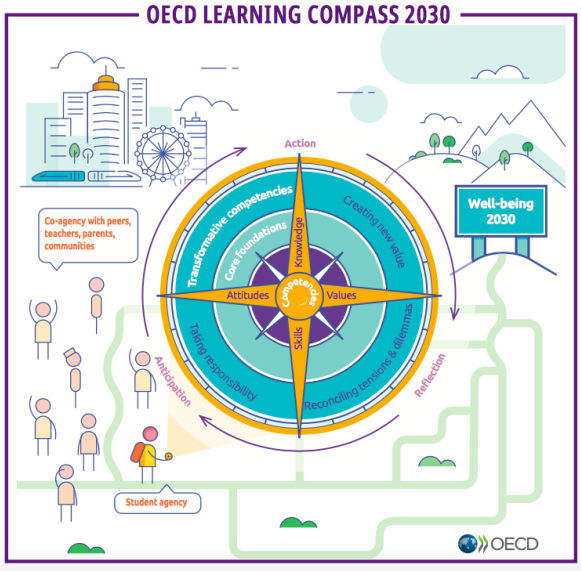
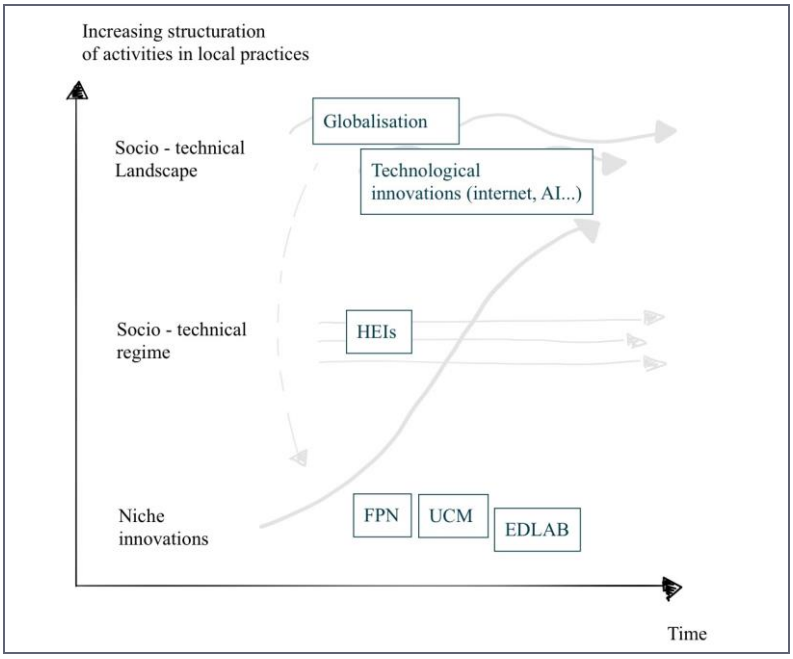
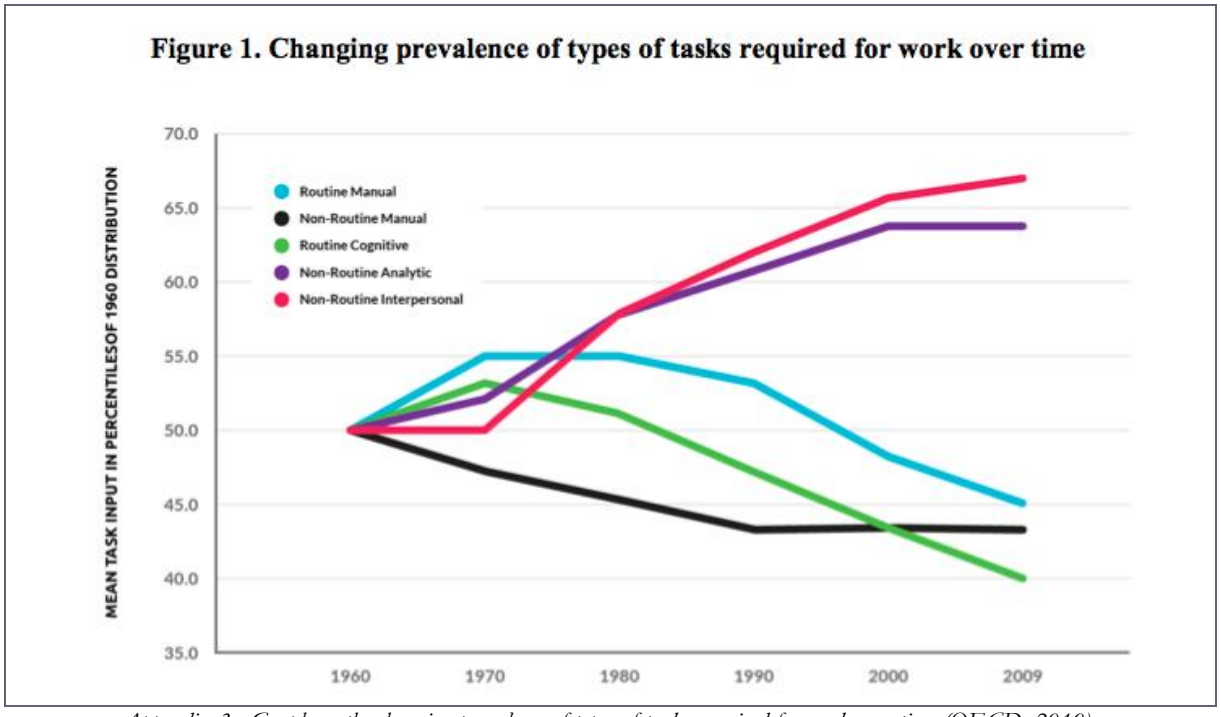
Appendices



Appendix 1 : OECD learning compass (OECD, 2019)



Appendix 2 : Application of the MLP to the context at hand



Appendix 3 : Graph on the changing prevalence of types of tasks required for work over time (OECD, 2019)

Appendix 4 : UCM course list

Course schedule

Week	Date	Format	Topic	Who
1	Wed, 05 Sep	Tutorial	**Introduction** - Set up of the course (2 parts: focus on individual and inter-relational soft skills) - Getting to know each other - Improv's principles: unconditional acceptance and embracement of failure	Tutor
2	Wed, 12 Sep	Tutorial	**Trust in one self and tolerance for uncertainty** - self-other perceptions of oneself - strengthening self-esteem and self-efficacy - dealing with uncertainty and ambiguity	**Students**
3	Wed, 19 Sep	Tutorial	**Authenticity** - personal values, needs, and motives - dealing with strengths and weaknesses - standing one's ground against opposing winds	**Students**
	Fri, 21 Sep (14-18h)	**Improv workshop 1**	**Focus on individual soft-skills** - self-trust/self-esteem/self-efficacy → **dealing with uncertainty and ambiguity** - authenticity/identity/strengths and weaknesses/sovereignty → **dealing with power and status**	Annika & Fabian
4	Wed, 26 Sep	Tutorial	**Trust in others, empathy and collaboration** - dealing with interdependence - practicing empathy and compassion - team-work and collaboration	**Students**
5	Wed, 03 Oct	Tutorial	**Conflict management** - understanding conflicts - discovering the benefits of conflicts - constructive problem solving	**Students**
6	Wed, 10 Oct	Tutorial	**Creativity** - perspective taking - divergent thinking - generating innovations	**Students**
	Fri, 12 Oct (14-18h)	**Improv workshop 2**	**Focus on inter-relational soft-skills** - trust in others/collaboration → **dealing with interdependence** - conflicts and their benefits/problem solving → **dealing with conflict** - creativity/innovation/divergent thinking → **dealing with complexity**	Annika & Fabian
7	Wed, 17 Oct	Tutorial	**Reflection and closing** - What have we learned? - How can you train the skills further in your daily life? - How can the skills be applied in future jobs/work settings?	Tutor
8	**Fri, 26 Oct @ 18h**	**Exam**	**Deadline to hand in a final individual paper**	Students

Please note! Exact times and rooms are provided on MyUM. In addition, please check the site of this course on the Student Portal regularly for possible changes and announcements.

Appendix 5: Improv(e) course organization & list of topics.

Making Participatory Policymaking Possible: A Case for E-democracy

Femke de Haan

Introduction

On October first, 2019, around 2200 tractors from all over the Netherlands took off in order to join a large protest in The Hague to speak their minds on the renewed nitrogen regulations (NOS, 2019-A). The plans included policies that hit multiple sectors, but the most noticeable reaction was that of the farmers who were against the need for reducing their nitrogen emissions if their farm is located near Natura-2000 areas (Nagtegaal, 2019). The new regulations came into play to address the nitrogen crisis in the Netherlands, which is an environmental problem that has been around for quite some time now. The newly introduced policies are thought to be the start of environmental betterment (NOS, 2019-B). Without the help of the farmers, however, there is little hope of achieving the necessary nitrogen reduction. This is a problem that is noticeable in many environmental issues, as the nature of those problems is complex (Van den Hove, 2000) and asking for cooperation between multiple actors (Geels, 2011). Furthermore, the need for environmental action cannot wait, as human impact can already be measured and noticed by environmental scientists, and inaction will only lead to greater problems (IPCC, n.d.). Additionally, the amount of Nitrogen present in the Netherlands is already harming nature, biodiversity, food production and human health (Natuurmonumenten, n.d.). Therefore, it is important that environmental policies, such as the one regarding the nitrogen crisis in the Netherlands, are executed in a manner that is effective and leads to smooth and swift implementation. Especially in the Netherlands, which is a relatively small, wealthy country with a knowledge-based economy, there are little excuses to be incapable of developing a well-working, inclusive way of creating environmental policies.

In the case of the phenomenon studied in this paper, something went wrong along the way resulting in protests and thus delay for addressing the nitrogen problem. In order to see what the problem is, the case will be analysed using transition management. The choice for transition management stems from the theory's ability to handle complex transitions like those concerning environmental topics (Loorback, Frantzeskaki & Huffenreuter, 2015). From that analysis it becomes clear that the problem is the lack of bottom-up support. This paper argues for the use of e-democracy in order to accomplish participatory environmental decision making in cases such as these in order to prevent further holdbacks and protests in environmental policy.

Dutch Nitrogen Crisis Management

When looking into the history of the nitrogen crisis management, errors are to be found in multiple places in the transition process. To start at the beginning, the Netherlands signed a treaty with the European Union in the 1970s on management of nature areas which needed to be protected, known as Natura 2000 areas (NOS, 2019-C). In and near those areas, companies could not expand their business or start construction work as that would harm the development of nature. However, in 2008, a landscape development accrued, namely the economic crisis of 2008. In order to revive the economy, the cabinet came up with a new policy: "Programmatische Aanpak Vermindering Stikstofdepositie" (translated: Programmatic Approach reduction Nitrogen deposition), better known as PAS (NOS, 2019-C). After battling some serious questioning from opposition, it was put into practice in 2015. The PAS facilitated the possibility for companies to acquire permits for construction or expansion near Natura 2000 areas. The permits were given under the precondition that the effects of the new activity would not harm or alternate life

in the Natura 2000 areas (Sietses & Drahmann, 2015). To make the constructions acceptable, the Dutch government agreed upon extra recovery programmes for nature in the country (NOS, 2019-C).

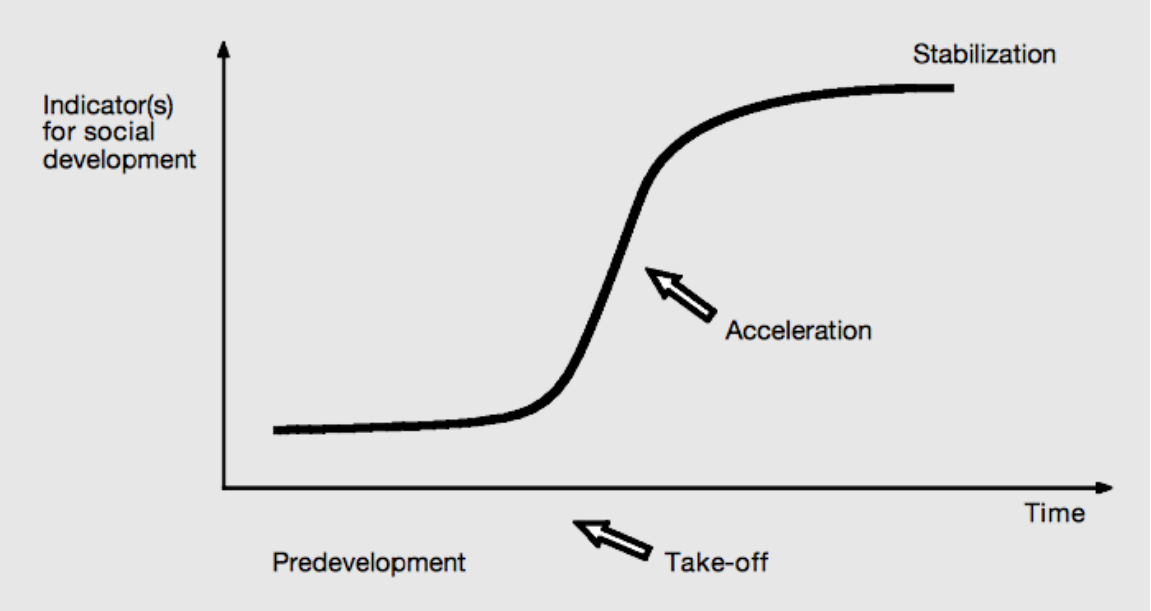
After implementation, the Raad van State, the advisory body to the Dutch government, received many complaints and was obliged to ask for advice of the European court of Justice (NOS, 2019-C). From European level the message was clear, the permits should not have been allowed to companies that are near Natura 2000 areas and are emitting Nitrogen (NOS, 2019-C). The Raad van State agreed with the European court of Justice, which resulted in denying PAS permits that had not yet been granted and new requests. New Nitrogen regulations were announced in October 2019. The result was the halt of many building projects as well as grand negative impact to agriculture, and as described in the introduction, heavy protests by farmers in The Hague.

Transition management

The transition towards the new regulations regarding the reduction of nitrogen can be classified as a sustainability transition, which means that it is a long-term, multi-dimensional and fundamental transformation process with the goal of pushing for more sustainable modes of consumption and production as the new established socio-technical system (Markard, Raven & Truffer, 2012). Such a transition is purposive, meaning it has a clear goal that is to be achieved by the public authority and civil society (Geels, 2011). Private actors, such as businesses, are less interested in addressing these problems as they are about public goods, which inherently results in prisoner's dilemma's and free rider behaviour (Geels, 2011). There are multiple ways to analyse such a transition, but in this paper transition management will be used.

Transition is the consequence of developments in several domains. It is a set of connected changes that strengthen each other but all take place in different areas (Rotmans, Kemp, & Van Asselt, 2001). The management of transition focusses on preventing conflict between short term concerns and long-term ambition by being sensitive to dynamics and regular alterations of goals (Rotmans et al., 2001). Transition management scholars have created an instrumental, practice-oriented model that can be used by governments to steer ongoing transitions towards more sustainable outcomes (Markard et al., 2012). Governments play a vital role in transition management. They should have a leading role in which they are supposed to inspire a collective learning process and encourage multiple actors and stakeholders to participate in polity making (Rotmans et al., 2001). Transition is believed to take place in four phases, as show in image 1, all with a different rule for governments (Rotmans et al., 2001).

The first is the predevelopment phase, with a dynamic equilibrium without visible status quo changes (Rotmans et al., 2001). The role of the government is to be the catalyst and director, opening up the discussion between different actors. Secondly, there is the take-off phase, where change is initiated by a shift in the system. In this phase, the government has to stimulate the learning process about possible solutions, as the actors must be mobilized towards the desired outcome. Thirdly the breakthrough phase stands for the moment structural changes become visible resulting from socio-cultural, economic, ecological and institutional changes that interact in which the government resumes its stimulating position. During this acceleration there are collective learning processes, embedding processes and diffusion. Lastly, there is the stabilization phase where social change slows down with the establishment of a new dynamic equilibrium where the government needs to prevent or minimize backlashes and negative effects (Rotmans et al., 2001). It is seen that the most effective role of the government finds itself in the predevelopment phase, where variation is key (Rotmans et al., 2001).



Looking at the management of the Nitrogen crisis in the Netherlands there is little resemblance to these transitions. First of all, in the long-term planning, which usually requires a timespan of about 25 years (Loorback, et al., 2015), the error seems to be a legal issue as the PAS was not complying with the legal framework set by the EU and signed by the Netherlands. However, zooming into the time from transitioning from the PAS to the new plan introduced in 2019, there has been little time. Obviously, there could not be because of pressure from the landscape: EU regulations. A second issue, based on statements made by protesting farmers, the decision-making process did not happen inclusively (NOS, 2019-D). Rather the new rules are imposed in the farmers by the government in a top-down manner. This would mean that, according to the protesting farmers, the government took an insufficient stimulating role in setting up the new regulations. One important aspect in transition management that has thus far been left implicit is participation of stakeholders in the transition process starting at the predevelopment phase (Loorback, et al., 2015; Rotmans et al., 2001). Although transition management focusses on selective participation in theory, it is often seen that certain marginalised groups are not included in practice (Loorback, et al., 2015). So, it is not only a puzzle of how to include these groups but also how to position the transition management in a way that it does create the space for those voices to be heard. Furthermore, literature shows that because of its informal status, the desired outcomes can only be reached when supported by other actors in the political field and society (Loorback, et al., 2015). In the case of the Dutch farmers, speaking of a marginalized group seems wrong, as they are major businesses with their own ministry and trade unions. However, their interests are thought not to be heard properly resulting in their protests. However, seeing that without their help the goals are not going to be reached, resulting in the nitrogen crisis not being fixed, a solution to this problem of representation in the decision-making process is needed.

Participatory policy making

Given the nature of the problem, it is a logical first step to go into participatory policymaking first. After all, by including the farmers in the decision-making process, the problem seems to be solved. Within the governmental realm, it is already seen that multi-level governance (MLG) improves the quality of the policy constructed around

environmental issues, because it brings an increased access to information and better understanding of what would help in which context (Newig, 2009). MLG refers to governmental systems that work on different levels, from national to municipal for example. Furthermore, within the decision-making process, participation of non-state actors is of great value. Especially because of its positive influence on acceptance of public policy, as that is an important precondition in a fast implementation process as well as compliance with the new policy (Newig, 2009). Van den Hove (2000) also stresses that, especially in the first phases of policymaking, participation of the stakeholders helps with increased knowledge, information, dynamics and a better use of the information. This reinforces the idea that the government should make use of its role as stimulator for discussions and solutions by many that are to be influenced by the policy eventually. Additionally, adding people to the process that are not bound by electoral constraints may improve legitimacy of the final policy as it reduces considerations regarding personal interest (Van den Hove, 2000).

The difficulty with participatory policymaking lies in its implementation. This is because the more the merrier is not easily adopted in existing political structures. First of all, if more groups participate, how does one legitimize them and how is the representativity of the groups ensured (Van den Hove, 2000)? In other words, what groups should be included and excluded on which topics and are they accurately representing their supporter's opinions? Secondly, depending on the exact design of the process, how is the selection of participants organised and can legitimacy be guaranteed (Van den Hove, 2000)? Lastly, there is the challenge of balancing the different power relations and being able to solve disputes between parties in a satisfactory manner. Both are required in order to safeguard both quality and equity criteria (Van den Hove, 2000). Especially in matters regarding environmental policy, where contradicting opinions of stakeholders can result in disputes (Van den Hove, 2000).

In order to find a suiting implementation of participatory policy making in the context of this paper, it is important to understand some limitations that are in place. First of all, the solution should fit within the Dutch political system as that is the context in which the problem is taking place. Secondly, because there is limited time available, the solution should try to be as time efficient as possible. Lastly, it should be remembered that farmers are busy people who have companies that require loads of time, money and effort every day, thus a successful solution tries to limit the effort farmers have to put into it.

E-democracy

The way of implementing participatory policymaking is the use of E-democracy within a participatory, multi-level governmental system. E-democracy is an umbrella term for a range of democratic activities carried out by using electronics (Lee, Chang & Berry, 2011). More specifically, it can be described as "the use of information and communications technologies and strategies by "democratic sectors" within the pollical processes" on multiple levels in the governmental system (Clift, 2004, p.2). Democratic sectors refer to governments, elected officials, media, civil society organizations, political parties and interest groups, international governmental organizations and citizens (Clift, 2004). The goals of using e-democracy are improving efficiency, equity and quality of democratic participation (Lee et al., 2011). While not booming in the Netherlands so far, e-democracy has found its way in countries like the United Kingdom and Canada, where it is mainly used for consultation during the executive policy-making processes (Clift, 2004). When specifically talking about including citizens in the governmental processes, one usually speaks of e-participation (Lee, et al. 2011).

Diving deeper into the possibilities technology has to offer policy makers, one might find that Public Net-Work is an even more suitable solution to the problems addressed in this paper. Public New-Work refers to a government strategically using ICT to improve the implementation of established public policy goals by directly communicating with diversified stakeholders in an online format (Clift, 2004). It results in participative output in a selective approach that uses two-way online information and knowledge exchange to carry out a previously determined policy (Clift, 2004). During these discussions, many actors are included, but are focused on specific issues that require niche stakeholder points of view. In order for this type of e-democracy to work, though, the government needs to take its role as stimulator seriously, they are not to play the expert but the providers of public services in order to find solutions together with people who have different but valuable knowledge (Clift, 2004).

After describing both options, it would be best to find a mix or of e-democracy approaches. In the situation of the Dutch farmers, ideally, they would be included in the policy-making process during the predevelopment phase. By establishing a multi-level governmental approach, where farmers can have online discussions via online resources, or less elaborated versions like direct democracy on certain questions specific to their field of interest. In creating the online platform, the user needs to be held in mind. It has been found that higher levels of satisfaction among citizens positively relate to adaption and use of electronic government services (Lee et al., 2011). When the platform is too difficult to work with or too different from what people are used to currently, it will not be used properly (Clift, 2004; Lee et al., 2011). Therefore, it is desirable to use existing channels of online communication between the government and non-governmental actors. Luckily, the Netherlands has a well-established online access to governmental websites and such. Furthermore, in current times, Covid-19 has obliged many to move to online platforms, which is probably stimulating its development.

The process can be as follows: during the decision-making process, stakeholders (in this case Dutch farmers) are notified by their municipality after which an online meeting or voting session can be held. This can be hosted via a program that has shown to be working properly for meetings and discussions during the Corona crisis. The invitations can be sent to all farmers that are affected by the new regulations and thus let them speak their minds. The farmers can log-in to the meetings using their DigiD (an online and secure identification method that is already in place and used for governmental tasks like registering taxes (Belastingdienst, n.d.)) to prevent intruders from entering the conversation. Then, due to the multi-level governance system that is already in place, the conclusions from the municipal discussions can be taken up to provincial level and the governmental level where the knowledge, struggles and preferences can be acknowledged and considered by the national policy makers during the pre-development stage. From higher level and in other stages than pre-development, polls can be created which can be filled out through the same channels as described above, which allows for continuous information influx throughout the process.

Limitations

This solution does not come without limitations. To start with the obvious, this approach asks for access to online facilities, which makes the idea in favour of the economically advantaged (Thomas & Streib, 2005). This will probably not be an issue in a wealthy country like the Netherlands. However, if the solution is to be used in other context's this is a limitation to take into consideration. Furthermore, it is noted that it is hard to compare e-democracy across countries as the contexts are often very diversified (Lee et al., 2011). The studies used in this paper are not based on the Netherlands, and therefore it is important that such a solution could still be difficult to

implement due to contextual issues that have not accrued in other studies. Thirdly, as Van den Hove (2000) and Geels (2011) stated, there are conflicting interests. However, the sustainability transition is a goal-oriented phenomenon (Geels, 2011). Therefore, despite the differences in opinion, the nitrogen level must still reduce even if the farmers do not wish to do so. In other words, the influence of the participation can only go up to a certain point, otherwise it could endanger the environmental goal for which the policies were created.

Aside from the limitations that come with participatory (e-)democracy and decision making, there are also limitations to the role the government can take within transition management in total. Firstly, landscape changes, like the 2008 economic crisis or obligations from the EU, can only be steered to a certain extent (Rotmans et al., 2001). The landscape changes can alter the long-term plans of governments as what happened in the case of the nitrogen crisis management, which cannot be solved by the solution as proposed in this paper. Secondly, there are the constraints of the political system that is already in place, including the national and intra-national regulations (Rotmans et al., 2001), which constraints the possibilities of implementation manners of e-democracy. Thirdly, the process is still time consuming and should be adopted within the long-term planning of the government, which could thus be disrupted by landscape changes.

Conclusion

In this paper, a solution has been proposed for the nitrogen crisis management situation as seen in the Netherlands. The problems identified after an analysis with transition management were long-term planning issues and involvement of stakeholders. As the long-term planning was disrupted by landscape changes and legal issues, the focus in this paper was on analysing how to improve the participatory aspect in the policy making. For this puzzle, participatory policymaking is introduced which can be implemented by using e-democracy. More specifically, using Public Net-Work in the pre-development stage of the transition management. By using existing digital governmental channels on municipal level, the knowledge and opinions of farmers can be transferred to provincial and national level and taken into the transition plans. Studies have shown that increased participation will result in swifter and smoother implementation of policies as an acceptance is created. Therefore, the protests can be prevented using the solution as proposed in this paper.

There are some points that need to be addressed further in order to successfully implement this solution. First of all, as the context is very important and there is little information on e-democracy within the Netherlands, it is of great importance to start research on what kinds of e-democracy would work best and are easiest to implement in the Netherlands. Furthermore, research needs to be done on what mediums are best to use in the case of the Netherlands. As described in this paper, there are already many channels to look into, but in order to make the solution work as smoothly as possible, such information is very valuable. On a policy basis, e-democracy must be included as policy stating who can be invited to what issue, in order to have proper selections of stakeholders in the process of policymaking. Also, there need to be rules as to how much influence the outcomes of discussions and polls using e-democracy should have. As the contradicting interests cannot stand in the way of environmental betterment, it is important not to let contradicting views stall the decision making and environmental action. After all, it is not desirable to have improved participation result in destruction of the land both government and stakeholders fight for.

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Transitioning Towards More Holistic Nature Conservation in the UK

Frankie Osborne

Introduction

Despite decades since the start of the modern environmental movement, the foundation of more protected areas in the UK, high levels of admiration for nature and membership of environmental charities, there is still a 'crisis' in nature in the UK. Several State of Nature reports in the last decade reported the UK as one of the 'most nature depleted in the world', with 41% of species falling in abundance since the 1970s and 15% of species under threat of extinction (Hayhow et al., 2019). Within the UK, the largest environmental pressures are agricultural practices, climate change, pollution, urbanisation and invasive species (Hayhow et al., 2019). The problems of the UK are shared at a global level in what some describe as a Sixth Mass Extinction event, with 32% of species declining globally and potentially 50% of individual animals that were once present alongside humans gone (Ceballos, Ehrlich & Dirzo, 2017). The effects of biodiversity loss are profound and extinctions are irreversible. The associated loss of ecosystem services is also detrimental to humans and other issues such as climate change prevention, health, economics and poverty alleviation.

This paper focuses on conservation practices. Currently, conservation primarily happens in protected areas which are 'a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem and services and cultural values' (p125, Dudley & Stolton, 2008). Originally, these were suggested as a solution to environmental problems by creating wilderness free of human influence (Phillips, 2003). Over time, this has changed. A modern approach includes social or economic objectives, engages with locals and uses interdisciplinary governance in networks (Phillips, 2003). Protected areas are considered important for biodiversity for a number of reasons. First, they have important features that resulted in their designation, like Special Areas of Conservation (SACs) or Special Protected Areas (SPAs) are designated for supporting rare or endangered species (Jones-Walters & Čivić, 2013). They also can be areas for developing practices that could support a wider sustainability transition, for example, developing methods that can be applied to agroecology or regenerative design in surrounding areas (Kremen & Merenlender, 2018). There is a large literature on the philosophical understandings of conservation, with key divisions on human-nature relationships and different methods of conservation. The focus of this paper is on what Brockington, Igoe & Duffy call 'mainstream conservation' in the UK context, which is made of specific actors with their own definitions, institutions and methods (2012). These aspects of mainstream conservation are put into a Socio-technical systems conceptual framework.

Current research focuses on the suggestions for how to change conservation practice, but often overlooks how transitions succeed or fail. This paper first discusses the problems in the sector, followed by the theory of innovation and radical change. These are then brought together to explore different drivers and barriers for change in practice. As change is clearly needed, this paper argues for policy interventions that could result in a shift towards conservation that is more connected, both between locations in a network and to a broader segment of the UK population.

Problems with Conservation in the UK

One critique of mainstream conservation is its failure to protect the natural environment. Despite important environmental breakthroughs in international, EU and national legislation such as the Bern Convention or Aichi targets there has not been improvements concerning biodiversity loss, meaning conservation is failing at one of its key aims (Jones-Walter & Čivić, 2013). One criticism of protected areas is that they are too focused on protected areas. Carver describes this as a "fortress conservation" that focuses solely on specific protected areas (2019). A lack of connectivity and focusing too much on individual sites or species is consistently brought as an issue in conservation (Carver, 2019) (Glover et al., 2019). A related criticism is that management is bureaucratic and outdated. Moves towards smaller authorities for protected areas has led to less effective management as it is split up (Phillips, 2003). In the UK, local governance means that a lot of administration is repeated and boards of public authorities are exceptionally large compared to the budgets available (Glover et al., 2019). Other problems include an unmanageable number of priorities for land managers to handle and the time or resources needed for stakeholder participation (Phillips, 2003). As well as the protected areas being geographically limited, the management priorities

are also often limited in scope and have specific goals. Furthermore, managers are criticised for these goals not being flexible and processes of change requiring overly long consultations (Green, 2020). Overall, the picture of the sector is that management is not effective in setting priorities, managing budgets and being flexible in meeting conservation aims.

Second, a lack of engagement with people is criticised. First, the conservation sector has been criticised for a lack of engagement with local people. The previous issue of management contributes to this, as land managers are limited in time and resources for stakeholder engagement (Phillips, 2003). Critics view the current processes of engagement with locals as inadequate and tokenistic, therefore not providing value to the process (Green, 2020). Furthermore, VME (Visibly Minority Ethnic), younger, disabled and working class people are significantly less likely to visit protected spaces or work in mainstream conservation organisations (Glover et al., 2019) Barriers identified in the U.K. include lack of public transportation, limited access, social exclusion and a lack of long-term coordination to overcome these barriers (Glover et al., 2019). Others argue that inclusion of more people is necessary in the Anthropocene where humans have a massive impact on the environment (Büscher & Fletcher, 2020). Their argument is that conservation needs to integrate with human needs, with more of the economic and social goals being included (Büscher & Fletcher, 2020). This critique, the previous of management being bureaucratic and not focused enough on nature often clash in their proposed solutions to problems in conservation.

A third critique is how mainstream conservation is used to support or justify environmental destruction in other areas. Brockington, Igoe & Duffy describe how conservation is intertwined with capitalist processes that cause environmental degradation (2012). One example is the support of conservation organisations like the WWF and IUCN for dams along the Mekong River, as it would create new protected areas (Brockington, Igoe & Duffy, 2012). There has been a Polanyi-style marketisation of conservation practices in the modern mainstream style, such as pricing nature or promoting eco-tourism (Phillips, 2003) (Büscher & Fletcher, 2020). Many critics of this marketisation suggest more 'fortress conservation' to respond to this, by setting out more areas to protect spaces from human influences (Büscher & Fletcher, 2020). However, this viewpoint often considers conservation as a countermovement to capitalism or a socialisation movement. This is understandable, as many conservation sites were originally state-run with a focus on returning sites to 'pure wilderness' (Phillips, 2003). The first issue with this is how conservation is used to justify degradation outside of protected areas and second that a focus on wilderness has been used to exclude locals, particularly indigenous groups.

Theoretical Understandings

Geels describes socio-technical systems as 'the linkages between elements necessary to fulfil societal functions' (p900, 2004). ST-system theory draws on innovation system approaches whilst broadening the area of focus to include the distribution and use of innovations (Geels, 2004). Within a ST-system, there are human actors who act and interact for the ST-system to work (Geels, 2004). These actors have shared institutions at the level of the ST-system and in sub-groups within the system that guide how these actions are carried out (Geels, 2004). Institutions are similar to rules, which can be regulative rules, normative or cognitive (Geels, 2004). Within this paper, conservation is conceptualised as a ST-system where the societal function to be fulfilled is the preservation of nature. The actors in this sphere include landowners and traditional conservation groups like NGOs. Also involved are other contributors, including local individuals who use the land and other civil society groups, which are otherwise involved. The ST-system approach is useful in drawing the focus away from solely conservation groups, but also including actors such as visitors to areas or cultural organisations that have a role in the production and use of ecosystem services. Although it takes into account physical structures of these systems, this perspective is limited somewhat by anthropocentrism, so non-human purposes or meaning should also be considered outside of this perspective. Describing nature as something produced may also commodify it (Brockington, Duffy & Igoe, 2012).

The problems raised in the previous section show the need for a change in the conservation sector. In the MLP, changes to the ST-system can arise following the mis-alignment of parts of the ST-system (Geels, 2012). These parts are the niche, regime and landscape levels, as well as sub-systems within these (Geels, 2012). Misalignments can lead to transformations, such as the landscape level change of WW2 leading to transformation in jet engines (Geels, 2012).A change is a socio-technical transition if they are a fundamental shift in the ST-system in many aspects of the system (technological, material, organisational, institutional, political, economic, socio-cultural) over time (Markland, Raven & Truffler, 2012). Transformative innovations include not only technological change but also changes in user

practice and institutions, such as the transition to automobiles in transportation (Markland, Raven & Truffler, 2012). For the conservation system, a transition would require recognised innovations in management techniques, such as the use of GIS technology or new knowledge from ecological science (Glover et al., 2019) (Isaac et al., 2019). Nevertheless, a transition would also require changes to institutions and user practices, which requires a wider perspective.

Thinking Big

A suggested action is to shift the focus of conservation away from protected towards planning at a regional or landscape scale. This has been argued for since the 2000s as part of the modern approach (Phillips, 2003). Such an approach is supported by ecological science suggesting it makes ecological networks more resilient to shocks, as areas can be recolonised, populations can shift and a reduced statistical effect of local shock (Isaac et al., 2019). In the UK, the Lawton Report called for a landscape-based approach that was aptly described as 'More, Bigger, Better, Joined' (Lawton et al., 2010). These are the key aspects of regional planning- creating *more* areas, having *bigger* protected areas, improving management so there are *better* quality areas and *joining* these through corridors or buffer zones (Lawton et al., 2010). The report was influential due to the skills of the leader author as a 'policy entrepreneur', the use of accessible language, having rigorous science and using politically salient frames during a favourable policy window (Rose et al., 2018). It resulted in a White Paper soon after, however in the longer term the success of the report is mixed. More recent reviews of policy in the UK still find that it is lacking in terms of connecting different protected areas (Glover et al., 2019). This suggests that there are still major barriers to implementing this innovation, despite the presence of scientific evidence and support in principle from policymakers for changing practices.

In the MLP, there are different drivers of transitions at the landscape and niche level. For conservation in the UK, there are numerous landscape level drivers. The landscape level is contextual backdrop and forces on the ST-regime, which is generally relatively stable (Geels & Schott, 2007). The 'key drivers' of environmental change in the UK identified by the *State of Nature Report* are some of these, including invasive species, urbanisation, pollution, climate change and agricultural practices (Hayhow et al., 2019). Whilst the conservation sector can have some impact on these problems, these influences are often in areas of policy outside of its reach (Hayhow et al., 2019). The key actors, such as NGOs like the RSPB or National Trust, generally have less power with policymakers than would be expected for their membership numbers (Carver, 2019). Notably, climate change is a type of slowly changing factor that creates a pressure on the ST-regime. It has led to calls for changes in management to think more long-term and also to minimise climate change impacts, seen in the 2010 Aichi Targets (Phillips, 2003) (Jones-Walters & Civic, 2013). Regional planning is one response to this. However, there is a disconnect between the 'conservation sector' and climate change activism. This is despite climate change being a politically salient theme that can get the interest of politicians and of younger people (van Hensbergen & Huggett, 2015) (Rose et al., 2018). Climate change is one of many landscape drivers, which are the dominant pressure on the conservation ST-system.

International policy is another drive of change. This includes the Paris Climate Agreement, Sustainable Development Goals and the Convention on Biodiversity as frameworks guiding national legislation in the UK (Stewart et al., 2019). In turn, these influence the legislative rules in the conservation ST-system. Currently Brexit is the most notable landscape driver, with the UK regaining legislative powers from the EU that carry risks for environmental policy in the UK (Burns, Gravy & Jordan, 2018). Whilst the UK promises to maintain environmental policies, there is still a loss of expertise from EU agencies, the enforcement by the European Court of Justice and also that a trade deal without standards could reduce the case for maintaining current protected areas (Burns, Gravy & Jordan, 2018). Whilst it poses a risk, Brexit is also viewed as an opportunity for changing agricultural policy to a more environmentally-supportive option than the EU Common Agricultural Policy (Stewart et al., 2019). In order to achieve this, the new post-brexit environment would need to consider sustainable land use, food production and supporting the rural economy (Stewart et al., 2019). The landscape pressure of Brexit is recognised as a potential cause of fundamental change in conservation in the UK, as well as surrounding policy like agriculture. In Geels & Schot, this would be a rapid external shock from the landscape (2007). Such actions do not automatically result in change but can provide deep-structural influences that can make certain actions easier (Geels & Schot, 2007). In this case, Brexit can provide an opportunity for a new niche to emerge, as the legislative rules of EU policy are removed.

The niche level also drives transitions. Niches are protected spaces where radical innovations from the current

regime can emerge and develop (Geels, 2004). In a niche, there are three processes of articulating visions, building social networks to increase the resource base and learning to further articulate processes (Geels, 2011). One example of a conservation niche is Rewilding, inspired by methods of conservation from the Netherlands and USA (Pettorelli, Durant & du Toit, 2019). This approach includes both a technical change to using natural processes for conservation and social changes such as establishing a new understanding of the human-nature relationship (Pettorelli, Durant & du Toit, 2019) (Carver, 2019) . Similarly, the rewilding community in the UK has a network of researchers, practitioners, journalists and activists involved in researching ideas, articulating visions and experimenting with rewilding initiatives at specific sites (Pettorelli, Durant & du Toit, 2019). Currently there is science and policy development on regional planning, as well as initiatives, but it lacks a social innovation focus. This is similar for many proposed innovations in conservation and it is clear that further development of ideas outside of the current ST-regime is necessary. This lack of niche development is a key barrier to shifting the focus of conservation from protected areas to regional management.

Despite consistent calls for change and the recognition of these by the government, fundamental changes have not occurred in the UK conservation ST-system. The literature on ST-systems suggests several reasons why this can occur. One issue is that all ST-systems are relatively stable due to their game-like dynamics, resulting in path dependency and an interdependent network of actors (Geels, 2011). In conservation, UK National Parks have a cognitive or normative barrier to collaborating with and supporting strengthening other protected areas in the UK, as it is viewed as a threat to their existing resources (Glover et al., 2019). A second aspect from the literature is the institutions that limit the behavior of actors and which actors reinforce by actors carrying them out (Geels, 2004). Complaints about bureaucracy are representative of the issue of institutions that are ineffective or negative. Another example is the normative institutions of values, expectations and norms in conservation organisations that exclude people outside of a certain demographic (Glover et al., 2019). A third barrier is existing material and technical investments in the regime, which are clear in the current budgets, priorities and areas designated for protection. It is acknowledged that reform would mean some areas lose out compared to the status quo in terms of resources (Glover et al., 2019). These barriers need to be considered in conjunction with the recognition that the niche is not fully developed.

Conclusions and Recommendations

There are limitations to the analysis in this paper. The MLP has been criticised for having a clear ontology but less developed methodology, meaning that it would benefit from other analyses such as agent-based modelling or network analysis (Geels, 2011). Looking at the conservation sector as a ST-system also can suggest a higher level of coherence than there is in the ST-system, which is not fully addressed in this paper. Furthermore, this specific paper is limited in its focus on the UK, limiting the applicability to other countries, especially outside of Europe. Second, the landscape pressures of Brexit are highly uncertain and their impacts on any system are difficult to ascertain as it depends highly on negotiation outcomes.

There are also issues with a regional approach that need to be considered. The approach is data-intensive and would only be as effective as the information collecting procedures for it (Isaac et al., 2019). Another limitation referenced in this paper are the many landscape pressures such as international policy, agricultural policy and climate change that are largely out of the control of the conservation-sector as an ST-System. One argument of the paper is that individual innovations in the conservation sector are unlikely to be a solution for the issue of biodiversity because of these limits. However, a regional approach could be beneficial for the purposes of conservation.

The focus of this paper has largely been on the barriers and drivers of change in the conservation sector. The lack of fundamental change in response to criticism suggests conservation is not currently supportive of innovation. Therefore, the suggestions below concern both regional planning but also the support of innovation in conservation generally. Borras & Edquist argue that the individual instruments need to be concrete, customised to their setting and in a mix of instruments that complement one another (2013). It is therefore important that any policy concerning conservation is aligned with other policy on areas such as agriculture, urban planning or fisheries. Overall, the conversation ST-system should leverage more power in these areas. Rose et al. suggest using cognitively salient issues and leveraging windows of opportunity can mean policy recommendations are noticed (2018). The current policy window of Brexit and a higher public interest in the environment is an opportunity that should be capitalised on. Brexit is potentially a situation where the organisational capital of the existing network is broken,

meaning the ST-regime is less locked-in (Geels, 2004). If landscape developments were to pressure the regime to fundamentally change, it would resemble a *transformation* pathway, as the current innovation is not developed (Geels, 2011). Overall, conservation in protected areas needs to respond to landscape developments and policies are needed to develop niche ideas in response.

Policy Recommendations

- *Building Networks*
- *Iterative Policy Approach*
- *Working Beyond Traditional Areas*
- *Connecting to More People*
- *Use Technology & Volunteering*

To support a transformation, several areas of policy are suggested above. The first of these involves building networks. This is a key step of niche development and is necessary for a regional approach to develop enough to compete with the ST-regime. Strategic niche management such as is required (Markland, Raven & Truffler, 2012). Second, an iterative approach is needed. Isaac et al. argue these steps of collecting data on networks, assessing them, monitoring them and reviewing them is necessary for a network based approach (2019). Third, any approach needs to work beyond traditional areas of conservation. Physically this could mean rethinking the nature of protected areas to being part of networks of working habitats that also support biodiversity like those suggested by Kremen & Merenlender (2018). It also involves rethinking the nature of conservation, perhaps to remove the focus on protected areas. Fourth, the issue of disconnect needs to be addressed because as previously mentioned, ST-transitions include user practices and social innovations. Substantive actions need to be taken to engage VME people, youth, disabled, lower SES and urban people. Having new actors in the space would uproot some of the rules and regimes, by bringing in different areas of expertise with different cognitive approaches and by breaking down normative rules about what priorities are important (Geels, 2004). Finally, both the issue of data collection for the iterative approach and the engagement could be addressed using technology and volunteers in conjunction. Approaches from digital participation and the wider environmental movement could inspire opportunities for new types of volunteering such as collecting data to post online, shorter term volunteering and reaching out to different audiences using digital technology.

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Policy Innovation and Instruments for Citizen-Driven Urban Living Labs

Isa Laurent

Introduction

This paper imagines a city where citizens are city makers and urban governments serve citizen's interests in an innovative, responsive and legitimate way. *Although this urban Utopia lies at the horizon and might never be reachable, it may cause us to advance.* Public services have been criticized to be ineffective and robust (Maarse, 2017). Under New Public Management, cities were being marketized and were run like companies. The human, the citizen, participation and democracy were not at the centre of it. Also, the marketization of human life and the state-based social protection have been argued to be partly flawed and did not carry human values at the core (Kemp et al, 2016).

A request for change has been found on several levels. SDG targets 11.3, 16.7, 17.17 have focused on the importance of inclusive sustainable urbanization, civic participation in decision-making and civil society partnerships. Also, the European Urban Agenda and Urban Network organisations like Urbact, Eurocities and Breakthrough Cities have called for an increase in cities' capacity to support higher levels of citizen participation, in specific to commit to experiment and listen to its citizens.

Different types and levels of citizen participation or engagement have been identified. This paper will align with what Faehnle et al (2018) has called Citizen Engagement 3.0. Citizens are herein engaged till such an extent that they can be considered city-makers themselves. They choose and organize where there and the community's interests lie. This paper will look at one specific new type of urban governance: Citizen-Driven Urban Living Labs (ULLs) which highly aligns with the view of making citizens as city makers. This paper will ask the question: 'In which ways, if so, can Citizen-Driven Urban Living Labs be stimulated by policy for a human-centred transition towards citizen engagement 3.0?. Citizen-driven ULLs are a newly and relatively under researched classification of the bigger family of ULL's. It is thus relevant to look into this type. It does, however, also point at a general limitation of this paper. The concept's boundaries are not clear-cut. For the scope of this paper, there will be focus on the presence and absence of policies regarding Citizen-Driven ULL's in the Netherlands. The Netherlands have been considered to move from a Welfare State to a Participation Society in 2013 (Maarse, 2017), a lot of emphasis, but also shortcomings within citizen engagement are still present.

This paper will argue that Citizen-Driven ULLs are one type of social innovation, which is, so far, fairly individualized and in-between existing support systems. However, Citizen-Driven ULLs do not have the capability or intention to deeply reform urban governance, with increased support from urban governments these initiatives could be strengthened and urban governments' services might (slightly) change through it. In what follows this paper will first give some more background information on Citizen-Driven ULLs and why they can be considered to be socially innovative, afterwards the main theories informing this paper will be shared, followed by a discussion on the current status of ULLs and motivations to provide more policy support. Finally, the main shortcomings in policy and this paper's recommendations to improve the latter will be shared.

Background: Socially Innovative Citizen-Dirven Urban Living Labs

Urban Living Labs address urban challenges by several methods of real-life experimentation and learning applied in a geographically bounded space and active citizens' involvement in the innovation process. Citizen-driven ULLs are besides technology- and transition-driven ULLs (which are more government steered), a classification of ULL which include a special platform which emphasizes residents and their communities as users and providers, an instrument for citizen engagement 3.0. They are rather informally arranged around the community of users and aim to solve a citizen's real-life challenge. Herein local urban governments are the main partners, stimulators or enablers involved according to the Rathenau Institute (2017).

Each Citizen-Driven ULL could be considered a social innovation since they all introduce new social relations, involving the spread of new knowledge and new practices. Adopting the first three principles of the Transformative Social Innovation theory (Haxeltine et al., 2017), one can indeed see that they, first of all, endorse alternative values, including inclusiveness, engagement and resilience, and they often shape a geographically bounded reflexive and experimental space therefore in which their vision may be realised in the form of new or alternative social relations

and practices between the citizens and another actor (in the case of this paper mainly the urban government) (Fiuza, 2017). Citizen-driven ULL should herein both empower the individuals involved, always safeguarding their interests, and the SI initiative as a collective place. They differ from 'normal' citizen initiatives in that they emphasize their experimental and innovative working and rely on another cooperative actor with whom they cooperate.

The Anatomy of Transformative Social Innovation and Potential Policy Facilitations

Citizen-driven ULLs as a social innovation can be situated within transitions from a human perspective. This humanization is based upon the values of reciprocity, responsible citizenship, integrity and autonomy, connection and trust (Kemp et al., 2016). Within this type of transition this paper will zoom into the Transformative Social Innovation theory, which describes social innovation and how it can increase or maintain its 'transformative' agency (Haxeltine et al., 2017). It argues that even if SI initiatives manage to emerge and sustain themselves as empowering collectives of 'transformation-minded' individuals, their scope for engendering transformative change still depends on their capacity to form network formation with other SI initiatives, which can be broken down into the distinct dynamics of: the emergence of SI in more or less stable action fields (proposition 4), the formation of transnational SI networks (proposition 5), and discourse formation (proposition 6). The efforts of SI initiatives to emerge in coherent forms and engage in network formation in turn provides the basis for them to realise transformative ambitions by attempting to challenge, alter or replace dominant institutions by finding of an institutional home (proposition 7), and the identification of strategies for challenging, altering or replacing existing institutions (proposition 8). Finally, also the relations with the socio-material context inform and are plausibly affected by the SI initiatives (Haxeltine et al., 2017).

Looking into how social innovation could be stimulated by policy. It is important to mention that it points at a paradox one needs to be aware of. The TSI theory pointed at the paradox of embedded agency: SI initiatives strive to exercise 'transformative' agency while in turn they are also strongly shaped by the very same institutions and structures that they seek to challenge (Haxletine et al., 2017). Creating policies for social innovation should thus take care that they do not disempower these initiatives but empower them through o.a. stimulating their independence and maintaining their social innovation.

Borrás and Edquist (2013) identify three types of innovation policy instruments: regulatory (tools for the regulation of social and market interactions), economic ((dis)incentives for the pursuit of certain social and economic activities), and soft instruments (voluntary and non-coercive means to build capacity, often connected to the government in the role of coordinator and facilitator*).* Importantly, these instruments are often used in mixes (Borrás & Edquist, 2013).

In choosing a policy instrument, it is therefore crucial to not only consider the context in which it will be implemented, but also how the several instruments complement each other. Looking in specific at policy instruments for social innovation, The Social Innovation Community distinguishes two manners how policy can support social innovation: (1) policy for social innovation which enhances supply of and demand for social innovation, and attempts to create a wider environment in which social innovations can thrive, and (2) policy as social innovation which makes policymaking socially innovative in process, adopting principles and tools f social innovation (Figure 1) (Reynolds, 2017).

Status of Policy Support for Citizen-Driven ULLS

Motivations for Strengthening the Transformation Status

Citizen-Driven Urban labs position themselves at niches at the boundary between local public administration and society (Scholl et al., 2017). Citizen-Driven Urban Living labs often start as a singular small social innovative, as 'local community initiatives' (which are not necessarily connected to, but possibly inspired by other similar initiatives) (Fiuza, 2017). On the other hand, these labs can also come forward be explicitly an innovative request of the local municipality (Fiuza, 2017). In both cases they might, but do not always have the potential to grow, or to become transformative. If initiatives or the municipality would have a wish to become transformative, this paper believes that positioning the citizen-driven ULL in the intersection of a social innovation initiative, and policy as and for social innovation is necessary, and are both part of the internal dynamics of these labs, and their possible transformative effects. Transformation in the case of Citizen-Driven ULLs would refer to changes in the

municipalities towards more innovative, responsive human-centred institutions. Municipalities are generally also looking for new ways to give sense to their existence (De Nationale Ombudsman, 2018).

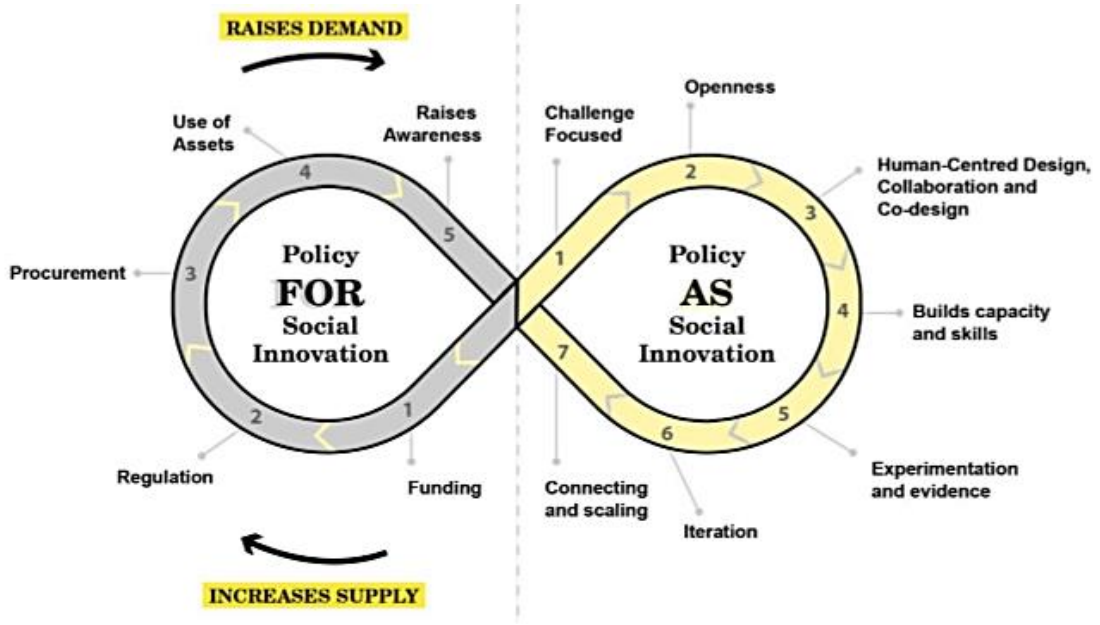

Figure 2: Policy for and as social innovation (Reynolds, 2017)

This paper believes there are several reasons why urban governments and citizens would benefit from the solidification and the growth of Citizen-Driven ULLs in this transition towards more humanized cities. First, the labs would empower in the first place more citizens to be city-makers, increasing civic engagement 3.0. They have the possibility to foster resilience in communities and give people the means to solve their own problems. These changing relationships between state and citizens, could moreover also improve public services, and could create greater legitimacy, making these institutions more responsive, and potentially cheaper. Lastly, these supported Citizen-Driven ULL's will not solely create 'home improvements' in all separate cities but also contributions to wider transformation processes (Reynolds, 2017).

Limitations in Policy Support in the Netherlands

There is a lot of attention on participation within the Netherlands and there is a multiplicity of participation initiatives which (in)directly relate to Citizen-Driven ULLs throughout the country. Rather than pointing at everything that has been done, this paper will point at the shortcomings relating the support in the Dutch status quo. If they want to develop further their direction towards a Participation Society, this paper believes more specific attention could be given to Citizen-Driven Urban Living Labs. Two main limitations will be shared within this section. These were identified based upon a generic research across Dutch policy for Citizen-Driven ULLs and alike. This paper gives a rather wide perspective on this topic, without delving into the details. In the next section recommendations to these limitations will be shared.

To begin with, this paper argues that Citizen-Driven ULLs seem to reside somewhat awkwardly between citizen initiatives and other (bigger) lab like projects. A strong discourse around Citizen-Driven ULLs, an awareness of the initiatives both on the supply and demand side, applied economics and soft policy instruments is lacking. Subsidies for citizen initiatives, for example, are (within certain formats) present in almost every Dutch city, but do not necessarily embrace the values of innovation, experimentation and reflection Citizen-driven ULLs would need. On the other hand, subsidies for urban labs, if present (i.e. Rotterdam), are primarily focused on other actors in the quadruple helix. Similarly, research projects (i.e. on the creation of an Urban Lab Toolkit-Maastricht), and networking places (i.e. Urban Living Lab meeting organized by the Creative Industries Fund) (Potjer, 2017), are not focusing on Citizen-Driven ULLs in specific. Moreover, Citizen-Driven ULLs lack the potential to move beyond

their singularity, due to a lack of support or insights on leading or co-creating sustainable empowering internal dynamics within the social innovation (Fiuza, 2017).

Secondly, common problems within the interaction of citizen initiatives with the municipality are argued to perpetuate themselves in particular manners for Citizen-Driven ULLs. De Nationale Ombudsman (2018) clarified that 42 % of Dutch citizens involved within citizen initiatives was unsatisfied with the municipalities support. Common factors of dissatisfaction were regulations which held their initiatives back, a lack of enthusiastic actions of civil servants, and the lack or false promises regarding the lack of the housing of citizen initiatives. For Citizen-Driven ULLs this paper expects the same difficulties. These difficulties refer to potential processes of disempowerment for the ULL in the interaction with institutional logics of the municipality. Herein the lack of a place where this socially innovative experimentation between different partners can happen in a reflective way, and unattainable and creative co-creation would be problematic according to the TSI theory. Moreover, it is necessary to mention that some Dutch cities are much further in this innovation of the public services to attain today's needs (i.e. Amsterdam or Utrecht) than others who are constrained by the public service's isomorphism, and do not have this innovative culture and the lack specific know-how to involve themselves in these type of citizen-driven innovations (Rathenau Instituut, 2017).

Policy Recommendations

In what follows this section will specify what potential solutions there could be regarding the two identified limitations. These are based upon the paper's theoretical framework, additional research and exemplar cases within the Netherlands.

A general start herein is that a myriad of policy instruments which are present for citizen initiatives and other city labs should be translated and made more easily accessible to Citizen-Driven ULL's. This applies to economic instruments like subsidies, the offering of goods and housing for the labs, and soft innovation policy instruments including public-private partnerships and providing supportive voluntarily regulations. Throughout this section some of the latter will be further discussed. A main proposal that this paper would like to bring forward is the need for the creation of (trans-) local networks of these labs. This paper argues that besides a possible importance of transnational networks, especially local horizontal networks might be helpful for these labs because of two main reasons. It is wishful that not one such social innovation locates itself in one city, but that multiple innovation projects, addressing other citizens needs to do so. Secondly, since these Citizen-Driven ULL's are explicitly in interaction with the localities and the context, this local horizontal sharing, might create locally relevant sharing and support. These network formations would thus, first of all, provide a platform to share lessons and give peer support regarding the internal dynamics within the labs, so that more experiences of disempowerment could be avoided or turned into empowerment. Secondly, the network would help with spreading awareness and the creation of a discourse around Citizen-Driven ULLs and could be associated to funding mechanisms.

There are several ways on how urban governments could create these networks. Especially the creation of an online centralized networking platform (a policy as a social and digital innovation) could be a preferred option. Certain services on the Amsterdam Smart City[2] portal could be an example of the latter, or online purchasable tools like the Citizen Lab platform[3] can help municipalities herein by creating certain groups of inhabitants in online groups and chats. A second direction for the creation of networks might be through collaborations with incubation spaces and knowledge institutes.

Secondly, in order to address the problems that have often been associated to municipal practices and its institutional isomorphism, this paper further emphasizes the importance of innovation within the municipality's instruments, but also within their own services. To help urban governments with taking the first steps to change their practices and since the success of social innovations are embedded in 'place-based' interactive processes and often depend on the context, the implementation of policy pitches instead of policy instruments might be helpful. Policy pitches are not subject to immediate efficiency concerns, but instead to (inter-) subjective valorisation of

[2] Retrieved from source: Amsterdam Smart City, https://amsterdamsmartcity.com/
[3] Retrieved from source: Citizenlab, https://www.citizenlab.co/nl/platform

communities engaged (Turkeli and Wintjes, 2014). These pitches might convince in specific those municipalities who would otherwise lack behind in embodying values that could help Citizen-Driven ULLs.

Meeting points to cooperatively, innovatively and reflectively work between citizens and the municipality were in specifically an attention point for Citizen-Driven ULLs. Besides, as emphasized above the possibility to include incubation spaces (or existing knowledge institutions), this paper also emphasizes the need for experimentation with *innovative and alternative housing. Vacant spaces throughout the city could for example be granted to these labs.* On the other hand, the government requesting public procurement of existing or social innovations, or the establishment of public-private partnerships to support the government in this transition journey can be done much more extensively, if embedded well in their own practices and communicated clearly to citizens. An example would be the start of collaboration between independent platforms like De Natuurlijke Stad[4]. The latter offers a variety of services for making streets more liveable by for example permanently replacing citizen's parking spots by a table, small playground,… Collaboration could professionalize the social enterprise, while innovating and expanding the municipal services. If De Natuurlijke Stad could maintain some sort of freedom still, and the municipality could increase its responsiveness and legitimacy more, this might be an interesting direction.

It is, however, necessary to note that much more contextual responses are necessary to concretize any advice. The recommendations given could contribute to making Citizen-Driven Urban Living Labs more transformative. The boundary between empowerment and disempowerment, however, remains narrow. The creation of a network between these labs should, for example, take care that they do not lead towards fragmentation and dilution. Experimentation and reflective assessment remains for all actors a key attention point.

Concluding Remarks

This paper started from an imagination of liveable, enjoyable future cities where citizens are city-makers. The specific question this paper wanted to address included: In which ways, if so, can Citizen-Driven Urban Living Labs be stimulated by policy for a human-centred transition towards citizen engagement 3.0? Citizen-driven ULLs were considered to not have the ambition and capability to cover the whole cosmos of urban governance; they are just one type of social innovation which can contribute to citizen engagement 3.0. Embodying these values of direct citizen empowerment, this paper argued for more support for Citizen-Driven ULLs, which are so far mostly individual social innovations. The recommendations made included the general revision of all sorts of supportive economic and soft policy instruments. A specific call was made to create local urban networks for these urban labs, online or offline, since these might be associated to, among others, encourage peer-support, reflexive learning, the spread of awareness and subsidies. This paper also emphasized the importance of policy pitches as a less constrained manner to start with supporting Citizen-Driven Urban Living Labs in specific. Innovative, responsive policies and policy as social innovation remain imperative to support to these experimental labs.

Future Research is required in various directions. First of all, research surrounding Citizen-Driven ULLs should be clarified. The distinctions between citizen initiatives and Urban Living Labs classifications should be clarified and a detailed scan should be made on the presence, characteristics, and policy support for Citizen-Driven ULLs across The Netherlands in order to give better general and local recommendations. Secondly, there should be more Urban Living Labs if this would also imply a change in their own practices. Also, the sustainability and inclusivity of Citizen-Driven ULLs should be more closely analysed. This research took an important initial step in the status of and policy for Citizen-Driven Urban Living Labs, these directions of future research are however necessary to assess the further desirability, barriers, and best policy instruments for intervention.

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Innovation in Dutch VWO-Education in the aftermath of the CoVid-19 Crisis

Jules Wouters

Introduction

The quality of Dutch foundational education has been steadily declining for the past 20 years (Inspectie van het Onderwijs, 2018). Dutch high schools lack ambition according to the Dutch Education Inspection (Inspectie van het Onderwijs, 2018, 2019). There currently is a big shortage of teachers, a shortage that could have been foreseen as early as 2007 (Inspectie van het Onderwijs, 2018, 2019; Visser, 2019).

Furthermore, Dutch high school students show a general lack of motivation (Inspectie van het Onderwijs, 2019). Even when compared to other European countries (OECD, 2016). Students lack intrinsic motivation and their main driving force is the diploma they will get when they are done (Inspectie van het Onderwijs, 2019). There is an excessive focus on grades from both students and teachers. In class they often do not feel challenged by either teacher or learning material. In most classes teachers did not make high demands towards their students or appealed to their higher cognitive abilities. Students feel like they lack ownership or autonomy over their learning process, both in form and in substance.

When it comes to digital technologies teachers often fail to make use of new online, digital, and technological innovations. A perfect example is the failed introduction of iPad education in many high schools. Even if they have received training beforehand, most teachers do not know how or are not willing to make use of these new technologies. Almost all high schools have some form of an online platform that can be used for student-teacher communication and the sharing of information or material. Here again however, many teachers do not know or are not willing to make use of all the tools available to them.

This problem became more prominent after schools were forced to shift to online education as a result of the CoVid-19 outbreak. The closing of schools forced teachers to adapt and shift their entire teaching from physical to online education. While generally speaking physical education would be preferred over fully online education, online education still has some benefits over physical education. Many teachers however tried to translate their physical teaching methods directly into online teaching methods, therefore suffering from all of the downsides of online education while not making use of the benefits of online education.

This paper will propose a framework that educators in VWO-education can use to make more and better use of the online tools and technologies already available by them. It shows furthermore that now is the perfect time to push for this innovation in education because of pressure put on education by landscape factors. It does so by first providing and justifying the educational framework used, namely Bloom's Taxonomy. Secondly, a brief overview of the current state of technology in education will be given. Thirdly, the issue will be evaluated according to the multi-level perspective on transition. Finally, these elements will be brought together to provide the framework for the use of online methods in VWO-education.

Bloom's Taxonomy

Bloom's Taxonomy is one of the most influential writings in education. His book has been translated into 22 languages and is one of the most widely applied and most often cited references in the field of education (Forehand, 2010). First introduced in 1956 Bloom's taxonomy has stood the test of time, and all educational staff will be familiar with Bloom's work. It therefore serves as the perfect foundation to build new guidelines regarding online education on.

Bloom's Taxonomy is a model which classifies thinking according to six levels of cognitive complexity (Forehand, 2010). These six levels have been revised in 2001 by Krathwohl and Anderson and now consist of remembering, understanding, applying, analysing, evaluating, creating (Krathwohl & Anderson, 2001). These are what Bloom calls the cognitive processes. The levels are ordered in increasing level of cognitive complexity, with mastery of a new level requiring mastery of the previous level (Forehand, 2010). Students mastering new material should then optimally engage with the material on all six levels.

The first level of Bloom's Taxonomy is remembering. This is as straightforward as it sounds, remembering is retrieving information you have previously seen, it is recognizing and recalling (Krathwohl & Anderson, 2001). The

second level is understanding. Understanding means creating meaning from the information of knowledge you now have remembered, it is interpreting, explaining, summarizing, or comparing. The third level is applying. Applying means to use the knowledge you now understand in different contexts. The fourth level is analysing. Analysing is breaking knowledge down into smaller parts and seeing how they relate to one another, but also to other pieces of knowledge or to their overall purpose. The fifth level is evaluating. Evaluating is making judgments based on criteria and standards. It is checking or critiquing, finding out which solution fits the problem best. The sixth and highest level of Bloom's Taxonomy is creating. Creating is using the knowledge and your mastery of the ways in which to engage with this knowledge to reorganise and put together something new, creating a new pattern or a new structure. To further clarify the six cognitive levels, Krathwohl and Anderson used 'action words' to describe the cognitive processes, as displayed below in table 1.

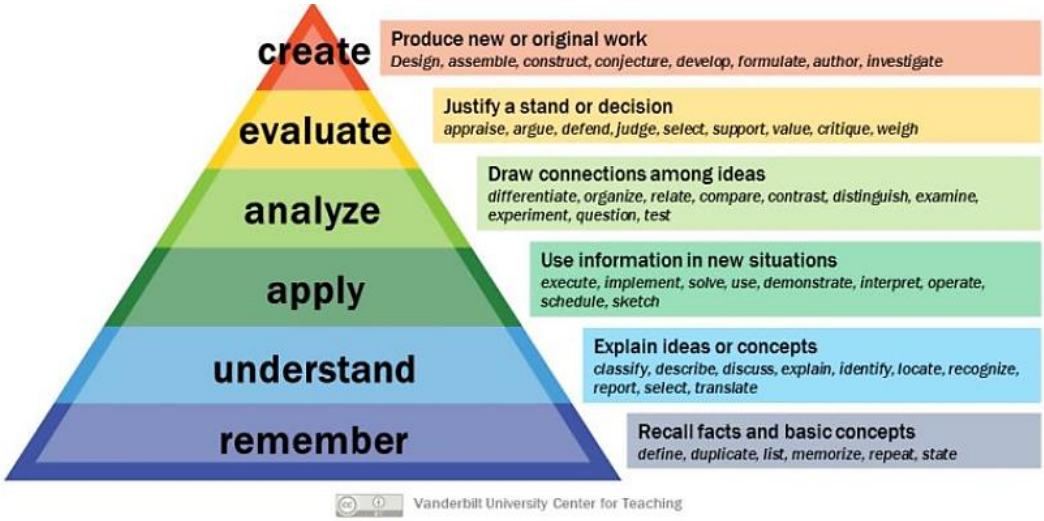


Table 1: Bloom's Taxonomy (Armstrong, 2016)

Using Bloom's Taxonomy is useful for several reasons. First, Bloom's Taxonomy makes it very easy for both students and teachers to clarify and understand what the purpose of learning is and to establish learning goals (Armstrong, 2016). Representing learning goals in the terms used in Bloom's Taxonomy creates clear expectations and structures learning. Bloom's Taxonomy allows teachers to organise and cluster objectives, clarifying them both for themselves and for students. Furthermore structuring learning in this way allows teachers to plan and deliver instructions appropriate to the learning objectives. It simplifies the creation of valid assessment tasks and ensures that instruction and assessment are in line with the learning objectives. Furthermore, because of its already widespread use and familiarity of Bloom's Taxonomy makes it a great foundation to build new guidelines of technology incorporation in education, allowing for the same benefits of structure and clarity as aforementioned.

Current state of technology in education

Digitalisation, online education, and the incorporation of technology in education has several benefits. First online education can give teachers better insight into progress of individual students. Learning analytics for example can provide teachers with a better overview of which students understand the material and which students need more attention (Van Gastel-Firet, 2019). It also allows for more differentiation between students. Allowing students to learn at their own pace, spending less time on material they already understand thereby giving them more time for material they find more difficult. Moreover, by using online instructional videos for the remembering and understanding part of the cognitive process, teachers will have more time to give students personal attention or to delve deeper into the material.

However, online education has its downsides. Online education means that students will have to put in work outside of the class room, whether that is watching videos made by teachers or working on online projects or exercises. This means that online education asks a higher degree of responsibility and self-discipline (Van Gastel-Firet, 2019). Furthermore, research has shown that reading from a screen has negative effects on comprehension and understanding of the text compared to reading from paper (Alexander & Singer Trakhman, 2017). Especially when deep understanding and comprehension are asked from students, reading from paper produces better results. Students do, however, read faster when using an online medium and results are not significantly different when the task is just to understand and remember the big idea of a story.

It seems then that in certain areas online and technology driven education can be beneficial over traditional offline education. Incorporation of these ideas is however slow and very much dependent on the mindset and attitude of teachers. Tondeur and colleagues found that the pedagogical beliefs teachers hold greatly influences to what extent and how teachers incorporate technology in their teaching (Tondeur, Van Braak, Ertmer, & Ottenbreit-Leftwich, 2017). Teachers select applications of technology on the basis of what fits with their pedagogical beliefs.

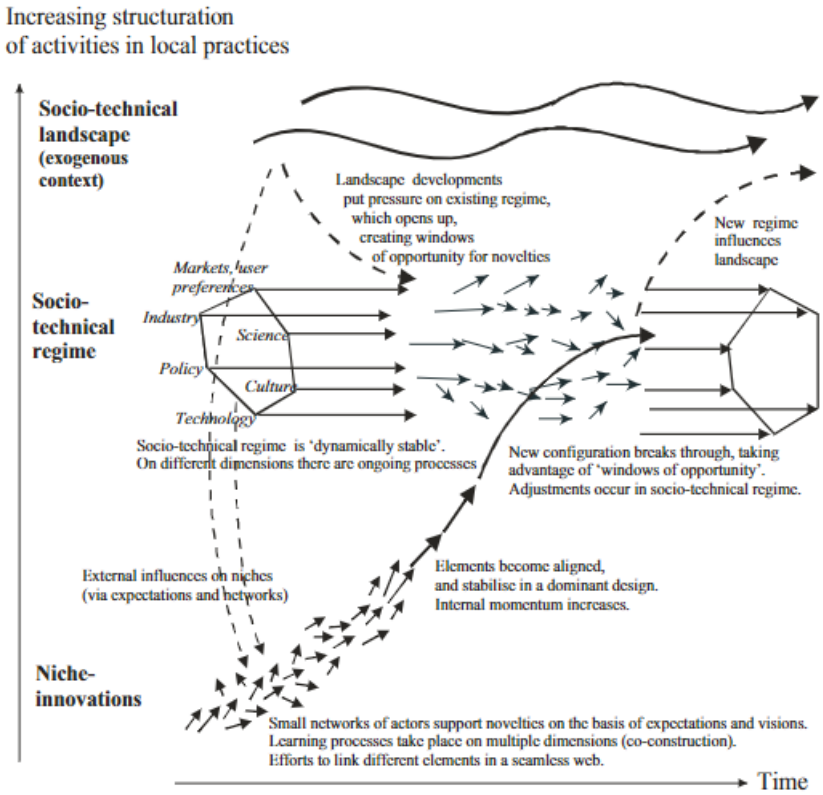
Furthermore, according to Tondeur and colleagues (2012) the extent to which teachers are ready to incorporate technology in their teaching is highly dependent on the quantity and quality their experience with technology during their teacher education programmes. There seems to exist a gap between what teachers are taught in their education programmes and how they need or are expected to use technology in the classroom. Generally speaking beginning teachers are underprepared to incorporate technology in a beneficial way. Moreover, it can be assumed that because of the relatively high age of many high-school teachers, they have received even less education on how to incorporate technology in the classroom.

Introducing more online tools and technology in the classroom is therefore a big transition from current affairs. In order to identify the different factors needed to pull of such a transition, the issue will now be looked at from the multi-level perspective on socio-technical transitions.

Current situation through from the multi-level perspective

The multi-level perspective provides a three level framework for socio-technical transitions (Geels, 2011). It describes socio-technical transition as taking place by the interaction between three levels, the socio-technical regime, niche and the socio-technical landscape. The main focus is however on the socio-technical regime, since

Table 2: Multi-level perspective on transitions (Geels, 2011)



socio-technical transition is defined as shifting from one socio-technical regime to another. The niche and landscape levels are then of particular interest in the way they influence or put pressure on the socio-technical regime and thereby can help drive, provide a barrier, or influence the direction of a transition.

The socio-technical regime consists of many sub-regimes, user and market regime, socio-cultural regime, policy regime, science regime, and technological regime (Geels, 2011). The socio-technical regime is then the 'deep structure', as Geels (2011) puts it, that provides the stability of the socio-technical system. This deep structure can be seen as a semi-coherent set of rules that structure and coordinate the actions of actors within the regime. Examples of such rules are shared beliefs, capabilities and competencies, user practices, regulations, and contracts. With

regards to the issue at hand, the socio-technical regime is in essence the current state of affairs in VWO-education with regards to the use of online methods. The regime is the way VWO-education is organised more broadly, but also the way teachers teach their classes. This includes the before mentioned problems with the incorporation of technology and online education into regular teaching practices.

Geels (2011) describes niches as 'protected spaces' in which innovations can develop. Niche actors work on innovations that deviate radical from technologies used in the current regime. They hope that their innovations can eventually replace the current regime or be incorporated in it. This is however not an easy process. The downside of the stability of the socio-technical regime is that many aspects of the regime are intertwined and dependent on each other. This makes that the regime can be seen as locked in. Examples of this lock-in are lack of appropriate infrastructure for the new innovation, regulations, or consumer practices. Niches are more likely to break into and change the regime when the elements of the niches become more aligned and a dominant design emerges. While in education we cannot really see the 'protected spaces' element of niche-innovations, there are however many voice and actors trying to incorporate already existing online and digital technologies into the socio-technical education regime. Digital technologies for years have already allowed for online lectures, instructional videos, online discussion, online simulations, tools for creating of mind maps, infographics or concept maps, peer feedback, different reward systems, polling. These technologies, resources, and tools have been available for many years but are only used on a very limited scale in current VWO-education.

The socio-technical landscape is as Geels (2011) describes the wider context. The landscape is the backdrop of technology and society influencing both the socio-technical regime and niche developments. It includes demographical trends, political ideologies, societal values, and macro-economic patterns (Geels, 2011). In the case of education an example of a landscape development is the move towards a more market oriented approach in education and less government involvement over the last few years (Visser, 2019). Other landscape developments are the increase in use of technology and social media by teenagers in general. The most important landscape development, however, is the global CoVid-19 pandemic. This pandemic has forced teachers, schools, and universities all over the country to adapt to online education in a matter of weeks. Where before many teachers did not know their way around the digital educational space, they are now forced to record lectures, organise online classes, and figure out ways in which to test students without being able to get them all together in the same classroom.

Looking at the CoVid-19 pandemic from the multi-level perspective shows us why this is the perfect time to combine existing insights within the field of education and existing technologies to solve problems existing in VWO-education and improve general quality of VWO-education. The CoVid-19 pandemic is a landscape development that has put pressure on the existing socio-technical regime and has opened a window of opportunity for the already existing technologies and tools to be incorporated into a new socio-technical regime. This is then the perfect time to take a look at what things from this period of exclusively online education should stick, and which should be left behind.

Synthesis

Bloom's Taxonomy can helps teachers in three main ways, by answering four main questions. First, the taxonomy can help teachers get a better understanding or formulate more clearly what their objectives are (Krathwohl & Anderson, 2001). It can help educators formulate a clearer answer to the 'learning question'. Second, the taxonomy can give educators a clearer idea or help make decisions about how to teach and test their students. In other words it can help educators answer the 'instruction question' and the 'assessment question'. Third, the taxonomy can help educators evaluate whether their methods of instruction and assessment fit their objectives. The taxonomy can help them answer the alignment question. Alignment means that when the objective is for example applying, instruction and assessment are aligned with this objective when they also attempt to teach or test applying. For the purpose of this paper the main interest is in how technology can provide new and better ways to answer the instruction and assessment questions. This is because student involvement in answering the other two questions is limited.

It is furthermore important to distinguish between three stages in which instruction takes places, since the class room is not the only place in which the cognitive process takes place. Educators when answering the instruction question have to think about what learning activities they want students to do in preparation of class, during class, and after class processing the new knowledge.

Remembering and understanding

Remembering and understanding are the cognitive processes where teachers can gain the most from incorporating online tools. Right now much of the remembering and understanding is done under the guidance of educators during class. This is done in the form of in-class instruction. Using online tools can allow teachers to shift most of this process to the preparation stage of instruction, especially at the VWO-level.

By cutting up the material otherwise discussed during in-class instruction into a number of instructional videos covering smaller parts of the material. This allows students to digest the material at their own pace. They can pause and play back parts they found difficult, or skip parts they have already mastered. If necessary educators can make sure that students have remembered and understood the material properly by making them take formative tests, or use online tools such as Socrative or Kahoot, before going into-class. Students can also be asked to complete smaller assignments after watching these instructional videos. These assignments, such as summarizing or categorizing, should of course be aligned with the understanding and remembering cognitive objectives.

Moreover, online classes can be very useful to provide extra instruction to students who need it, while allowing students who do not need this extra instruction to work ahead, or on problems they find more difficult. Online classes are ideal for this kind of non-mandatory instruction for a number of reasons. First, online classes provide more flexibility to both students and educators. They can be scheduled more easily and save time when both students and educators do not have to travel to a certain destination. Second, online classes allow students to more easily drop in and out of class as they need to without much disturbance. Some students might not be able to understand the material to the degree necessary and might require more extra instruction, while some students might have only one or two questions on the material. Online classes allow educators to differentiate in this way between students and allows students to focus their efforts on the material or courses they find most difficult.

Answering questions outside of class is something that can be done easily using online tools but is done only very rarely. Online platforms such as Slack, Microsoft Teams, or Blackboard, allow for the creation of online spaces where teachers and students can interact with each other. Such platforms can give teachers and students to ask each other questions and answer them. Not only does this allow students to ask questions about the material whenever they want, it also allows other students to get involved and can in this way promote student-to-student teaching as well.

Incorporation of online tools and technologies is not equally useful between different subjects. For subjects like mathematics and physics for example, physical in-class instruction might still be preferred over instruction in online-video format. Being able to ask questions as the teachers is explaining how to solve a certain problem is more important for understanding than it is for many other subjects. This does not mean however that online instruction videos do not have its use for these subjects. Being able to go back and rematch instructions on specific topics is extremely useful for students and only stimulates learning.

Applying and analysing

The above mentioned applications of online tools can allow educators to save time during class and spend more time with students mastering higher level cognitive processes such as analysing and applying. These cognitive processes can be taught very well in-class using conventional teaching methods educators are comfortable with. These can however complemented by online tools, such as Slack. On these kind of online platforms educators can for example share themselves, or ask students to share other relevant or interesting articles or web pages. Stimulating students to find applications of the material studied in other places. Such online platforms can also be used to create forum discussions between students according to questions posed by the teacher. Forcing students to apply, analyse, and even evaluate

Evaluating and creating

Evaluating and creating are much more personal processes than the previous cognitive processes. When asked students can give vastly different correct answers when evaluating problems and will create very different end products when asked to do so. The personal nature means that the role of the educator during most evaluative and creative cognitive processes will be to provide guidance. Learning then mostly happens through the creation of for example a paper, essay, or presentation. This does not mean that there are no online tools educators can use to stimulate this process. Electronic learning spaces can for example be used to let students give feedback to each other. Online technologies furthermore allow students to expand the possibilities of things they can create. Students can use skills and knowledge gathered during the course to create for example a blog, videos, or a podcast.

Discussion and conclusion

This paper provided a framework for teachers to improve the quality of VWO-education during and after the CoVid-19 pandemic by providing ways in which educators can implement some of the online tools and technologies available. It uses Bloom's taxonomy as a framework to ease implementation and in order to combine insights in academia with the these online tools and technologies. However, implementation of this framework will of course not be without its barriers. Pedagogic beliefs and attitudes of educators can prove to be a significant barrier to implementation, as shown by Tondeur and colleagues (Tondeur et al., 2017). Furthermore, educational programmes for teachers need to be reformed as to improve the quantity and quality of education on online and electronic tools in education (Tondeur et al., 2017). The landscape pressure put on educators by CoVid-19 showed however, how much is possible to do online. Dutch high schools have been giving fully online education for two full months now, while many universities are expecting to stay full online well into the next school year. Online tools and technologies have been available to teachers for quite some time now, now it is time to start properly using them in everyday teaching.

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The EU Eco-Score: Towards a Single, Mandatory, and Transparent Ecolabel for the EU

Julia De Koster

Introduction

By now it is well-established that the climate crisis is caused by the actions of humans (Maibach, Myers, & Leiserowitz, 2014). The era we are living in today is commonly known as the "Anthropocene," i.e. affected by human influence (Ellis & Trechtenberg, 2011). However, Bonneuil and Fressoz (2016) suggest using the term "Capitalocene" which emphasises the reasons behind climate change; the capitalist system (Bonneuil & Fressoz, 2016). The European Union (EU) has a liberal capitalist system (Jørgensen, Aarstad, Drieskens, Laatikainen, & Tonra, 2015) where the goal of companies is to produce at the lowest possible price, whilst most do not consider the effects the production process has on the environment. Together with the behaviour of consumers, this causes environmental degradation (Fiori Maccioni, 2018).

The past decade more and more sustainability certificates and labels were introduced to promote awareness about the environmental impacts of certain products (Janßen & Langen, 2017). These indicate how sustainable a product is (Bernard, Bertrandias, & Elgaaied-Gambier, 2015). However, there are too many sustainability certificates and labels which do not offer enough transparency for the consumer, and are mostly voluntary.

Democracy is essential for the EU, where citizens enjoy freedom of choice ("Values and objectives - Demorcracy," n.d.). But the question is how free we are in choosing without transparency about products we purchase. Whilst ecolabels aim at providing transparency the question remains whether they effectively do.

Ecolabels programs are usually open to most sectors, but often exclude (unprocessed) food (Lavallee & Plouffe, 2004). However, the food sector' production is a key global emitter. Data from January 2020 shows that, next to other environmental degradation, 26% of global greenhouse gas emissions are caused by food production (see fig.1) (Ritchie & Roser, 2020). For the purpose of this paper I will focus on the EU's food production, even if the problem is global.

The European Commission's Joint Research Centre (DG JRC) performed a meta-analysis to identify products with the greatest environmental impact (Tukker et al., 2006). The study concluded that the production of food is at the top of this list. Thus, what solution can the EU propose to decrease the environmental impact of the life-cycle of food?

This paper suggests that the EU implements legislation obliging food companies to depict an Eco-score on their products. This will both ensure consumer transparency and trust and stimulate reputational competition fostering innovation around sustainability. In the future this label could be extended to further products.

This paper starts by giving the context before explaining the suggested solution. Secondly, the EU Eco-score will be explained thoroughly, followed by its aim, benefits and drawbacks, and actors and institutions involved. Thirdly, it will explain why introducing a gradual plan seems most favourable. Fourthly, it will analyse the limitations of the proposal of implementing an EU Eco-score regulation. Lastly, it will conclude that the EU Eco-score regulation would be a major first step towards a greener EU and eventually world.

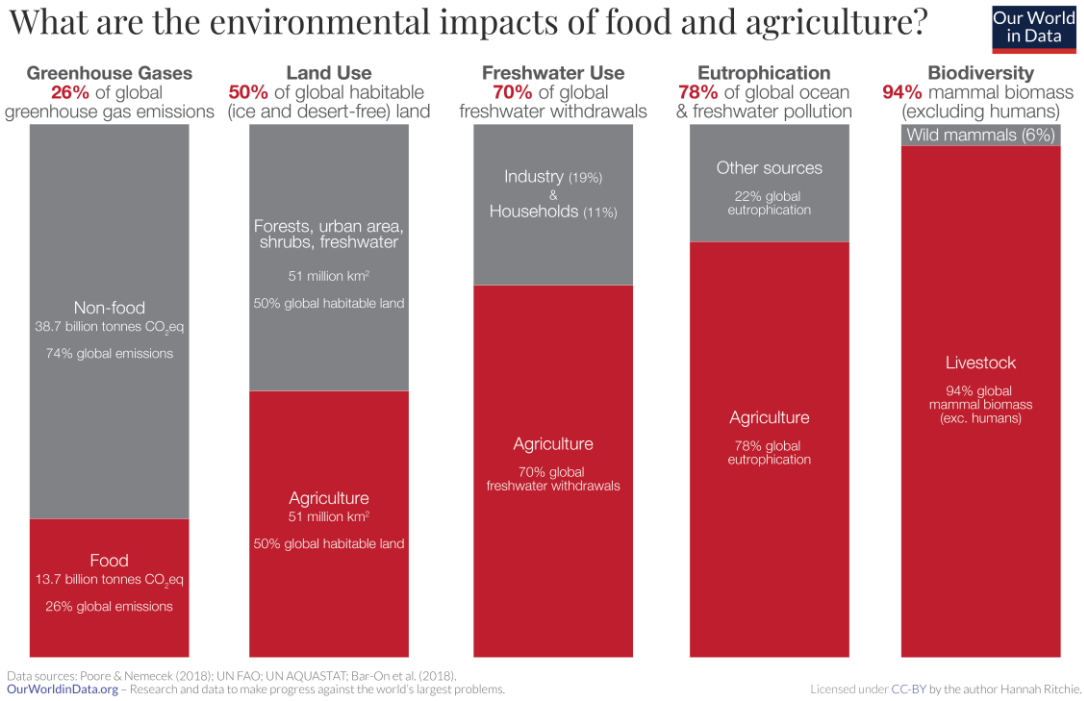

Figure 1: Environmental impacts of food and agriculture (Ritchie & Roser, 2020)

Flawless Ecolabels, Do they exist? - Context

As explained before, the way production ways are problematic today. The capitalist system conditions the creation of cheap and environmentally destructive production processes and aims at producing as cheap as possible. Herein, the environmental impact of the life-cycle of food is mostly ignored.

Additionally, consumers are often unaware of the environmental impact of the life cycle of the food they buy. These consumers have no incentive to pay attention to the sustainability of the product they buy. There are consumers who are aware but still choose to ignore the environmental impact. If this is not indicated on the product, awareness-building is problematic. Furthermore, food that does have an indication of its environmental impact, through certificates or labels for example, can be confusing for the consumer. Today we see a wide a variety of ecolabels: 232 in the EU alone ("All ecolabels in Europe," n.d.). In order to fully understand a label, one must know what and how it measures, which product categories it applies and its trustworthiness. But this seems sheer impossible for each of the numerous ecolabels. Therefore, the ecolabels currently depicted on a variety of products and sometimes even services, can be confusing. The expression 'the more the merrier' does not apply to ecolabels. Lastly, not all the details about a specific label are always straightforward and easy to understand even for the informed or eco-aware buyer because of a lack of available information on the label. Research by Grunert, Hieke, and Wills (2014) shows that current labels do not fulfil their purpose in playing a role in consumer's food choices.

Existing labels or certificates have some issues too. First, they are mostly based on voluntary participation. This has the disadvantage that the way these labels are measured is not checked by a higher authority. Mostly they are either checked by a third party or the producer self. This also means that the criteria are not defined by a higher authority. Hence, it is sometimes questioned how accurate and transparent these ecolabels are (Lavallee & Plouffe, 2004). Since the criteria can sometimes be chosen by the producer, the question is how representative this label is of its overall environmental impact. Therefore, actual transparency of ecolabels is not guaranteed. Lastly, since ecolabels are voluntary, only products which qualify will have the label and no information exists on other products' environmental impact. This makes comparison impossible. And even those products who have labels are difficult to compare if they have two different labels, since these all entail different criteria.

However, the example of the EU Energy Label is promising. In 2017 the EU regulation 2017/1369 was implemented ("Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU ", 2017). It entails that a number of clearly defined electronic products need to depict an energy efficiency label. The label indicates on an A-G and green-red scale how energy efficient the product is. The EU hereby hopes to stimulate consumers' awareness of energy efficiency and that producers innovate. This label has proven to be successful according to the EU as "the energy label is recognised by 93% of consumers and 79% consider it when they are buying energy efficient products." ("About the energy label and ecodesign ", n.d.). This shows that mandatory labelling is more efficient because it is introduced and checked by a higher authority, in this case the European Commission.

The EU Eco-score, what is it? - Solution

An introduction to the EU Eco-score

This paper suggests that the European Commission introduces a new regulation for member states to introduce a single 'EU Eco-score.' This score will be mandatory and replace most of the existing ecolabels. Making this an incremental innovation. With a single, clear label depicted on all food products produced in the EU, the EU can provide a solution to decrease the environmental impact of the life-cycle of food. Hereby consumers get the transparency they deserve, and companies are motivated to innovate.

Figure 2: Nutri-score (Julia et al., 2017)

The score will be indicated with a design similar to the 'Nutri-score' (see fig.2). The label will be indicated through a line with numbers from one to ten, with ten as most sustainable and one as least sustainable. Additionally, to provide a clear visual indicator, a colour-range from green to red will be integrated. The label, indicating the score, must be clear and easily understandable to everyone and contain a minimum of information. However, it should mention key information for the consumer and be accompanied by a user-friendly website explaining in layman's terms the score in general and that of a specific product. The label will include a link to the website and its access through a QR code. Research shows that it is highly important for the effectiveness of a label, or score in this case, to be accurate and indicating only the relevant information for the consumer (D'Souza, 2004).

The accuracy of the score depends on choosing clearly defined criteria to be measured before the actual measurements start. Lavallee and Plouffe (2004) indicate that the criteria will be decided by the product category. "Each of these categories includes products whose functions, technical safety, and fitness for use are similar" (Lavallee & Plouffe, 2004p. 350). Creating product categories ensures that the score contains the most relevant and most environmentally impactful criteria. Additionally, this allows the consumer to compare between two food products of the same category. This paper suggests that the Commission nominates a team of independent scientists to elaborate these product categories and the corresponding criteria.

In order to provide the greatest clarity and transparency for the consumer the score should "account [for] the impacts that the product may cause throughout its entire life cycle" (Lavallee & Plouffe, 2004, p.350-351). This can best be done through Life Cycle Assessments (LCA) (Lavallee & Plouffe, 2004). The LCA would be assessed for each product by the manufacturers. Yet, it is this team of scientists that will define any extra criteria that need to be measured as both generally recognised environmental effects, such as greenhouse gas emissions, and more specific aspects that are explicit for each product category, such as water consumption for meat. The group of specialists will also, through random sample checks, certify the manufacturer's LCA and score's correctness and accuracy. Non-compliance could lead to the EU imposing sanctions and could harm the companies' reputation.

To achieve its aims this EU Eco-score should be introduced through binding EU legislation and not become another voluntary initiative. Therefore, this paper emphasises the importance of making this a policy innovation (Borrás & Edquist, 2013), as a new EU law. This will mean that to access the EU market all food products must contain the EU Eco-Score pictogram. Indirectly this policy will work as an instrument to boost innovation (Borrás & Edquist, 2013). The EU Energy Efficiency Label proves that a score or label is efficient when it is introduced through binding EU legislation ("About the energy label and ecodesign ", n.d.).

Lastly, an information campaign directed to the general public is crucial to trigger awareness and understanding of the label. This campaign can be conducted through advertisements with brief and easily understandable information about the score and how to interpret it both on social media as well as via more traditional channels. Furthermore, the evaluation of policy instruments shows that "the legitimacy of an instrument is strongly related to the legitimacy and popular acceptance of the instrument" (Borrás & Edquist, 2013, p.1521). Therefore, it is important to inform the public so that the regulation can be widely accepted by the general public and be effective.

Overall, the suggested solution can be identifies ad both a socio-technical (the score itself) and a socio-cultural (the spread of information and the change in production habits) transition (Geels, 2004). Whilst, the introduction of the new label can be identified as a product innovation.

What is the aim of the EU Eco-score?

Implementing an Eco-score regulation in the EU has several aims. Firstly, by means of a single, clear indicator to make the consumer aware of a product's environmental impact. Hereby, the negative effects the life cycle of certain foods will become apparent, allowing the consumer to compare food products' sustainability, whilst of course retaining their free choice when purchasing labelled products. The overall aim of the score is to enable everyone to make a well-informed decision before buying a product. As this will be a score defined and regulated by the European institutions, consumers can be assured about its accuracy and trustworthiness and of the assessment of the environmental impacts of the life cycle of food.

Furthermore, the aim of this policy is to stimulate companies into innovating their production processes and products. It is important to note that companies are in no way obliged to produce more sustainably. However, research shows that "reputational advantage, as a function of credibility, reliability, responsibility and trustworthiness, is enhanced by superior environmental performance" (Miles & Covin, 2000, p.300). Therefore, companies are expected to be motivated to achieve a higher score on the label than their competitors. Obtaining a high score is beneficial for the company's reputation. This might in turn generate higher income and raise market value (Miles & Covin, 2000). The regulation, therefore, indirectly promotes product innovation. Decreasing the environmental impact of food production is an important, but indirect, aim of this policy. Eventually, the aim is that companies innovate so that the decrease their environmental impact. Therefore, this is a sustainability transition (Markard, Raven, & Truffer, 2012)

What are the benefits of implementing the EU Eco-score?

The EU Eco-score comes with a range of benefits. Firstly, it does not restrict companies as they will remain free to produce in terms of (un)sustainability. Whilst the goal of the regulation is to motivate companies to innovate their production processes and their products, it does not oblige them. Secondly, the best outcome was if companies felt motivated to improve their reputation by innovating their food production. Eventually this would result in a lessened environmental impact of the food industry, and later other industries. Thirdly, this also means that there are no restrictions for the consumers. They are allowed to buy all of their favourite food brand or product, even if they are produced unsustainably. Yet, the score enables consumers to have transparency and the possibility to make an informed choice before buying a product. Therefore, giving the consumer the freedom of choice they deserve. Lastly, setting up the board of scientists offers new job opportunities.

What are the setbacks?

Whilst the introduction of a regulation that obliges all food products to have a score indicating its environmental impact has benefits, it also has some setbacks. First, implementing such legislation entails a significant administrative burden. Many things have to be organised; from the design of the score, to the website, to the creation of a board of specialists, to the creation of a set of criteria etc. Secondly, it is also costly. Thirdly, the fact that companies will have

to hold LCA can be costly for the company. But above all producing in a more sustainable way may trigger important additional production costs. This could mean an increase in the prices of concerned products. Fourthly, it is expected that the business community will show resistance towards the implementation of this regulation. Exposing a companies' environmental footprint can be devastating for the image of the company (Miles & Covin, 2000). Additionally, most companies focus only on producing at the lowest price, having to innovate their food production can be a costly procedure. However, companies will benefit from the long-term profits in investing in a greener world. Lastly, it is also to be expected that the ecolabelling community will show resistance. Eliminating all the other ecolabels will be devastating for the eco-label industry. Therefore, this paper suggests working together with these existing ecolabels in order to include them in the new single Eco-score.

Who are the institutions and actors involved?

In order to create a successful innovation, it is important to analyse which institutions and actors will be involved in the whole process. Firstly, the European Union institutions will be involved. The Commission will be responsible for proposing the regulation which will then be sent to the Council and Parliament for adoption ("Law-making process ", n.d.). In the process of making this regulation legally binding under EU legislation, besides the European Parliament, through the Council all member states are thus involved. Eventually, the member states will also be affected by the implementation of the law since they will have to include the regulation in their national law. Secondly, the actors involved in the public sector are; EU policymakers, media (to inform the public), scientists (who will form a board to create and assess the criteria). Additionally, in the private sector the actors involved will be the companies affected by this regulation (in first instance the food industry) and representatives of various interest groups (consumers, environmental NGOs, trade unions, employers' associations etc). Overall, these actors will be involved in the creation and implementation of the EU Eco-score.

All at Once or Step-by-Step? - Plan

Once the legislation would be passed, it will be important to introduce the EU Eco-score in a progressive, step-by-step way to allow for adaptation time to what is ultimately a complex score. Therefore, this paper suggests three steps. Making this a step-by-step procedure gives companies the time to adapt before the introduction of the label on their products. However, these steps are open for change and can be further extended into more steps. This paper only briefly provides an idea of how this plan could look like.

The first phase would consist of introducing the score in a limited number of food product categories. Starting on a smaller scale allows helping the food sector as well as monitoring implementation closely. Furthermore, it will show whether the proposal is effective. It is envisaged to start with the food productions that have the largest environmental impact, such as meat, fish and dairy industry. It will be easier to set criteria for and measuring these. This first phase must include an awareness-raising campaign about the introduction of the scheme, what it entails and how consumers can read the score.

If the evaluation of the first phase is positive, the scheme can be scaled up. The next phase could include all other food product categories, i.e. vegetables, fruit, processed foods, etc.. This progressive introduction will give the EU institutions time to monitor and scaling down sample checking. Additionally, the awareness-campaign can be ramped up.

The EU Eco-score scheme should be evaluated after three years of implementation in the food sector to test its effectiveness also in terms of changes to consumers' purchasing patterns and of process innovation in the food industry. If the outcome of this evaluation is positive the EU Eco-score scheme can be extended to the non-food industry with a specific progressive roll-out schedule.

Can hindrance be expected? - Limitations

With every new innovation or proposal comes a set of limitations, also with the implementation of the EU Eco-score regulation.

Firstly, measuring the score can become complicated. In order to measure an abstract object, such as the environmental impact of the life-cycle of an object, a set of criteria have to be defined first. However, in the case of environmental impact, it is impossible to include all aspects that affect the environment during the life cycle of a

project. Therefore, most impactful factors must be selected on the basis of objective criteria. Furthermore, to avoid criticism on the selection and possible abuse of the measurement criteria this paper suggests that the Commission sets up a board of scientists, tasked with defining criteria per set of product categories and the LCA measurement schemes for companies. Additionally, the Commission, as a public authority, will perform regular checks to ensure that measurements are properly used.

Secondly, the previous paragraph argues for strict and clear terms under the regulation, together with regular compliance and accuracy checks. However, this is both costly and time-intensive. However, this would key in avoiding that this new EU Eco-score scheme becomes just another ecolabel with little transparency for consumers. Therefore, this scheme can only become successful if made mandatory through EU legislation for all food produced in the EU. however, introducing a new regulation under EU law is not simple. If there is too much resistance from the public or member states, the legislation will not pass. It could then for example end up becoming a directive which is still binding but leaves room to the member states to adapt to their national specificities which weakens its implementation. Therefore, it is extremely important that all parties are well informed about the benefits and setbacks of this proposal in order to convince them to see the overall and long-term benefits this regulation could provide.

Thirdly, innovating products and production processes and the holding of LCA are all costly procedures. These could significantly increase the price of products, making them less available to everyone.

Lastly, there are two questions that remain and that can only be answered after testing the implementation of this regulation. First, will consumers take account of the score? While this question cannot be answered before testing, a study conducted by the Commission on the Energy Efficiency Label showed that 79% of consumers consider the label when they are buying these products ("About the energy label and ecodesign ", n.d.), showing that if such a label is implemented effectively it is considered by the majority of consumers. Lastly, the question whether corporations will take account of the score maintains. However, the example of the EU Energy Efficiency Label provides confidence that such a mandatory label can motivate companies to innovate their products.

Concluding Remarks

This paper proposes the implementation of the EU Eco-score as a solution to several issues that were identified with the environmental impact of food production and the currently existing ecolabels. The EU will be able to provide a solution to decrease the environmental impact of the life-cycle of food by illustrating this single and clear score on all food products. Hereby consumers get the transparency they deserve, and companies are motivated to innovate.

This paper both analysed the benefits and setbacks of this proposal, and its limitations. However, this paper believes that these do not out-weigh the overall benefits, especially, with the pressing climate crisis. By implementing such a regulation enable the EU to support the promises made about the Green Deal ("A European Green Deal ", n.d.). Most importantly, the EU could inspire other countries to start similar initiatives. This is the time for the EU to take such initiatives and show their agency for a greener future. However, further research is needed to improve this proposal.

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Supporting Sustainability Transitions through Sustainability Education for Primary and Secondary Schools

Layla van der Donk

Introduction

With major inequalities between developed and developing countries and outrageous exploitation and destruction of the Earth's natural resources, sustainability is among the key challenges of this generation. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (1997), education is our "best hope" in moving towards sustainable ways of development. But while international agreements and climate strikes point out the urgency for change, the need for awareness on these issues is not reflected in most classrooms. As Einstein famously said: "we cannot solve our problems with the same thinking we used when we created them". The ways of thinking and doing that once initiated and currently reproduce the exhaustion and pollution of our environment must be reconsidered and tackled at their core. This requires us to install a new global ethic, which can be achieved through education that includes sustainability at a young age (UNESCO, 1975).

The need for including sustainability in education has led to the establishment of various programs that each incorporate the knowledge, skills, and values associated with sustainability in their own way, comprising so-called 'education for sustainable development' (ESD) (UNESCO, n.d.). One of the prominent developments among these programs is Eco-Schools (1994). This program sets out a framework for schools to include sustainability issues in their education. Since its take-off 25 years ago, the program has grown to be a global one, reaching 19 million children in 68 countries (Eco-Schools, n.d.).

Because of its prevalence, it is useful to investigate the key factors of Eco-Schools' present success and how it might further develop to fulfil its full potential to support sustainability transitions at large. However, it is also essential to consider the local application differences, as well as the importance of institutional support through policy and investment. Hence, the present paper attempts to answer how existing sustainability education programs for basic education can be enhanced to support the competence of future actors in sustainability transitions. 'Basic education' refers to education that offers a basic level of learning needs, encompassing primary and lower secondary education, as well as other learning activities that serve basic educational needs (UNESCO, n.d.).

The paper is divided into four sections through which it builds toward an answer to the research question. It first demonstrates the global need for incorporating sustainability in the basic education system. Second, it analyzes this transition within the education system, employing the multi-level perspective. Third, it examines existing niche-initiatives in the field and concludes the Eco-Schools program to be a promising embodiment of large-scale sustainability education. Third, the development of Eco-schools is critically analyzed by identifying key actors, drivers, and barriers. Fourth and last, the paper adopts a local perspective and proposes interventions to advance the Eco-Schools program, to support the problem-solving capacity and large-scale reach of sustainability education.

Education and normative value creation

The required changes for present and future sustainability transitions compose so-called 'socio-technical transitions' (STSs), consisting of complex and long-term shifts in the overall structure of society (Geels, 2011). This means that regimes in different sectors must transition into more environmentally responsible and intergenerationally considerate ways of doing. Existing (unsustainable) socio-technical systems are bound by so-called 'lock-in mechanisms', established user practices, policies, and institutional and political structures, that withhold them from radical changes toward more sustainable socio-technical systems (Geels, 2011; Markard, Raven, & Truffer, 2012). Examples of sectors confronted with sustainability challenges are the transportation sector, the energy sector, and the agricultural sector, but these are merely some obvious areas of struggle. Overall, sustainability transitions cannot be considered separately from other socio-technical systems. They are embedded in socio-technical systems throughout society. This means that sustainability transitions require the interplay of various actors, both public and private, at different levels (Geels, 2011).

The very fact that sustainability transitions are complex and require regime-shifts in various socio-technical systems demands competence building throughout the entire society. Actors require the knowledge, skills, and values associated with sustainability to embody sustainability transitions and support radical regime shifts. Education produces knowledge and thinking, which practically link to technology and action (Türkeli, 2020), and thereby influences socio-technical systems. Education is thus both a specific socio-technical system, undergoing a shift toward a more sustainable regime, as well as an instrument of competence-building and value-creation that is expressed in other socio-technical systems. Students can then be considered "tomorrow's leaders and stewards of the Earth" (Ballantyne, Connell, & Fien, 1998, p. 285).

Logically, the urgency of quality education (SDG4) has been affirmed by the United Nations as one of the seventeen Sustainable development goals (SDGs) (United Nations, 2015). Target 4.7 demands that "By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development". Quality education links to climate action as "education is key to mass understanding of the impacts of climate change and to adaptation and mitigation" (ICSU, 2015, p. 29).

Thus, for all societal areas to smoothly go through sustainability transitions, we need a transition in the education system toward sustainability education. However, even though the importance of sustainability education is increasingly acknowledged, its power for competence building for sustainability transitions is not yet a commonly accepted idea in conventional innovation thinking (Bangay & Blum, 2010).

Employing the multi-level perspective

Now that we have established the importance of a transition toward sustainability education in primary and secondary schools, we will analyze this transition through socio-technical transition analysis.

One of the existing approaches to socio-technical transitions is the multi-level perspective, which serves as an analytical tool that, in contrast to most approaches to socio-technical system analysis, manages to include both multi-dimensionality and structural change (Geels, 2011). The model identifies three levels of analysis within a socio-technical transition: the socio-technical regime, the socio-technical landscape, which sets the context against which socio-technical transitions take place, and technological niches, which exist at the micro-level. The stable socio-technical regime is challenged by pressures from the socio-technical landscape. If these developments put sufficient pressure on the regime, the regime may break open, creating a 'window of opportunity'. If niche innovations are fully developed at the time such a window of opportunity opens up, they may use this possibility to break through into the regime and therewith disrupt the reproduction of the existing system. Figure 1 shows the multi-level perspective and the interplay of the three analytical levels.

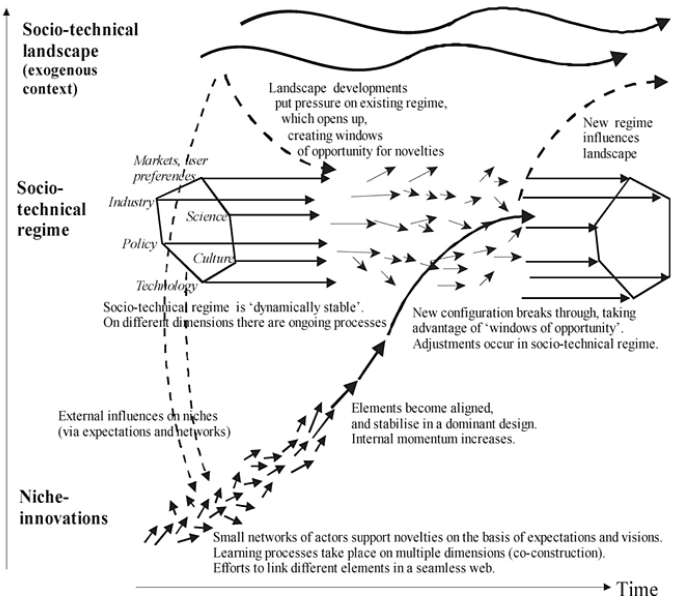

Figure 1: Model of the multi-level perspective (Geels & Schot, 2007)

Applying the multi-level perspective to the education system, the socio-technical regime is characterized by long-standing practices of educating and established institutional support of these practices. At the landscape level, the threat of climate change and the increasing attention it receives puts pressure on the regime, demanding education that equips everyone for these challenges (Bangay & Blum, 2010; Læssøe et al., 2009). As the figure depicts, expectations evolving from landscape developments influence the creation and evolution of niche-innovations. These expectations demand that schools must provide children with the knowledge, skills, and values associated with sustainability.

Niche-innovations for sustainability education

As a response to the need for the inclusion of sustainability education in primary and secondary schools, various initiatives have appeared. One can distinguish three different ways in which niches include sustainability in primary and secondary schools, and we will briefly discuss examples of each of these ways.

First, sustainability education can be introduced through an alternative educational concept that includes sustainability. An example of such an alternative schooling method is that of Waldorf education, which, based on the humanistic pedagogical philosophy of Rudolf Steiner, aims at educating children to blossom into independent and responsible individuals, able to face both present-day and future challenges (Waldorf School, n.d.). Sustainability is included as one of the elements shaping Waldorf education (International Waldorf School The Hague, n.d.). The program carries out this and its other key values through employing the 'head, heart, hands' approach, which combines cognitive, physical, and emotional learning (Easton, 1997).

Waldorf education can be considered a plausible innovation in the field of sustainability education as it adopts a holistic approach, embedding sustainability in its comprehensive idea of the responsible, creative, and conscious child. However, schools like Waldorf schools have at their core an alternative philosophy that goes beyond the mere wish to include sustainability. It is one that we do not argue to be good or bad, but it is certainly one that cannot simply replace the existing education regime. As this paper aims to achieve a societal shift through the education system, an educational program that exists separate from the regular public-school system cannot be considered a suitable candidate, for it does not give incentive for change within the public school system.

Secondly, new schools can be established that use a radically different way of teaching that includes a direct involvement with sustainability. Examples of such initiatives are Forest Schools and Green Schools, both offering the majority of their educational activities in the outdoors (Wood, 2017). These schools allow children to learn directly from the complexity and richness of nature by engaging with it, which can be considered highly valuable for awareness on sustainability. Like the previous category, these kinds of schools do not pose pressure for widespread transitions in regular schools. Moreover, they require a natural environment most urban schools do not have access to.

Third, sustainability education can be gradually integrated into the existing system by providing the knowledge, skills, and values around sustainability as an add-on to the existing system. Such initiatives do provide an incentive for sustainability shifts within the education regime, as they can fit in any school. A prominent example of such an initiative is the Eco-Schools program. Where Waldorf education and forest schools exist as separate niches beside the public-school system, Eco-Schools offers a framework for regular public schools to include sustainability, without the need to disrupt existing linkages in the system. As Eco-Schools poses an add-on to the existing public education system, it can be regarded as a promising program for public value and competence creation, which is why the paper narrows its focus to the analysis of Eco-Schools.

The nature of the Eco-Schools transition

As discussed above, the potential of the Eco-Schools program lies mainly in its ability to act as an add-on to existing education regime, which makes for a low adoption threshold, as well as global applicability. The program sets out a seven-step framework through which schools can embed sustainability in their education. The seven steps are: 1) to form an Eco-committee, 2) to conduct an environmental review, 3) to make an action-plan, 4) to draw links

between the curriculum and sustainability, 5) to inform and involve the wider community, 6) to monitor and evaluate progress, and 7) to design an Eco-code (Eco-Schools, n.d.). Once these steps are well implemented, the school may obtain the Eco-Schools quality mark: the green flag (Eco-Schools, n.d.). Apparently, the framework consists of an initial add-on, which gradually induces further changes within the school environment.

This kind of transition is that of a reconfiguration pathway, displayed in figure 2 below. In the figure, one can observe the pathway an innovation takes to become part of the existing regime, and how it influences the regime from within.

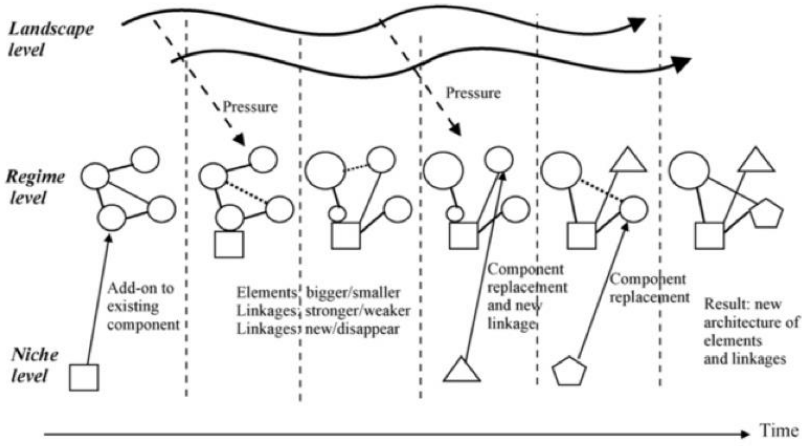

Figure 2: a reconfiguration pathway (Geels & Schot, 2007)

Actors, Drivers, and Barriers

While local circumstances determine the exact drivers and barriers that come into play, one can observe several generally occurring drivers and barriers, as well as key actors. First, schools that have already adopted the Eco-Schools program heighten the pressure for other schools to commit to sustainability education, as it increasingly becomes a standard. Regarding the implementation of the program, the school management plays an important role as its intrinsic motivation to include sustainability is crucial. In that way, school managements can act as either a driver or a barrier, depending on their support or reluctance towards the Eco-Schools program. Moreover, local policy-makers determine the institutional support schools receive in their transitions. Parents comprise another important group of actors, as they can be considered 'customers' in the education 'market', choosing among different 'products' the one that best fits their likes. Thus, as supply adapts to demand, parents' expectations may put pressure on the school to adopt sustainability education.

What seriously complicates the expansion and the successful implementation of the Eco-Schools program is the fact that those who must carry out the innovation (e.g. teachers and the school direction), have not been educated the knowledge, skills, and values concerning sustainability themselves. Nor are they taught the social skills to successfully go through a transition process as would be required. Thus, they demonstrate the precise issue sustainability education should solve. The fact that these actors have not been equipped with the required means for sustainability transitions expresses a value-, knowledge-, and skills-gap. The value gap means that teachers and school managements might lack the ambition to change the present school regime as they have not been confronted with the importance of sustainability throughout their education. The knowledge and skills gaps refer to the fact that these teachers might not be competent to teach the knowledge and skills to their students (Læssøe et al., 2009), which calls for time- and energy-demanding training.

The need to invest extra time to innovate teaching practices composes a main barrier to include sustainability education in the school. Teachers, the school board, and children are already busy. Curricula are generally stuffed with compulsory subject matter, which makes it difficult to make space, in terms of time, money, and headspace, for sustainability education (Læssøe et al., 2009). As schools first and foremost have an executive task of existing educational policies, the additional task of transforming present ways of doing is one that is often not prioritized. Thus, interventions should consider the importance of space for schools to successfully implement the Eco-Schools program.

Policy interventions

Now that we have established the importance of a transition toward sustainability education in the basic education system, as well as an argued preference for a specific innovation initiative in this field, we must consider what could be done to further encourage the innovation process. The choice of specific policy instruments must be based on identified barriers that obstruct the innovation from fully evolving (Borrás & Edquist, 2013), which were discussed in the previous section.

Three different kinds of policy instruments can be distinguished: regulatory instruments, economic and financial instruments, and soft instruments. Regulatory instruments set out boundaries of what is permitted and what is not. They can be considered the 'stick', preventing people to act in undesirable ways (Borrás & Edquist, 2013). Economic and financial instruments, on the other hand, provide positive incentives as the 'carrot', a reward for acting in desirable ways (Borras & Edquist, 2013). Lastly, soft instruments compose non-coercive means of innovation support.

Based on the previously discussed lack of space and insufficiently equipped teachers, a suitable intervention this paper proposes is to subsidize schools who adopt the Eco-Schools program, providing them with the space to fully take on the Eco-Schools ethic. The program likely requires those working in the school to put in extra work hours, which the subsidy would compensate, making this barrier of the adoption less considerable. This proposition comprises an economic incentive, providing additional benefit for complying with the desired behavior. In 2019, the municipality of Amsterdam offered to support the adoption of the Eco-Schools program through funding, as part of their endeavor for policy that supports sustainability (n.a, 2019).

A second intervention is for policies to facilitate the deployment of facilitators connected to the Eco-Schools program, who guide the school through the process of introducing sustainability and becoming an Eco-School. Such facilitators are not bound by established user practices, which makes them a suitable carrier of the innovation within the school. Moreover, they provide a solution to the knowledge- and skills-gap discussed before, as they have been educated in the field. These facilitators are already included in the Eco-Schools program. A representative of Eco-Schools pointed out in a conversation that the extent to which facilitators are engaged in schools heavily influences the observed progress schools make, making the program more effective. It is thus beneficial for the Eco-Schools program to strengthen the involvement of such facilitators.

With regards to soft instruments, it is useful to support communication between initiatives concerned with sustainability and education and the Eco-Schools program. It is important for the program to connect with local actors to ensure cooperation to provide a welcoming environment for schools to adopt the Eco-Schools program.

Local application: A case study on Maastricht

While Eco-Schools offers a global framework for global sustainable competency creation, one must adopt a local perspective in examining the local opportunities for its application and development, as circumstances differ in each country (Mogensen & Mayer, 2005), but also in local communities. Thus, as an example of how the general recommendations proposed above can be applied at the local level, we briefly examine the city of Maastricht.

In Maastricht, two schools, 'United World College' and 'De Geluksvogel', have adopted the Eco-Schools program (Rijkx, 2017). The small number of Eco-Schools in Maastricht makes for low pressure for other schools to adopt the program. In the Netherlands, schools get charged a registration fee as well as yearly costs for their participation, which poses an additional barrier to the adoption of the Eco-Schools program (Eco-Schools, n.d.). Unlike Amsterdam, the municipality of Maastricht does not fund sustainability education programs. So, a possible intervention to encourage more schools in Maastricht to adopt the Eco-Schools program is for the municipality to subsidize the adoption of the program.

Secondly, the University of Maastricht is currently working on expanding their sustainability-related course- and program-offerings, as well as generally becoming more sustainable (Green Office, n.d.). There is an opportunity to connect students concerned with sustainability and education to the Eco-Schools program by training them to become facilitators. This provides students the opportunity to gain practical experience, while at the same time offering Eco-Schools valuable social capital. As these students are educated in sustainability, they provide the required knowledge and skills for sustainability education. Existing collectives that could contribute here are the

university Maastricht Green Office and GECCO (the University College Maastricht sustainability committee). As discussed above, the role of facilitators in the program must be strengthened.

Discussion and Concluding Remarks

This paper examined how existing sustainability education programs for basic education can be enhanced to support the competence of future actors in sustainability transitions. It examined the need for sustainability education in the basic education system for sustainability transitions and focused on the Eco-Schools program for its wide applicability. Although opportunities for interventions should be considered locally, this paper gives general recommendations that can be adapted to local circumstances. These recommendations are for local authorities to offer schools subsidies to adopt the Eco-Schools program, and for the Eco-Schools program to improve the deployment of facilitators. Lastly, it argues to make use of local assets by engaging local organizations that together built a supportive environment for schools to adopt the Eco-Schools program. The local application to Maastricht exemplifies how the general recommendations this paper offers can be adapted to local circumstances. One can emphasize the importance of local action for the effective and broad implementation of sustainability education programs. Further research in the field must acknowledge this socio-technical transition as one that requires a nested approach.

While this paper argues for the enhancement of sustainability education in primary and secondary schools, it acknowledges that competence building for sustainability transitions in higher education is essential as well. This paper also recognizes the fact that there are other initiatives that offer sustainability education as an add-on to existing schools apart from Eco-Schools. However, because of the prominence of Eco-Schools compared to other initiatives, it was considered valuable for the societal competence creation this paper seeks. Similar programs cannot be taken out of consideration for this purpose, but for the sake of this paper, they were disregarded.

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Transforming Loco Tuinen to Engage Students in Their Mission

Lianne Harmsen

In 2015, the first LOCO Tuinen garden was founded in Heer, a suburb in Maastricht. For the first time, people from Maastricht reached out to farmers to set up an organization which focuses on connectedness and the responsibility of its members to be actively engaged with the food they consume. The ultimate goal of the organization is to counteract against the dominance of the current corporate agricultural sector by focussing on locally produced food (Edening, n.d.);(LOCO Tuinen, n.d.). Local food is defined by Peter, Bills, Wilkins & Fick in 2008 as "a geographical concept referring to the distance between food producers and consumers". The concept however, also has a political dimension. The local food connected to this concept focuses on an alternative food supply system. It has been described as "a banner under which people attempt to counteract trends of economic concentration, social disempowerment, and environmental degradation in the food and agricultural landscape" (Peter, Bills, Wilkins & Fick, 2008, p. 2). LOCO Tuinen now counts 150 members, but to fully support the involved farmer, to create more gardens in the city and to increasingly challenge the current system, the initiative needs to grow towards a membership of 250 people (Anne Lefevre, 2020). 27,5% of the people living in Maastricht are students or young professionals (Maastricht in Cijfer, n.d.). However, this group is often not involved in such initiatives. This raises the research question of how LOCO Tuinen in Maastricht can innovate in order to engage students and young professionals in their mission. This paper offers two solutions: the creation of interpersonal relationships between LOCO Tuinen and student associations and by digitally innovating their site. Secondly, this paper proposes network formation between transnational and local food initiatives.

This research will first describe the relevance of innovating LOCO Tuinen and other local farmer initiatives using the Sustainable Development Goals. Secondly, the typology of the innovation of LOCO Tuinen will be analyzed. After that, the paper will apply and discuss the TSI theory. The drivers and barriers of the innovation will be analyzed before proposing a number of innovations for LOCO Tuinen based on the propositions recommended in the theory.

Relevance

This paper will first explore the relevance of LOCO Tuinen's initiative and locally produced food. Our world is entering a new era. At the end of the 20th century it became clear that we are facing a number of challenges. Population growth, rising food prices, increased consumption of animal products all have great impact on the world's food production system. Over the last years, more attention has been drawn to other challenges the global food system is facing: climate change and rising energy prices (Peters, Bills, Wilkins, & Fick, 2008). Global warming is likely to reach 1.5 degrees celsius above pre-industrial times between 2030 and 2052. This will cause an increase in mean temperature on land and sea, increased precipitation, droughts and hot extremes in several areas. These changes will greatly influence the ecosystems and species on earth. There will be extinction and species loss as well as risk to health, human security, water supply and livelihoods (IPPC, 2018). These impacts demand climate adaptation and mitigation. The world's agricultural system is, thus, facing the following challenge: how can we improve food security while reducing the greenhouse gases emitted? The answer of this question might lie in the patterns of the consumers. Through lifestyle changes both food security and climate mitigation can be achieved (Peters, Bills, Wilkins, & Fick, 2008). Scholars and civilians argue that local food might be a part of the solution (Colloredo-Mansfeld, et al., 2014). The current system, corporate agribusiness, is also linked to a number of problems ranging from health treats to farmer bankruptcy and labor abuses (Colloredo-Mansfeld, et al., 2014).

This paper will connect locally produced food to the Sustainable Development Goals (SDGs). The SDGS are interconnected goals created as a blueprint to work on a better and more sustainable future. The local food movement is linked to SDG 12 which focuses on sustainable production and consumption. According to the United Nations, sustainable production and consumption will contribute to poverty alleviation as well as contributing to a greener world (United Nations Sustainable Development, n.d.). Locally produced food also has a higher probability to be produced under environmentally friendly practises (Martinez et al., 2010). Consuming locally produced food also helps to preserve local farmland (Brain, 2012). The local food movement can also be linked to SDG 13 called urgent climate action (United Nations Sustainable Development, n.d.). This links to the ecological benefit of locally

produced food. When locally producing food less carbon is being emitted to transport the food (Peters, Bills, Wilkins, & Fick, 2008) . SGG 11, sustainable cities and communities, is also linked to locally produced food (United Nations Sustainable Development, n.d.). The SGG focuses on the creation of more safe, sustainable and resilient cities. In the past years there has been a disconnect between the social and natural aspect of agriculture. Locally produced foods raise public awareness about the food system as well as creating more public control over the system. Locally produced food also improves the economic resilience of local farmers and rural communities (Gale, 1997) (Peters, Bills, Wilkins, & Fick, 2008) (Coelho, Coelho, & Egerer, 2018). If one purchases food directly from the farmer, the added value who is normally contributed by large firms is captured by the farmer. Buying locally produced food also creates more jobs in towns (Brain, 2012).

The problems our societies are facing cannot be solved by only political and technical processes. It is of utmost importance to get citizens involved in the transition towards a more sustainable and ecologically friendly foodshed and society. Especially the younger generation who will suffer the consequences from the modern-day challenges and will be the future leaders need to be involved in deliberations and discussions regarding locally produced food (Ojala, 2012). This highlights the importance of the youth as key actors in these transitions.

Maastricht houses 121.565 people and hosts a large number of students (Maastricht in Cijfer, n.d.). If the local farmer initiatives in Maastricht can innovate to engage students in their mission, Maastricht can be used as a blueprint for the rest of the Netherlands. Maastricht also hosts relatively more young people in comparison to other Dutch cities. In Maastricht, 27,5% of the people is between the age of 15 and 29 in comparison to the Dutch average of 18,8%. Therefore, when aiming to produce more food locally in Maastricht, the younger generation is of utmost importance (Maastricht in Cijfer, n.d.).

Type of innovation

This paper has established the importance of innovating local food initiatives and to engage more students and young professionals. Now, this paper will analyze the innovation of LOCO Tuinen through the use of the transformative social innovation theory (TSI) (Haxeltine et al, 2017). First, TSI needs to be defined and the LOCO Tuinen concept should be explained.

Haxeltine et. al. in 2017, define TSI as "the process of challenging, altering, or replacing the dominance of existing institutions in a specific social and material context" (Hexeltine et. al, 2017, p. 2). The innovation of LOCO Tuinen wishes to challenge the current dominant system: the corporate agricultural system which is driven by capitalist globalization (Colloredo-Mansfeld, et al., 2014). This will be done by enhancing their local initiative, which is already present in Maastricht, by engaging students in their mission. This is done through transformative change. Transformative change is defined as persistent adjustment in societal values, outlooks and behaviours of sufficient 'width and depth' to alter any preceding situation in the social and material context" (Haxeltine, et.al, 2017, p. 3). The transition of LOCO Tuinen can be seen as one which adjusts the societal value, outlooks, and behaviours. By making LOCO Tuinen more engaging for students, the view of students on the current food apply system can be changed. The societal perception of grocery shopping as "the" way of supplying student's households with food can be transformed. There will come a more fluid definition, behaviour, and outlook on supplying food to students. One which holds LOCO Tuinen and other farmer initiatives as part of the food supply landscape. This, thus, challenges the dominant institutions of the agricultural business.

Often, social innovation (SI) and networks are seen as the key actors who instigate TSI processes. Social innovation is defined as a process of creating new social relations as well as evolving the transmission of knowledge and practices (Haxeltine et.al, 2017). This paper thus tries to create linkages between students in Maastricht and LOCO Tuinen. These linkages are multiple dimensional. An example of the linkages created are personal linkages. These are created between the students and people already involved in LOCO Tuinen. These linkages can be seen as the transmission of knowledge and practices. By defining the transition of LOCO Tuinen as a process in which social relations are changed, we emphasize the importance of the "innovators" and "innovations" (Haxeltine et.al, 2017). We can, thus, conclude that the transition of LOCO Tuinen can be seen as a transformative social innovation.

Application of the theory

Haxeltine et al. in 2017 constructed a paradigm that depicts the relationship between social innovation and the socio-material context. Their paper focuses on four clusters that show progress relations. The relationship between SI initiatives is the first cluster discussed. It focuses on how TSI processes require individuals to be motivated to create SI innovations. There needs to be an intrinsic motivation to create, experiment, and preform. The second cluster is interconnected with the first cluster as it focuses on the network formation. SI's do not work in isolation, through the use of action networks they find allies, together creating networks. The third cluster focuses on institutional change. SI's aim to develop knowledge and practices which address a need. The last cluster focuses on the relations in socio-material context (Haxeltine, et al, 2017). This paper focuses on the first two clusters of the TSI theory. The third cluster focuses on institutional change. LOCO Tuinen's ambition is not to create institutional change, rather a social change in the way we produce and consume food. Therefore, this paper will not explicitly focus on cluster three.

First, TSI's need for motivated individuals to create innovations will be discussed. LOCO Tuinen now counts 150 members. 150 members are not enough members to fully financially support the farmer involved and to create more LOCO Tuinen in the region. When the initiative would grow towards 250 members, the farmer could earn his entire salary with his work at the LOCO Tuinen and a second LOCO Tuin could be set up. LOCO Tuinen, thus, has the ambition to grow (Anne Lefevre, 2020).

Haxeltine et al. in 2017 describe in their 10th proposition for TSI innovation that SI initiatives are "strongly shaped by the historical context of the wider sociomaterial context." (Haxeltine et al., 2017, p. 18). These goals shape the strategic actions as well as the formulation of the goals created by the individuals involved. The context of the SI is described in the relevance part of this paper: climate change, rising food prices and population growth. TSI people create these transformative solutions to these challenges. The biggest driver of this innovation, thus, is the that consumption and production of locally produced food has proven to have received more and more attention the past years because of the context of the world right now (IMemery, Angell, Megicks, & Lindgreen, 2015).

However, student-based growth is held back for several reasons. First of all, consumers are not willing to pay more money for locally produced products (Schneider and Francis, 2005), (Roininen, et al., 2006) Price is thus often considered a barrier (Dukeshire, Garbes, Kennedy, Boudreau, & Osborne, 2011). When buying a vegetable box subscription at LOCO Tuinen, a student would pay €230,- a year for 36 weeks of harvesting. Especially for students, this seems like quite a lot of money. However, in actuality, this is only €6,38 a week, which is comparable to the money one would spend in the supermarket. It would not be achievable to lower the price even more (Anne Lefevre, 2020). LOCO Tuinen, however, still tried to combat this barrier by removing the entrance fee of €25,- and the subscription fee of €100,- (LOCO Tuinen, n,d.) as well as creating the option to pay the money on monthly basis instead on yearly basis.

They also made their subscription more flexible by creating the option to cancel your subscription every 3 months instead of every year. Although the initiatives provide a good start, they will not engage the majority of the students. Students and young professionals live a more irregular lifestyle than elders and working adults. This is due to the fact that, for example, students spend fewer hours at school than elders spend at work and generally have more free time. Dutch students often stay at their parental home in the weekend. International students leave Maastricht for extended periods during the holidays. According to Anne Lefevre, creating more flexibility would be possible when the amounts of members would increase. Right now, this would be too risky for the farmer involved. LOCO Tuinen aims to engage, especially, student houses in their program, since this causes less administrative work than individual clients. Individual students are harder to bind to the project for the long term, as they will often leave the city after a few years. Student houses provide a continuous flow of new students and will thus be clients for an extended period (Anne Lefevre, 2020).

Anne Lefevre did highlight another challenge. While it is rather easy for LOCO Tuinen to attract green-oriented students, LOCO Tuinen has trouble engaging the more "passive" and "normal" students in their mission. She reported that the initiative has to deal with the stereotypical view of being for "hippies." LOCO Tuinen is well presented on social media and has a functioning website. Their volunteers try to be at lectures, debates, and major

university events. They also collaborate with the Green Office (Anne Lefevre, 2020). The Green Office is a taskforce of Maastricht University run by students, intending to present the student body and implement sustainable initiatives (Maastricht University, n.d.). Such initiatives, which are often in collaboration with the university, however, mostly attract students who are already invested in the green lifestyle. LOCO Tuinen needs to innovate its strategy to also attract the less invested students.

Colloredo-Mansfeld, et al. in 2014 highlighted another barrier in the process of developing local food system. They argue that tension is created when local initiatives are scaling up their production and sales. This could lead to friction as local initiatives want to retain their often idealized ideas on localization.

Proposed innovation

This paper aims to provide a framework on how LOCO Tuinen could innovate its marketing strategy to attract students who are not already invested in a green lifestyle. This is done using the propositions in clusters one and two proposed by Haxeltine et al. in 2017. Proposition two focuses on establishing new or alternative interpersonal relations in order to create the optimal condition to challenge, alter, or replace the dominance. This paper proposes linkages with student associations and the people of LOCO Tuinen in order to challenge the dominance of supermarket-based consumption. When establishing interpersonal relations with the board of the associations, they can provide LOCO Tuinen with a new niche of members which otherwise would not have been attracted to initiatives like LOCO Tuinen. Student associations often have houses for their members. For example, Circumflex has 30 student housings in the inner city that hosts 3 to 24 students each (Studentenvereniging Circumflex, n.d.). Tragos, another big association in Maastricht, has 25 student houses (Tragos, n.d.). As mentioned before, LOCO Tuinen prefer student houses as members rather than individual members.

This paper also proposes establishing new interpersonal relations between LOCO Tuinen members and international students. The site and social media of LOCO need to be digitally innovated to the English language. At Maastricht University, 53% of the students come from abroad (Maastricht University, 2018). Innovating the site would lead to even more students being able to join LOCO Tuinen.

Proposition five focuses on the fact that local SI initiatives can be empowered by joining or initiating transnational or local initiatives. Studies have shown that local initiatives that collaborate lead to four mechanisms of empowerment. The SI could gain more: funding, knowledge, peer support, and learning. The spread of ideas is crucial in allowing SI initiatives, like LOCO Tuinen, to make transformative impacts (Haxeltine et al. in 2017). Therefore, this paper proposes more network formation on two levels in order to alter, change, replace the dominant structure through the use of more members. First, this paper proposes network formation with global initiatives such as Slow Food. Slow Food is a global organization which focuses on the prevention of the disappearance of local food cultures and traditions. The organizations try to counteract the fast life and engage people in their own consumption (Slow Food, 2017). These values and ideas are also at the core of the LOCO Tuinen initiative. Slow Food tries to achieve these goals by working to acquire funds for programs. The organization of international events and setting up programs that focus on food education. Their organization has different sub-organizations such as Slow Europe (Slow Food, 2017). This paper thus proposes the joining of organizations like Slow Food to expend the transnational network of LOCO Tuinen. The four mechanisms of empowerment will then cause the initiative to gain more members and create transformative change.

This paper also proposes network formation on the local level, with already existing initiatives in Maastricht. Many initiatives in Maastricht share a common vision. This common vision could lead to deeper linkages between programs. This paper proposes the collaboration of Foodcop Maastricht, Farmers from Lekker dichtbij, and LOCO Tuinen.

Conclusion

This paper questioned how LOCO Tuinen in Maastricht can innovate in order to engage students and young professionals in their mission. Due to climate change, high food prices, globalisation and population growth, the current food system is under pressure. This created more and more attention for locally produced foods (Memery,

Angell, Megicks, & Lindgreen, 2015). LOCO Tuinen and other local farmer initiatives try to challenge the corporate agricultural system. Often, there is trouble engaging students and young professionals because of the price, lack of flexibility and attraction of only a niche part of the student body. This paper proposed innovations for LOCO Tuinen based on propositions made in the TSI theory to tackle the last barrier. The paper first proposes new interpersonal relationships by creating linkages with student associations and by digitally innovating their site. Secondly, this paper proposes network formation between transnational and local food initiatives. Future research should focus on the other two barriers, the expansion of the current literature on the linkages between transnational local initiatives and governmental policies to stimulate local initiatives.

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CultureUp: Cultural Heritage Online

Margherita Serpieri

Introduction

Culture has always been a significant aspect of societies and their identity. Since ever, cultural heritage has been considered a special part of a population's "spiritual and intellectual health", by affirming its past (Idris, Mustaffa, & Yusoff, 2016, p.1; "Preserving Culture and Heritage through generations", 2014). Additionally, Kokko and Kyritsi (2012) consider cultural heritage as an instrument for social cohesion both within and between different communities. I refer to 'cultural heritage' as "[...] the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations" ("Preserving Culture and Heritage through generations", 2014, p.4).

Due to this importance, cultural heritage must be preserved and valued by everyone worldwide. However, this is not always the case, and the last few decades have shown that a large part of the global population, especially the youth, is losing interest in cultural heritage, as the latter is not valued enough by societies (UNESCO, 2019). Froschauer, Arends, Goldfarb and Merkl (2012) stress that, it is of vital importance that the youth recaches interest, as they are the next generations which will have to take care of cultural heritage. Thus, the problem that should be tackled is that today's young generations are not sufficiently involved in culture, as they are considered only passive inheritors (Morrison, 2019). Throughout the paper I argue that the issue of this phenomenon lies in how cultural heritage is presented to them.

Therefore, my essay aims at answering the research question: how can the interest in cultural heritage be revitalized, especially for younger generations? For the sake of clarity, the 'youth' or 'younger generations' refer to people aged from 15 to 24 years old (The United Nations, n.d.). My research suggests that part of the solution to the lost interest in cultural heritage comes from digitalization and new technologies. To provide a more concrete idea, I developed the concept of a technological innovation. More precisely, a digital app whose aim is to revitalize the concepts of 'culture' and 'art', and thus, spike more interest among young people toward cultural heritage. For simplicity sake, throughout my essay I refer to my innovative app as 'CultureUp'. Developing a digital innovation is relevant as in the last decades there has been a radical shift in almost all sectors towards online versions of real life: in communication, education, politics, and many more (Marres, 2017). Therefore, I believe it is crucial to academically analyse the impact of new technologies in sectors which are not directly linked to digital innovations, such as culture, which has always been associated with unchanging tradition.

CultureUp and its application are depicted in this paper according to the following structure: first, the problem is analysed further, in order to better understand the usefulness of CultureUp. Then, the paper presents the solution, CultureUp, through a multi-level analysis: the niche, the socio-technical regime, and the landscape developments. Throughout these sections, CultureUp is explained more in detail as well as all the aspects its implementation would involve, such as the type of innovation, of change, transition and economies. The conclusion synthesizes the main arguments and provides insight for future research.

The Issue, Its Causes and Consequences

Cultural sectors are facing a crisis in terms of their popularity among the youth (Morrison, 2019). To understand why this phenomenon is occurring, one might think 'what is it about cultural heritage which is uninteresting for the younger people? What has changed since the past centuries?' In my opinion, nothing is wrong with cultural heritage in itself: the paintings, the music, or the sculptures which compose the global cultural capital have been the same since their creation. Thus, the issue is not art. Instead, we must look at the broader context in which culture is embedded: the world, and every aspect of it, is becoming digitalized, and thus, is bringing inevitable changes. Nowadays, it is almost impossible to find a version of some real-life phenomena which has not been transformed into a digital format (Marres, 2017). The main characteristics of digitalization is that content is dynamic and there is more participation from the public. Thanks to the User-Generated-Content (UGC) people are not limited to being consumers, but transform themselves into producers (Marres, 2017). Consequently, the new younger generations are growing up in an environment which makes them participate in what they see and experience. Marres suggests that social media is the prime example of this digitalization trend.

However, cultural sectors are among the last to adapt to a new way of exposing life: their heritage is preserved in a very traditional way; people are only considered consumers and passive viewers. I do not think that this is wrong, as I believe keeping tradition intact is very important. However, by doing so, cultural sectors are not following the progress that the rest of the world is facing, hence, they are losing appeal.

In this digital shift, the younger generations are probably the main actors as they are used to a dynamic and active interaction with the world around them thanks to social media. Consequently, they expect to experience and rely on their connected devices in multiple fields. Hence, it can be argued that the problem with cultural heritage is that it is not considered a social and fun experience; tradition is seen as boring by the youth (Morrison, 2019). This directly affects young people as they undermine the importance of cultural heritage, and hence, the latter loses audience and may not have enough funds to thrive. In other words, some cultural sectors are experiencing a financial and structural crisis which must be solved quickly and in a sustainable way (Bonet and Donato, 2011). It could be discussed that the problem has been increasing with COVID-19, which is causing disturbing consequences on these sectors: millions of people cannot travel, concerts cannot take place, many employees are being fired, and, in all this, the youth do not prioritize culture. The world is changing, and so must the exposition of tradition.

Solution Approach: A Multi-Level Analysis

Niche

By considering the claims of the previous section, I believe that to solve the present issue, there should be some adaptations in the field. Meaning, it is the duty of cultural sectors to innovate themselves. Specifically, as cultural heritage cannot be changed in itself, innovation must come from the way it is exposed, based on the global digitalization trend. Therefore, I propose an innovation which aims at bringing an interactive dimension to art and culture: 'CultureUp', a digital app downloadable by everyone on any connected device. The functioning of CultureUp is based on social media's features: creating, sharing, and participating (Marres, 2017). These concepts are embedded in the app as every cultural institution willing to participate has to shift its own content into a digital format, and then post it on the app, where people can subscribe and view the digital versions of cultural heritage. 'Cultural institution' here refers to museums, ancient sites, theatres, musical institutions and more. Additionally, users will be able to comment on the posts and share them in a private messaging system with their friends. The main difference with social media platforms such as Instagram, is that CultureUp does not give the opportunity to post one's own content. In other words, the app is made for promoting and broadening professional institutions, including both public institutions and private foundations. Nonetheless, there is still the chance to comment and share opinions. Furthermore, to assure that cultural sectors don't lose economically-wise, a business model has to be studied by digital economy experts to find a sustainable way to make the app work.

This practical explanation of how CultureUp would work is what constitutes the niche of innovation: a protected space where different actors brainstorm about a certain idea, and wait for the right window for opportunity to enter the real world (Schot and Geels, 2017). In our example, this window could be right now, as COVID-19 is proving that a digitized access to culture could be of great use. This explanation also provides a concrete introduction to the type of network of actors that will be needed to make CultureUp more concrete, and thus, enter the socio-technical regime. Once its technicalities are fully acknowledged, and the market demand becomes clearer, in our case especially among the youth, the implementation of the app will be ready to become real.

Socio-technical Regime

As mentioned above, certain actors are required in order to assure a successful creation and implementation of the app. To better understand this, the drivers of the innovation must be determined. There is a wide range of actors who will lead to the creation, development, and maintenance of the app. On the niche level, these actors represent art and music experts, economists, sociologists, historians, and more. Multiple factors from different disciplines will have to be considered in order to have a complete overview of the creation of the app.

On a broader scale, there are two main drivers of CultureUp. On one hand there are all the cultural institutions. These are the drivers that theoretically will take part in it and post their content in the form most suitable for them. For instance, a museum might post pictures with a written description, and a concert hall might make (live) videos of real-life performances. I must also specify that CultureUp will make sure that each institution provides the content with some sort of explanation of what is being posted. This will enable a better quality of content as well as

potential creation of jobs for art experts, as cultural institutions will ask them to provide interesting and dynamic explanations of certain items. On the other hand, there are the governmental directives which constitute the second large driver of the app. An example could be EU directives, as well as the regulations established by the ministries of culture. These instructions will provide CultureUp with regulatory instruments for its creation and application. Moreover, governmental directives might provide financial instruments to help the digital transition of content.

These drivers give a very optimistic overview of CultureUp. However, it must be considered that there are also barriers which could hinder the successful implementation of the app. First, there might be economic barriers, as not all cultural institutions may have the means to develop a well-structured digital content. This brings to the second point, namely, organizational issues: various tensions could arise, either within a cultural institution, thus among its individual actors on the exposition of content, or between institutions and the politics of government regarding regulations. Also, the directives could disapprove certain proposed methods of exposition or fees for the public to pay. Furthermore, the directives constituting the drivers of CultureUp are complex legislative processes which might require a long time before they make change happen. These regulations also have the risk of restricting the freedom and flexibility of the app. Another barrier is that competition between institutions might have a damaging effect on their content (Komarac, Ozretic-Dosen, & Skare, 2017). However, it could also encourage them to perform better. This is a highly disputable point. Other limits of the successful application of the app are linked to the digital world: people sharing a log-in to avoid paying, which might lead to damaging economic effects, or there might be problems regarding the language of the app: how many and which languages must be included? Moreover, digital always brings the problem of hackers and data protection, concerning details of bank accounts. A final note on the barriers, CultureUp will need to be maintained, both financially as well as socially. These barriers must be partially dealt with by the above-mentioned drivers; this is tackled further in the next section.

At this point, having considered drivers and barriers, one must reflect on the potential change and impact that CultureUp would have in the fields of arts and culture. Based on prior research, digital innovations are already taking place in these domains. For instance, in 2019, a digital app, 'GIFT', was created with the aim of sharing a museum's exposition by taking pictures and then sending them to friends (Jarrett & Bacon, 2019). The idea behind GIFT is not too different from CultureUp, as both try to increase cultural heritage's appeal by shifting it online. However, I believe that GIFT has some flaws: first, one might easily share a picture by using other means, such as WhatsApp or Snapchat, hence, making a new app for simply sharing photos is not that innovative. Second, there is no professional explanation coming with the picture, unless the person sharing them is a professional. Hence, quality is not guaranteed, and I see little reasons why the youth might increase their interest by simply looking at a photo.

Moreover, I believe CultureUp should be compared to cultural institution websites: why would we need an entirely new app if we can find free content on websites? In my opinion, the answer lies in the question itself: as websites content is free, it means that it is also limited; otherwise institutions would risk economic lost (Pauwels, 2012). A second problem with websites is that they take longer to access than an app, and if people want to check out more than one institution it will take even longer. The main idea behind this is that on an app everything is in it: no time is lost in the search.

These two examples show that CultureUp would not be a radical change: there are already existing socio-technical regime infrastructures. CultureUp represents instead a substantial change. In other words, my innovation would add professional content, compared to GIFT, and a more extensive content with easier access compared to individual websites.

Considering the drivers, the barriers, and the implementation of the app in its cultural domain, we get a more precise view of the socio-technical regime of the innovation. In this phase of the development of CultureUp, there is already more organization and the actual implementation of the app is starting to take shape. However, there are still factors to be considered in order to have a full overview of what the innovation will bring to societies and the various cultural sectors. More specifically, once the app is created, everyone must be aware that it is more than a simple product innovation. Otherwise, the app will not reach its desired success as it might be treated as another simple new product. This is not desirable, as CultureUp's aim is to change the whole approach to cultural heritage and its exposition, especially for the youth, who do not perceive it as an important dimension of society. A key technique to do so is by raising awareness in cultural sectors. As the American philosopher Kuhn stated, people learn the paradigm through which they see the world throughout education (Kuhn & Epstein, 1979). This holds for

culture as well. In order to increase awareness, the app will need to be embedded into the educational systems of young people.

Therefore, I argue that CultureUp involves other three types of innovation: process innovation, organizational innovation, and social innovation. First, it involves the entire process of exposing cultural heritage and shifts its meaning to a new way of using the digital in relation to these fields. This first change will affect both the people currently working within culture heritage and in the long-term even those who are not in contact with it. Consequently, the cultural sectors will be subject to a socio-technical transition towards a more connected approach to culture. It will affect the social environment around it, especially the younger generations, by adapting its processes to a digital format. This transition also includes the brainstorm created and knowledge shared in the niche of CultureUp, where different experts idealize the implementation of the app (Türkeli, 2020). Following this thought, it is an organizational innovation as the aim of CultureUp is to transform the management and exposition of cultural heritage on a global level, involving all the drivers mentioned above, as well as the public itself. Finally, despite not being the main aim of the app, there will be innovation in the social sphere: people will be exposed to new ways of communicating in the cultural sectors. The social aspect of this innovation will be inevitably linked to cultural matters, thus, bringing a socio-cultural transition to the fields.

This section shows that the socio-technical regime involved in this innovation entails both socio-technical transitions as well as socio-cultural transitions in the mix of innovations concerning CultureUp. All the effects of these types of innovations are still difficult to predict. Hopefully, if everyone collaborates and believes in the app, the future of cultural heritage will be revitalized, but for this to happen, the broader context must be considered. The next section explains what happens on a landscape level.

Landscape Developments

There might be some criticisms about an optimistic view of CultureUp. For instance, it could be argued that the youth will not adhere to the innovation only because it is digital, or that cultural institutions will not agree to collaborate. However, I believe that the app has strong probabilities to succeed thanks to the multidisciplinarity and the vast range of actors on all levels that it involves. The last step to consider for CultureUp is the landscape development; what happens on a national and international level during the idealization and creation of the app?

It is important to understand that CultureUp involves a significant number of disciplines with it, to name a few; sociology, STS (science and technology studies), history, economics, arts, culture. These can be disputed upon and more could be added, nonetheless, the aim of showing the fields which would play a role in CultureUp is to get a broader picture of what the app entails.

The cultural sectors will not just deal with technology, but with teamwork and cooperation between them as well as with higher authorities. Cultural institutions will have to cooperate and communicate with each other, both nationally and internationally, in order to deal with their exposition methods, similarly as they do now. In addition, some experts of the fields mentioned above might be required to contribute to a more successful digital app. For example, art professionals, technicians, or economists will be asked to share their opinions or offer suggestions regarding different features of the app. Moreover, the implementation of CultureUp will need support from the government(s). State support will be needed to help the drivers, to avoid as much as possible the barriers, and to provide economic funds to improve technical controls. This entails providing money for the execution of the digital shift, providing directives on how to behave, and technical help to avoid hacker or data protection problems. This also brings to a dimension of international support between governments, needed to establish the same, fair, rules for everyone.

Concluding Remarks

This paper is a call for change. It argued that one of the problems of our societies is that people undervalue the lack of attention younger generations have towards cultural heritage. The relevance of this concern is that cultural sectors are fundamental parts of a society's identity and history. The solution and contribution to the field that I propose is related to a change in the exposition of cultural heritage, following the global digitalization trend. The purpose of my innovation, CultureUp, is to revitalize the interest in cultural heritage, especially among the youth, by shifting tradition into a digital version, thus, more dynamic and connected. The digital economy which will result from it

might actually be the less radical change, as people already buy tickets online for expositions, concerts, performances and more.

The main takeaway of this essay is that cultural heritage will not only be a technological change but will also tackle other types of transitions and economies, such as the creative and the youth economies. In my argumentation I tried to emphasize the importance of creativity, sharing, and participating, features which are proving to be very successful on social media. Moreover, addressing CultureUp to younger people in particular is fundamental, as they will be the future generations taking care of cultural heritage. Therefore, the connection between the two must be strengthened as much as possible. CultureUp represents all these ideals, as I believe it connects a bottom-up approach, which highlights the people instead of the institutions, with new and easy sets of methods for the youth to be more involved.

A limitation of this essay is that it assumes CultureUp is the only solution to the identified problem, but I believe that other methods could be implemented, and as shown in the text, already some changes are happening in the field. Future research will be needed once the app is implemented, in order to monitor the impact it will have in society. I believe it will be crucial to evaluate the power of people within the app: assess whether they will feel more part of culture, and on some level producers of it, or if more participatory measures will have to be included.

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Teaching the Knowledge and Skills of Sustainable Development through Interdisciplinary Study Opportunities: An Innovative Approach to Sustainability Education at the University of Maastricht

Quaid Cey

Abstract

In prescribing actions to be taken with regards to the climate crisis, many scholars have identified the need for cooperation amongst actors along horizontal and vertical scales of expertise and influence toward sustainable transitions in consumption and production patterns (Breznitz, 2009; Dryzek, 2013; Geels, 2004; Geels & Schot, 2007; Markard, Raven & Truffer, 2012; Soete, Verspagen & Ter Weel, 2010). Departing from the conclusion that greater knowledge-sharing and cross-sectorial mediation are fundamental to cooperative, informed action within a thriving democracy (Borrás, 2012; Hoppe, 1999; Li, 2015), I recommend innovations in the formalized instruction of "knowledge and skills needed to promote sustainable development" (United Nations). In order to provide concrete suggestions regarding the implementation of an educational model attune to the demands of sustainable development (SD), I draw on the example of Maastricht University (Netherlands). In an attempt to assist the university to achieve its ambitious goal of becoming a "sustainable university," I identify the needs for improved "ecological literacy" (Coletta & Bradley, 1981) and greater interdisciplinarity in undergraduate learning as part of a nested approach to pedagogical innovation. These needs are concretely addressed in terms of implementing core studies of SD and inter-faculty (as well as inter-*university*) academic projects aimed at teaching problem-solving and communication skills relevant to life in the 21st century "risk society" (Beck, 1992 as in Dryzek, 2013). Successful implementation of an improved undergraduate sustainability education program at Maastricht University is acknowledged here as a small, but influential example of a scalable "sustainability transition" (Markard, Raven & Truffer, 2012) that combines shifts in social paradigms with technical revisions of existing educational models.

Key words: Climate crisis; sustainable development; sustainability education; interdisciplinarity; environmental sciences

Jack of all trades

At a tea party during my freshman year at the University College of Maastricht (UCM), I happened across a poster hung in the bathroom of my friend's apartment, which read "Jack of all trades, master of none, but surely better than the master of one." As is my reaction to most things I see in bathrooms, I regarded the message with an upturned nose. Yet time and time again it has resurfaced, taking renewed form in conversations and coursework alike. Ruminating on this message, I have found it has a certain resonance in the decisions I have made as a student of the liberal arts and sciences. If not a personal maxim, this re-imagination of an all-too ubiquitous catchphrase has at least been a justification for my enrollment in courses as different as public policy and microbiology. It is perhaps not difficult to imagine what significance this message has for someone of my interests and career aspirations, but I have pondered what practical relevance it might have for the lives of young people everywhere. Is it the kind of message that is destined to stay on the door of a too-small, first-floor bathroom, or does it offer something more?

To answer this simple question, I will present a rather complex issue with which many are quite painfully familiar: the global "climate breakdown," as The Guardian columnist George Monbiot suggests we call the massive set of present and future anthropogenic changes to life in Earth's biosphere (2017). By illustrating the issues posed by both the environmental crisis and the minds that conceptualize its resolution, I arrive at the conclusion that the so-called "eclectics" and polymaths of the world, while in many ways under-appreciated and misunderstood (Austin et al., 1996), may possess knowledge and skills fundamental to living in an increasingly complex world of interrelated crises. As such, redesigning education models to integrate the knowledge and skills of multiple disciplines -- especially the environmental sciences -- may provide the basis for a broader change in social consciousness and collective capacity to manage the environmental crisis.

Crisis management: Environmental concerns and solutions

As has been communicated by voices spanning the academic fields of innovation, policy, and sustainability systems and transitions, any solution to the climate crisis requires representation of voices across sectors and along the vertical scale from local to global spheres of public, private, and civil influence (Breznitz, 2009; Geels, 2004; Geels &

Schot, 2007; Markard, Raven & Truffer, 2012). Scholars of "sustainability solutions" highlight the need to integrate technological innovations and social and administrative reorientations in order to solve problems of ecologically and socially irresponsible production and consumption (Markard, Raven & Truffer, 2012; Soete, Verspagen & Ter Weel, 2010). Synthesizing these arguments, the multi-level perspective (MLP) on sustainability transitions assumes an interdependency amongst what are referred to as regimes, niches and landscapes, in which changes in long-term conditions (landscape factors) create opportunities for successful, independent, innovative projects (niches) to be implemented and to deliver changes in the strategies, opinions, and technicalities of social and administrative functioning (regime) (Geels & Schot, 2007).

The inherent logic that underlies a number of verbose and conceptually abstract articles on the topic of sustainable transitions is less challenging to identify than the nature of language used by their authors would indicate. Here, at the cost of being exceedingly reductionist, I would like to compound and contextualize the arguments of minds more brilliant than mine to say: human society cannot and will not find an innovative solution to the environmental crisis (or any other crisis with similar social, political, economic dimensions) if it does not enable cooperation amongst and between autonomous and dedicated citizens, industries and governments to re-orient the social and technological systems that have awarded humans destroyer status. Moreover, no technological fix alone will sustain the global human transition to new and improved systems of production and consumption in the absence of transformative social action (Dryzek, 2013).

What previous authors of sustainable innovations and transitions (Breznitz, 2009; Geels, 2004; Geels & Schot, 2007; Markard, Raven & Truffer, 2012; Soete, Verspagen & Ter Weel, 2010) tend to ignore is the necessity for knowledge diffusion as the foundation for social and technical change in a democratic society. The triumph of an informed society over technocratic order is conceptualized in Borrás' (2012) discussion of the scientific citizenry, a utopian community in which citizens are empowered to participate in public decision-making thanks to expanded access to knowledge and thus progress is driven increasingly by collective action and deliberation rather than technocratic unilateralism. Any such reality would necessitate a transition from an "information society" to a "knowledge society," whereby information undergoes the transformation from an input for economic growth, production, consumption and innovation utilized by the productive few to a social capital resource for the improvement of quality of life available to the masses (Thornton & Leahy, 2011; Wessels et al., 2017).

Consequently, overcoming present obstacles to expanded knowledge-sharing can be seen as a precondition for cooperative human responses to present and future socio-ecological crises. Given limitations in the feasibility of implementing participatory democratic practice at the global scale, one is obliged to envision new forms of scalable public representation that do not require the dissolution of cooperative international and national government -- the recommendation of so-called "green radicals" (Dryzek, 2013). A potential solution synthesizing the needs for greater knowledge-sharing and improved responsiveness of public officials to the change-making desires of the populace has been proposed by advocates of deliberative policy analysis, who focus on the fundamental role of the "applied political scientist" as a mediator between scientific disciplines, between science and society, and between policy-makers and citizens (Li, 2015; Hoppe, 1999). If the role of the applied social or political scientist were seen as valuable to the facilitation of cross-sectoral and multi-level negotiation, a middle-ground could perhaps be found between the alienating technocracy of today's democracies and the pluralist, participatory governance of a pipe dream. More imperatively, if citizens could be more regularly involved in socio-environmental problem-solving thanks to expanded access to and familiarity with scientific knowledge, the need for socially -- and not just *technologically* -- innovative action in the face of the metastasizing climate crisis could more likely be satisfied.

Thus, it appears that there are two potential methods for improving participatory capacity, neither of which calls for the complete dissolution of existing institutional structures. The first involves a global campaign for greater diffusion of knowledge regarding the climate crisis and its social implications. The second entails empowerment of mediators everywhere as an essential component of a functioning administrative system (Li, 2015; Hoppe, 1999). Employed as part of the same nested approach, these innovations constitute a fundamental transformation of technical and social realities. On the one hand, they prescribe adoption of new methods for knowledge sharing, knowledge acquisition and problem resolution, while on the other they necessitate and stimulate a shift in social consciousness. Specifically, this shift entails a greater valuation of responsive governance, an engaged citizenry, and scientific knowledge-sharing as the basis for quality living in a "risk society" where human life is understood to be constrained by the identifiable limits of the natural environment (Beck, 1992 as in Dryzek, 2013). As such, this

nested theoretical approach to crisis resolution constitutes the basis of a "sustainability transition" as well as a potential precursor for a string of similar, future systems transitions toward more sustainable -- alternatively, socially and ecologically conscious -- means of production and consumption (Markard, Raven & Truffer, 2012). Such a policy proposition mirrors the imaginative and reformist political discourse of SD (Dryzek, 2013) and represents part of an adaptive, solution-oriented paradigm that calls for game-changing actions without sacrificing acceptability to a global public differentiated in capacities, priorities, and perspectives (Borowy, 2013).

From problem to practice: Implementing and improving sustainability education

Sustainability education, or the instruction of "knowledge and skills essential to the promotion of sustainable development" ("Sustainable development goals: Goal 4.7") presents an avenue for innovations in knowledge-sharing. By means of reference to sustainability education, one may discuss practical manners for addressing desire for the diffusion of knowledge regarding the environmental crisis and its social implications as well as the future facilitation of multi-scalar cooperation.

Given the capacity of ecology studies to inform young people of human responsibility regarding the climate crisis and incentivize support for effective environmental policy (Coletta & Bradley, 1981), its place in education seems almost unnegotiable. Improvements to modern educational systems that incorporate ecological knowledge as a fundamental component of science education (Blackley & Sheffield, 2016) may be a direct means not just for approximating the utopic scientific citizenry (Borrás, 2012), but more imperatively of creating the *right* scientific citizenry: the one best equipped to discuss and provide solutions to the multifaceted crises related to anthropogenic climate change.

On the other hand, interdisciplinarity in education may allow for communication and cooperation amongst diverse actors in a pluralist, democratic society. While in its modern application to educational contexts interdisciplinarity remains ripe with inadequacy and diversity of interpretation and use (Austin et al., 1996), the underlying principles upon which interdisciplinary programs are built remain useful in teaching skills necessary to life in the 21st century. Though previous authors have discussed the need to distinguish between inter-, trans-, cross- and multidisciplinarity, here interdisciplinarity serves as an umbrella term referring to education that encompasses knowledge and skill acquisition from a variety of fields by means of "interaction across disciplines" (Paradis & Ayelet, 2017). Specifically, it entails formal instruction in various fields of study as a means of teaching synthesis of the methods, models, and understandings of varied disciplines for the purpose of application and analysis (Austin et al., 1996; De Greef, Post, Vink, & Wenting, 2017).

In addition to providing students with knowledge of the specifics of diverse fields of study, interdisciplinary education may potentially train students in higher-order soft skills in communication, situational control, and inter-epistemological reasoning[5] unavailable in the standard specialized curriculum. Despite growing appreciation for these skills in some sectors as indications of "collegiality, flexibility, collaboration, and scholarly breadth," modern standards for higher education largely fail to realize the benefits of breaking from academic specialization (Austin et al., 1996, p. 272). In many cases, interdisciplinary education is reduced in meaning and application to "cultural veneer" for students of the natural sciences (Ibid, p. 273). In short, many largely fail to understand what exactly interdisciplinary education means and as such, even the best-intentioned fail to capitalize on its true value, which lies in the expansion of students' capacities for multifaceted reasoning and problem resolution by integrating multiple perspectives in their analyses rather than limiting students to the rigidity of a monodisciplinary system (De Greef et al., 2017).

In light of the needs for greater diffusion of scientific knowledge in society and improved capacity of mediators to negotiate interests along horizontal and vertical scales of interests, innovations to education that promise "ecological literacy" (Coletta & Bradley, 1981) within the framework of a more interdisciplinarity model are a window of opportunity. By appealing to the widely resonant goals of SD, moreover, so-called "sustainability education" constitutes a publicly palatable improvement to contemporary educational models, or perhaps even their

[5] I would like to extend my thanks to Odile Joblin, candidate for a Master of Science in Public Policy and Human Development at the University of Maastricht (UM), for her collaboration and insights regarding the benefits of interdisciplinary learning. Joblin's current research into student-driven interdisciplinary program creation involving students of the biomedical sciences should serve as inspiration for future innovation in education at UM.

replacement. The following portion of this paper presents an attempt to illustrate how exactly the outlined practice of SD might take concrete form in the case of the University of Maastricht (Netherlands).

Teaching sustainability at the University of Maastricht

Geographic, political, and cultural contexts are essential when discussing the formulation, implementation, and success of SD policy (Pustovrh & Jaklic, 2014). While it is valuable to speak of vague but scalable solutions such as those discussed in abstract earlier in this paper, academics from the field of sustainability studies call for the localization of efforts as the precursor for whole-scale change. Geels and Schot (2007) speak of "reconfiguration pathways" for sustainability transitions, whereby niche innovators continue to develop at the local scale to solve local problems until their influence is strong enough to alter the "basic architecture" of larger, conventional paradigms (Geels & Schot, 2007, p. 411).

I take the University of Maastricht (UM) as case-in-point when discussing niche innovations in sustainability education. At present, UM's goal of becoming a "sustainable university" by the year 2030 (Maastricht University, "Sustainability education") represents a commitment to the localization of the goals of SD. UM's preparedness for the demands of the future is further evidenced in its integration of the problem-based learning (PBL) method (UM, "Problem-based learning"), a variation of innovative "constructivist" pedagogies which together yield improvements in student and teacher engagement by personalizing academic material and interrupting passive learning (Vance et al., 1995). The university's pedagogical orientation advantages the introduction of mandatory studies of the environmental sciences in a 'student-friendly' way that stresses social interpretation and applicability of scientific knowledge in all areas of human life (Ibid).

Departing from the theory of "open innovation" outlined by Pustovrh and Jaklič (2014), my proposal builds upon the inputs of previous pedagogical innovators in order to produce new value for a university and society both in need of systematic changes to survive the disruption of the environmental crisis. By synthesizing a student-oriented pedagogy for instruction in the environmental sciences (Coletta & Bradley, 1981; Vance, Miller & Hand, 1995) and interdisciplinary knowledge and skill creation (Greef, Post, Vink, & Wenting, 2017), I conceive of an education model that contributes to broader and deeper vital knowledge-sharing (Borrás, 2012; Wessels et al., 2017). Perhaps most importantly, my proposal to the University of Maastricht assumes a basic need for preserving the qualities of autonomy, social ties, and power-sharing that lay the foundations of a future "knowledge society" where citizens derive intrinsic value from environmental and socially responsible action (Haxeltine et al., 2017; Wessels et al., 2017).

Introducing core studies of sustainable development

Before one can speak of "teaching sustainable development," one must of course have an idea of what sustainable development means -- or better, to *which* definition of SD they are referring. Any definition more specific than 'development that equitably and globally meets the needs of present generations without compromising the capacity of future generations to meet their own needs' (World Commission on Environment and Development, 1987) remains elusive given differences in the interests and capacities of stakeholders (Borowy, 2013; Dryzek, 2013). At the same time, this very lack of precision represents a point of strength, for it is in the space for interpretation which such a lenient definition allows that individual nations, regions, and communities may find common grounds for commitment to the underlying premise of environmental and social stewardship as well as confidence in their own individual capacities to achieve more sustainable development.

As such, it makes little sense to speak of any proper form of sustainability education at the University of Maastricht other than one that provides students with knowledge essential to an understanding of living in an environmentally constrained world, but which also remains relevant to the focus of their selected study. At the same time, commonalities amongst approaches as a means for indicating progress toward collectively held goals remain imperative. Specifically, I honor the view that, given the fundamental place of the environment in any discussion of humankind's future, a university that prides itself in offering knowledge and skills relevant to the goals of SD must naturally provide also some degree of "ecological literacy" (Coletta & Bradley, 1981; Borrás, 2012). As such, the form of sustainability education that capitalizes on individual competencies of faculties and allows for autonomous integration of sustainability measures without compromising university-wide goals of diffusing environmental knowledge remains the most effective means by which to bring about effective and popularly supported change.

Achieving this ambitious goal requires that UM adopt common criteria for guiding and evaluating faculties' integration of SD into existing curricula departing from a common understanding of SD (see World Commission on Environment and Development, 1987) and the framework for achieving SD goals (UN), as well as an understanding of sustainability transitions as "long-term, multidimensional and fundamental" shifts toward more sustainable means of production and consumption (Markard, Raven & Truffer, 2012). Once the university's criteria have been established, consented to, and embedded in the existing system for curriculum oversight, faculties will be able to distinguish their own competencies, perspectives, and ambitions as they relate to the field of SD and establish operational, individual definitions of sustainability education relevant to their field of study. Such definitions constitute the basis for each faculty's unique introduction of obligatory sustainable development studies into their curriculum. Core studies of sustainability science present thus a compromise between the general and far-reaching goals of the university and specific competencies and interests of faculties, much like the negotiations that guide national implementation of international and supranational policy.

Improving interdisciplinarity by means of project-based learning

At present, interdisciplinarity within UM is best exemplified in the creation of the liberal arts and sciences programs within the Faculty of Science and Engineering (FSE) (UM, "Faculty of science and engineering"), which aim to offer students flexibility in their selection of courses from a range of disciplines. While programs in the liberal arts and sciences no doubt offer inspiration in the implementation of interdisciplinary programs, efforts should not be made to modify the structures of other faculties to replicate those of the liberal arts and sciences. Instead, students from across the gamut of disciplines taught at the University of Maastricht would benefit from novel academic opportunities for interdisciplinary education without compromising the singularity of their selected study program, perhaps best transmitted in the form of elective academic projects. One such project, which I here refer to as the Maastricht Project for Interdisciplinary sustainability education (MPrISE), might achieve just that.

The MPrISE takes as inspiration for its structure Li's (2015) conceptualization of "think tank 2.0," a model for problem resolution that focuses on deliberation amongst group members of diverse backgrounds in a cooperative, research-oriented settings, with the inclusion of public input as a means for deriving relevant solutions to issues of social relevance and presenting these solutions to the public and/or relevant interest groups. In honor of the goals of sustainable education, MPrISE would orient the efforts of participating student groups around specific issues and polemics within the larger subject of SD. As such, the cases posed to project participants -- who would be organized in terms of both number and relevant pairings amongst complementary disciplines -- would thus be intended to evoke innovative solutions to conflicts related to human-environment relationships. The questions employed in this and any similar project should necessarily reflect the complexity and need for inclusivity that persists in real-life problems of sustainable human development. Anything less could give space to the exclusivity and hierarchization of epistemologies and disciplines that currently limit the impact of interdisciplinary education (Paradis & Ayelet, 2017). As a potential complement to the MPrISE, one might consider adding an accredited academic project that assembles one or more councils of undergraduate students from divergent disciplines to discuss, formulate, and propose an array of problem statements or cases for use in the MPrISE and to organize an academic conference for the presentation of proposed solutions at the end of the MPrISE's duration.

What sets MPrISE apart from any other interdisciplinary program that could be implemented at the level of Maastricht University is its proposed cooperation with Zuyd University of Applied Sciences, UM's neighbor in the city of Maastricht. The fusion of technical and artistic disciplines such as hotel management and music provided at Zuyd (https://www.zuyd.nl/en) with those of the scientific disciplines taught at UM represents a novel window of opportunity for cross-disciplinary information exchange, whereby interested students from any undergraduate faculty at either university may participate (on a competitive basis) to gain vital insights into diverse and complementary perspectives on the subject of social and ecological stewardship as well as application of their own knowledge and skill sets. Inclusion particularly of students of the arts offers an under-discussed dimension to the presentation and communication of innovative solutions to issues of relevance to the environment and human society. It should be noted, however, that the primary impediment to Zuyd University's inclusion in a partnership with UM for the MPrISE -- other than differences in academic scheduling and pedagogical approaches – would be a potential discrepancy in project participants' knowledge regarding the environmental and social conflicts central to conceptions of SD. Successful alleviation of this conflict pivots on Zuyd's adoption of core studies of sustainability to mirror those adopted by UM.

In order to gauge the individual and collective benefits of the MPrISE for a more interdisciplinary and sustainability education, academic examiners from various faculties should implement a rubric for the assessment of each student's contributions within the project as well as for the academic relevance of their proposal as a whole. One such rubric may take inspiration from the model for evaluation of interdisciplinary learning outcomes developed by Spelt, Puning, van Boekel and Mulder (2015), which addresses: knowledge of the involved disciplines; knowledge of "interdisciplinary paradigms"; general knowledge of interdisciplinarity; attainment and presentation of "higher-order cognitive skills"; and communication skills (both *amongst members* during preparation and *by* members during presentation) (as cited in De Greef, Post, Vink, & Wenting, 2017).

Discussion of sustainability education

The problems that exist in formulating and implementing the sustainability education agenda mirror those faced in the formulation and implementation of any program for SD. Primarily, any intended socio-technical transition from more to less ecologically and socially responsible systems of production and consumption (Markard, Raven & Truffer, 2012; Soete, Verspagen & Ter Weel, 2010) is likely to confront the same series of dilemmas faced by the Commissioners of the 1987 Brundtland Report, namely those between the economy and the environment, more and less developed nations or regions, and scientific accuracy and political acceptability (Borowy, 2013). These tradeoffs present a barrier to the large-scale implementation of many ambitious solutions to the environmental crisis and its accompanying social, economic, and political troubles. In application to the proposed innovations in sustainability education at the scale of Maastricht University, the most obvious of limitations is the scalability of policy implementation. Given the financial, social, intellectual and cultural resources at UM's disposal and other advantages it has from the standpoint of openness for innovative pedagogy, the university remains a unique entity in higher learning whose transition to a system of active instruction of the knowledge and skills necessary for future SD would be likely much easier than that of other universities both in and out of Europe. However, the prescribed innovations in sustainability education appear more directly relevant when examined as part of a network of similar transitions in the minds and methods of university administrators across Europe and beyond.

While higher education cannot alone achieve the goals of complete diffusion of scientific knowledge in society due to its selectivity and accessibility to only a portion of the human population (Borrás, 2012), it remains a valuable tool for knowledge dissemination thanks to the place that universities and other centers of higher education have within a network of information sharers. Moreover, the basic premise of ecological learning within a frame of interdisciplinary knowledge-sharing remains a model that can inspire a range of efforts outside the realm of higher education, including in early learning[6] and private business.

Conclusion

While local examples of innovation in higher education like those prescribed may be varied in both methods and outcomes, what remains most relevant in discussing is their contribution to whole-scale sustainability transitions through revisions to the methods and paradigms that currently guide pedagogy. Specifically, any attempt to prepare younger generations for future cooperative action in a "risk society" (Beck, 1992 as in Dryzek, 2013) should prioritize interdisciplinary study as a means for disseminating relevant scientific knowledge regarding the environmental crisis and fostering skills in inter-epistemological reasoning and communication needed for the communication of interests in the democratic setting. The steady accumulation of 'niche' innovations in education like the proposed changes at UM are indeed essential to the creation of a viable, whole-scale alternative to present educational models. Moreover, the changes in social awareness of the needs for multifaceted solutions to the environmental crisis which have fostered a desire for more sustainability education (Foran, Gray, Gosse & LeQuesne, 2018) are both cause and indication of a general trend toward greater social consciousness regarding the relationship between humans and their environments.

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[6] See the work of my peer, Layla van Der Donk for a model of ecological learning in early education.

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How can Ecuadorean Society transition from Fossil Fuel-based Energy to Hydroelectric Dams?

Rafaela Vergara

Introduction

It is undeniable that fossil fuel exploitation has damaging effects to the environment and surrounding communities. Some of its consequences include the release of greenhouse gases into the atmosphere, mainly Carbon Dioxide, deforestation and destruction of natural resources. These come with a number of environmental and human rights violations (Rodriguez, 1998). In Ecuador specifically, there is a strong reliance on petroleum for energy and the economy. Unfortunately, its reserves are located on top of the most biodiverse areas on Earth, the Amazon rainforest. The rainforest also holds major socio-cultural significance as there are more than a dozen indigenous communities with their own unique language and culture. These populations hold legal rights under the "Communes Law" where they are entitled to the land they live in, resources on that land and political representation. Nevertheless, after the first discoveries of petroleum in these lands, companies such as Texaco and Gulf begun to exploit it ever since 1969 where Ecuador begun participating the global market and gained geopolitical importance (Rodriguez, 1998). This, of course, leads to environmental degradation and violation of rights of the indigenous people granted to them by the government under the Communes Law. Nowadays, 82% of energy is ran by fossil fuels and "Ecuador is internationally listed as one of the countries with the highest fuel subsidies. The fuel subsidy demands more than 3 billion dollars a year, equivalent to 17% of the state's general budget, more than the budget allocated to health and education" (Martinez Sojos, p. 1, 2018). Therefore, a transition needs to be made to a more sustainable way of energy that accounts for less environmental degradation and human rights violations. That transition can be towards hydroelectric power sources.

Hydroelectric power sources generate electricity by using bodies of water. Water flow generates kinetic energy that is later converted to electricity through the use of turbines. It is considered a renewable source of energy as it runs on water flow and it doesn't use up resources (Santiago, 2017). Nevertheless, there are major drawbacks when it comes to environmental degradation such as disturbance of ecosystems, CO2 emissions, and land use. In the Ecuadorean context, hydroelectric dams are largely effective due to the water that comes from the highlands of the Andes mountain that makes water flow rapid and constant (Santiago, 2017). The following paper will discuss how a technological transition towards hydroelectric dams would be beneficial to Ecuadorean society.

Theoretical framework

Fossil fuel energy is a sociotechnical or sociotechnological system that encompasses a wide array of actors and social groups. It is also deeply embedded in social and economic life, as mentioned before, it is the most important aspect of Ecuadorean economy. Therefore, it is interconnected and interdependent of many other systems such as the transportation system (Vogliano, 2009). This means that sustainably transitioning from this energy source is extremely difficult due to its normalization and dependence with other aspects of the economy and day-to-day life. Actors such as oil companies like Texaco and Gulf, the government, gas and diesel companies, indigenous groups, activist organizations are all groups that affect or are affected by this technological regime (Rodriguez, 1998). To analyze how a transition can be made towards hydroelectric dams a Multi-Level-Perspective (MLP) must be used in order to see if this socio-technical system can sustainably transition to another technology that can fulfill technological needs (Geels, 006). To do this, I will analyze if there is a 'window of opportunity' for this to occur. A window of opportunity is a term emphasized by MLP that address "conditions in relating regimes and landscapes are simultaneously favorable will wide diffusion of the novelty occur". In other words, in order to achieve a sustainable transition from one technological regime to another, a window of opportunity has to open. So, as Geels (2006) describes, there are three conditions that determine if this is the case: "(i) internal technical problems in the regime, which cannot be met with the available technology; (ii) problems external to the system, negative externalities; (iii) stricter regulations, often in reaction to negative externalities; (iv) changing user preferences, which

may lead to new markets with which new technologies may link" (pg. 174). In the following paper, I will describe how these conditions are in fact present in the Ecuadorean fossil fuel industry today and thus, a change towards hydroelectric dams are feasible and necessary. Further on, I will formulate a policy recommendation that will demonstrate how the government as an actor can demand this change by using the MLP framework of transition policy strategy and suggest how the government can guide and encourage the transition through specific policies (Geels, 2006).

Conditions for a 'window of oportunity'

Firstly, I'm going to talk about the technical problems in the regime, which cannot be met with available technology. The first and most important internal problem with the fossil fuel industry is the fact that fossil fuel is a non-renewable resource. According to Shafiee and Topal's research on "When will fossil fuels reserves be diminished?" it is expected that the World will continue to depend on oils for fuel until 2030. With energy consumption increasing 1.1%, there is still no sign of it slowing down. The market for oil is wort around 1.5 trillion dollars and it remains one of the primary concerns for a country's economic stability. This is a major internal problem with this technological regime as it is clearly unsustainable and in need of a transition. Even though it is impossible to determine when fossil fuel reserves will be completely gone, research does suggest that it will happen sooner than later some suggesting as early as 2030 (Shafiee & Topal, 2009) Furthermore, research for alternative sources of energy is limited and not promising. Nuclear power, for example, still needs extensive developments in terms of sustainability and security. Immense problems arise with radioactive waste and carbon emissions as well when it comes to nuclear power although it shows to be an efficient alternative. With all alternative sources of energy there are many challenges that have yet to be tackled such as geographic challenges. With hydroelectric power for instance, strong and constant water flow is needed which not all countries have (Pearce, 2012). They are also very costly, and technology has yet to figure out how to store the energy produced without being so costly. In conclusion, the fossil fuel industry is expected to fall dramatically as oil reserves decrease and so far, an alternative that can meet its efficiency safely has not been found (Thoubboron, 2018). Therefore, it is important to move towards these alternatives when feasible. In Ecuador, the geography allows for effective hydroelectric dams, enough to power the energy of most big cities. Furthermore, there is already budget allocated to these dams which needs to be adjusted and allocated properly to the effective functioning of these.

Secondly there are many external problems to the system both environmental and socio-cultural. When discussing the technological regime solely in Ecuadorean society, the environmental impact greater than average oil reserves in the Middle East for example. One of the biggest plants is located in the province of Pastaza, named on the of the most biodiverse areas (Rodriguez, 2998). The main problems with this plant are that it occupies around 200 thousand hectares without taking into account highways and roads built as a result of the project. An extensive research on the exact environmental impact has not yet been determined, it is clear that a large part of the forest was destroyed, threatening many already endangered species. Furthermore, bodies of water surrounding the area became greatly affected with indigenous communities in the area becoming greatly affected (Rodriguez, 2998). More up South in the province of Sucumbíos, other oil reserves are located. Indigenous people in the surrounding areas report that one of their major concerns is the pungent smell that is constantly in the air. The American company Chevron occupies that area and mobilized three communities in order to start excavations. (Collyns, 2019). This had led to many legal problems as well in 2001. About 30,000 people sued the company for damages. They were required to pay up to 18 million dollars for reparations, nevertheless the government lowered this number to 9 million and later on the Permanent Court of Arbitration declared that no charges against the company were to me made. Other lawsuits similar to this one occurred in the 1990s with American company Texaco. The river has become so contaminated by these companies that communities are forced to collect rain water and filter it. Furthermore, disease among children is also prominent due to water and soil pollution with high rates of stomach diseases (Collyns, 2019). It is clear that the industry is presenting a lot of socio-environmental external challenges. This again demonstrates how there is a window of opportunity for change to occur. These issues put a lot of pressure on the market especially in today's political climate were people are interested in "green" policies. This leads to point number three "changing user preferences, which may lead to new markets with which new

technologies may link". This point is very tricky since user preference lies in what is cheap and accessible. Furthermore, fossil fuel energy is deeply embedded in day-to-day life with electricity, light, gas and diesel being mainly driven by it. The oil industry is still heavily subsidized more so than any other area such as health and education. Furthermore, this makes the transportation system very cheap and accessible since gas prices are so low, in fact, the lowest in South America. As seen in the 2019 protests, any attempt to change these subsidies is met with great resistance. The protests sparked once the government decided to cut the subsidies on gas prices, increasing the price of public transport as a result of that. The public was extremely resistant, especially indigenous populations in the Andes that rely on public transport to mobilize (Ecuador's Moreno, indigenous groups reach deal to end protests, 2019). It is then easy to conclude that user preference when it comes to this technological regime is nearly impossible to change since the energy source is necessary for day-to-day life. However, it is clear that internal and external consequences of the industry outweigh this specific point as it is clearly unsustainable. A change is needed to not only preserve the environment but to find an alternative now that oil reserves are scarce.

Another point in the Multi-Level-Perspective approach that suggests a window of opportunity are "stricter regulations, often in reaction to negative externalities". This is becoming the case now that the government is hinting towards a subsidy cut. Additionally, environmental regulations are putting pressures and difficulties on oil companies. One of the most important pressures on the industry is the Declaration on the Rights of Indigenous Peoples signed in 2007 which Ecuador takes part in (Republica del Ecuador. Const.). This document was signed by a number of countries in order to ensure environmental protections for indigenous people. This document has put pressure on the protection of indigenous peoples' rights since it has been translated into constitutional law in the 2008 constitution. Article 60 of the Ecuadorean Republic constitution, for example, states that indigenous peoples have rights to preserve the ancestral territories through the establishment of communes and protected territories with political representation as also stated in the "Law of the Communes" document. Furthermore, after the presidency of Rafael Correa, the principle of Sumak Kawsay, quechuan for "well-being" became a concept to ensure welfare rights among indigenous peoples. Some of these rights included the right to live in a healthy environment free of pollution, ecologically balanced and in harmony with nature (Republica del Ecuador, Const.)

By following this framework set in place by the Multi-Level-Marketing approach, it can be concluded that, on the majority of aspects, there exists a window of opportunity for a transition. I suggest a technological transition towards hydroelectric dam power. First and foremost, it is important to highlight the negative consequences that hydroelectric power has on the environment as well. The Union of Concerned Scientists (2013) in the USA list three major problems with hydroelectric power. First there is the issue of land use. Some hydroelectric dams, mainly those that are located in flat areas require extensive amounts of land. This of course, comes with obvious problems such as deforestation and the destruction of agricultural land. One of the concerns with this is that the amount of land being used is not producing large amounts of energy to the point where it would be cost-beneficial. One example is the dam located in Brazil which takes up a lot of space, 2,360 square kilometers to be exact. This is not economical as it only produces 250 mmv power generating capacity. Secondly, there are wildlife impacts since aquatic ecosystems in rivers become affected by sound pollution and water pollution. Water in rivers where these types of dams are located are typically high in sediments due to the increase in water flow which disturbs the ecosystems resulting in damaging effects for wildlife. Specifically, the increase in nutrients in the water may result in an overpopulation of algae which heavily disturbs an ecosystem by altering oxygen levels in the water and creating dead zones, which refer to areas where wildlife has ceased to exist due to water pollution. Lastly: hydroelectric dams to release carbon dioxide and some methane into the atmosphere. This is without taking into account the process of building the dams which also releases high amounts of Co2. Nevertheless, it is only an average of 0.6 pounds per kilowatt hour which in comparison to fossil-fuel based energy (3.6 pounds of carbon dioxide equivalent per kilowatt-hour) is very low (UCSUSA, 2013).

In the Ecuadorean context, these negative impacts are different. Firstly, most rivers, especially in the Andes do not have a high population of wildlife. Furthermore, it is necessary to outweigh these consequences to the fossil fuel industry that destroys extremely biodiverse areas in the Amazon. Also, the dams do not significantly harm human

populations since hydroelectric dams do not affect the drinkability of water. When it comes to land-use, this industry takes up 123.243 km2 in space which is half as much as the fossil fuel industry utilizes (Chiriboga, 2020). And lastly, carbon emissions are much lower as mentioned before and it is also worth noting that overall air pollution is much lower as well. When it comes to internal limitations, hydroelectric power is not as efficient since it produces less energy per square meter it takes up in comparison to fossil fuels and, there is limited to no advances on how to store that energy which is a challenge faced by many alternative sources of energy.

Having stated the damaging effects of the fossil fuel industry plus reinstating the benefits and drawbacks of hydroelectric dams, it is important to formulate a way in which the government can influence the technological transition. Firstly, it is important to increase regulation of oil exploitation, starting with reparations to already affected communities. It is imperative that companies such as Chevron and Texaco are required to pay for the clean-up of the rivers and provide financial benefits to affected communities. Secondly, the subsidies allocated to the fossil fuel industry must change as well in spite of challenges faced by the government in doing so. This has to be done by allocating budget towards bettering public transport while maintaining prices which is feasible considering how much of the national budget is spent in the industry. Furthermore, a large part of that budget should be spent on improving the production of already existing hydroelectric power plants. This entails finishing projects such as "Proyecto Rio Chico", "Proyecto Hydroelectrico 'San José del Tambo'", as well as modernizing projects such as "Hydroelectrica La Playa" which means increasing efficiency by investing in new turbines and generators (Chiriboga, n. d.). These projects are examples of hydroelectric dams that either remain under construction or require changes in order to increase efficiency.

In conclusion, the fossil fuel industry worldwide has had irreversible damage on the world environment by largely increasing carbon emissions. In the Ecuadorean context, it is the cause of the suffering of many species and indigenous communities that surround fossil fuel plants. When 17% of the national budget is allocated to this industry it is difficult to regulate its growth and its effects on surrounding environments. Moreover, it has been clear there are no legal consequences to fossil fuel companies which prevent proper reparations to be given to affected communities (Martinez Sojos, p. 1, 2018)This all calls for a major change in this particular technological regime. It is then necessary to analyze this issue on a Multi-Level-Perspective since the fossil fuel industry as demonstrated above is deeply embedded and interdependent with other societal issues and technological regimes. It is particularly necessary to evaluate if there is a 'window of opportunity' to evaluate the possibility of transitioning form the existing regime towards a more sustainable alternative. In this specific context, it is proper to suggest that hydroelectric power is a feasible alternative. This is due to the fact that Ecuador has plenty of rivers that originate in the Andes that can sustain hydroelectric dams with fewer consequences when it comes to environmental rights and indigenous rights. Therefore, it is recommendable for the government of Ecuador to amend the damage with the following policies. First, it is important to require reparations for affected communities as a condition to exploit lands in the Amazon. Secondly, the budget must be revised so that subsidies can go to public transport reform and the construction or modernization of hydroelectric dams. This way, a successful and efficient transition towards a more sustainable and suitable source of energy can be achieved.

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Implementing Integrated Sustainable Roof Design (ISRD) in the Netherlands

Robin Martens

Introduction

Today, we are facing climate change. Cities are a center of attention when it comes to climate change as most people live in urban environments (Tang & Lee, 2016). With rising temperatures, the built environment of cities contributes to the urban heat island effect, where the darker surfaces of built environments absorb and emit more radiation (Tang & Lee, 2016). A big part of the built environments are homes, and in the EU, 40% of energy use comes from the housing stock (Ebrahimigharehbaghi, Qian, Meijer, & Visscher, 2019). As energy and resource use are a contributor to global warming (Owusu & Asumadu-Sarkodie, 2016), the housing stock is and the people living in it are both a contributor to and experiencer of climate change. As the paper focuses on climate mitigation and adaptation, especially in cities, it is relevant according to the SDGs, linking to SDG11 regarding sustainable cities and communities and SDG13 regarding climate action (UN, 2015).

The Integrated Sustainable Roof Design (ISRD) can be part of the solution to the issues in cities. The roof design includes a combination of solar panels, a green roof, and a water harvesting system (Sheng, Mari, Ariffin, & Hussein, 2011). This system contributes to both climate mitigation and climate adaptation. Through improving energy and water efficiency of the homes (Sheng et al., 2011), there are fewer energy emissions or stresses on water resources which helps mitigate the effect of resource use on climate change (Owusu & Asumadu-Sarkodie, 2016). Regarding, climate adaptation, the green roof would help with the urban heat island effect as the green surfaces would absorb less solar energy (Herrera-Gomez, Quevedo-Nolasco, & Pérez-Urrestarazu, 2017; Kolokotsa, Santamouris, & Zerefos, 2013). See Figure 1 below for a visual of the ISRD roof system.

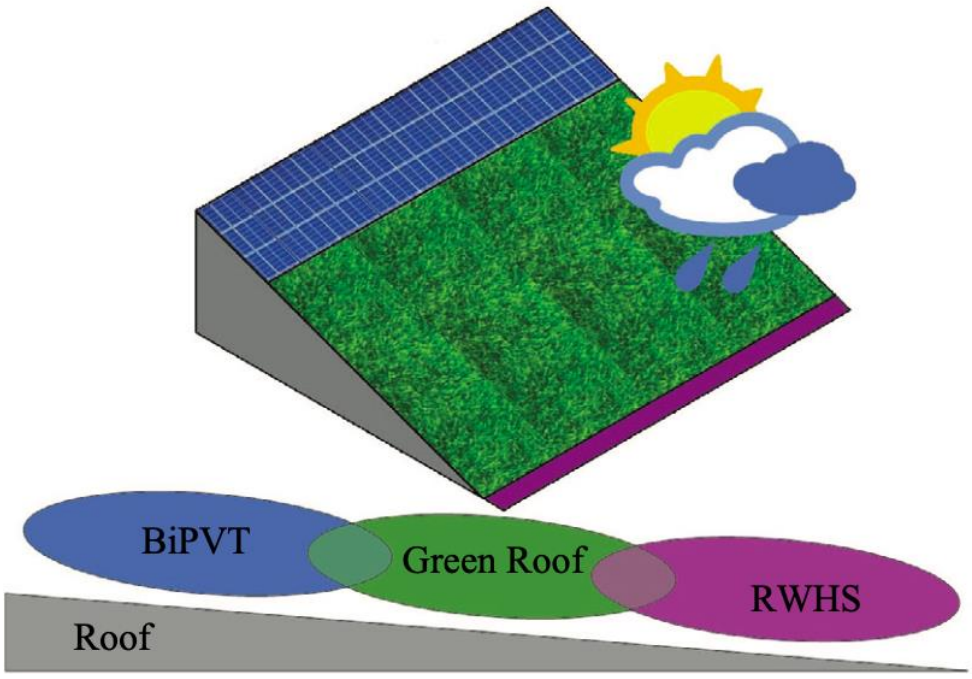

Figure 1. The ISRD, taken from Sheng et al. (2011)

This system has been applied to single homes but not in The Netherlands and not for row houses. As row houses are the biggest part of the Dutch housing stock, with 42% (Pellenbarg & Van Steen, 2005), the ISRD system would have to be adapted for row houses. For example, would you need separate water harvesting systems and energy collection systems for each home or would an entire street share an ISRD system? What would be the best option in this case? Therefore, the goal of this call for change is for the Dutch government to incentivize research into the application of this system to row houses as well as encourage implementation in the housing stock afterwards. It is thus a policy-oriented call for change.

The research question is: How can the Dutch government promote adaptation to and implementation of ISRD systems for row houses in The Netherlands? The focus is on row houses as this is the biggest part of the Dutch housing stock (Pellenbarg & Van Steen, 2005). However, the paper acknowledges that this leaves out other types of houses and non-residential dwellings. The paper first analyzes the current system in the context of The Netherlands. Then, the paper discusses different policy options, after which it argues what policy-mix would be the best. Then, it discusses anticipated changes as well as drivers and barriers. Lastly, the paper concludes and provides limitations and suggestions for further research. Of course, it is important to note that this paper does not provide a sufficient solution in itself to climate change. However, it can contribute.

Context and current system analysis

The paper is limited to the geographical scope of The Netherlands This section will discuss the relevant actors, landscape developments, regime, and different niches. Figure 2 and its explanation below provide details on this MLP analysis concerning climate-related home adaptations.

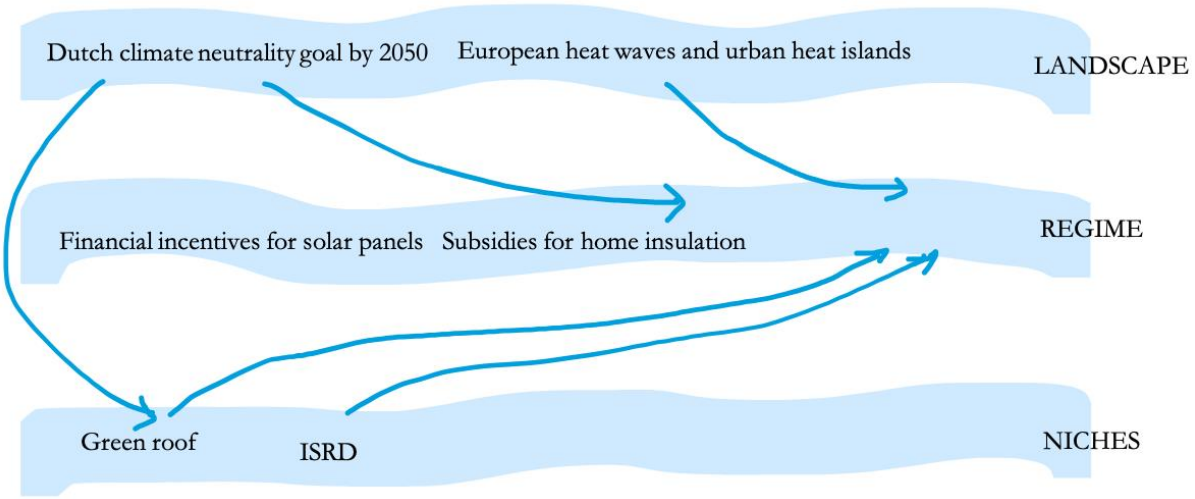

Figure 2. Multi-Level Perspective analysis (Geels, 2011) concerning climate-related home adaptations

Relevant actors in The Netherlands include, but are not limited to, the government as they make the policies, the research institutions who can research applications of this system to rowhouses, and the homeowners who would have to agree to get such a system for their homes. The current regime has systems in place for homeowners to make their homes more energy efficient. For example, home insulation subsidies (Ministerial Decision Aug 23rd, 2016) and financial incentives for solar panels (Second Chamber April 25th, 2019). The regime, however, does not

have any structures in place for homeowners to get an ISRD and individual homeowners do not have the cognitive skill to research and implement it themselves.

As for landscape developments, the Dutch government aims to become climate neutral by 2050 (Government of The Netherlands, n.d.). Additionally, the increasing frequency of heatwaves in Europe puts landscape pressure on relieving heat (Zhang, Sun, Zhu, Zhang, & Li, 2020). Given the urban heat island effect, special attention to relieving heat in cities is relevant. Thus, it seems like the landscape encourages niches that would help with relieving the heat in cities as well as decreasing resource usage of the Dutch housing stock.

Of course, the ISRD is not the only niche regarding roof designs and resource efficiency of homes. Another roof design is the regular green roof, which would contribute to relieving the urban heat island effect by absorbing and emitting less radiation (Herrera-Gomez et al., 2017; Kolokotsa et al., 2013). Even though this roof design is more common compared to the ISRD, it is not part of the current regime. Only a limited number of cities support the implementation of green roofs (Boas Berg, Adamcová, Radziemska, & Vaverková, 2018), while support for insulation and solar panels is offered and implemented everywhere in The Netherlands. However, this paper focuses on the Integrated Sustainable Roof Design as it offers more benefits than the regular green roof by also generating energy and harvesting water.

Design of solution to promote ISRD implementation

The proposed solution is a policy-mix that promotes the following two goals: 1) have research done to adapt the ISRD technology most optimally and efficiently to the Dutch row houses, and 2) implementing the new ISRD technology in the Dutch row housing stock. This section will go over different policy options for each goal, after which it will argue which policy-mix would be the best. It is important to note that not all policy options out there are discussed, as the scope of this paper does not allow for that. The policy options this paper discusses here include regulatory instruments and economic and financial instruments. Regulatory policy instruments are legal tools and include laws, rules, and directives, for example. Economic and financial instruments support certain activities by providing monetary incentives (e.g. grants, subsidies) or disincentives (e.g. taxes, fees) (Borrás & Edquist, 2013). The paper also acknowledges that a focus on row houses leaves out other types of dwellings, limiting the scale of the solution.

Goal 1 policy options

Regarding Goal 1, it is important to have research institutions look into the adaptation of the ISRD system to row houses. This is relevant because even though people might agree that environmental sustainability is important, you need people with technical skills and resource and knowledge from research institutions to acquire what you need to implement solutions. For example, would you have separate water tanks per home, or would a row of row houses share a tank? It is important to look into what would be the most efficient and/or practical. Another example would be what to do if a home in the middle of a street of row houses refuses to get the system while the rest of the street agreed. Would it be better to connect the ISRD systems around that home or create separate systems? Another aspect to look at is the division of the sections of the roof that would have solar panels, be green, or harvest water. Figure 3 gives some examples of divisions. Research can look into what the most effective division would be given the Dutch climate. These examples are only a fraction of the research that should be done to optimize the adaptation of the system to row houses.

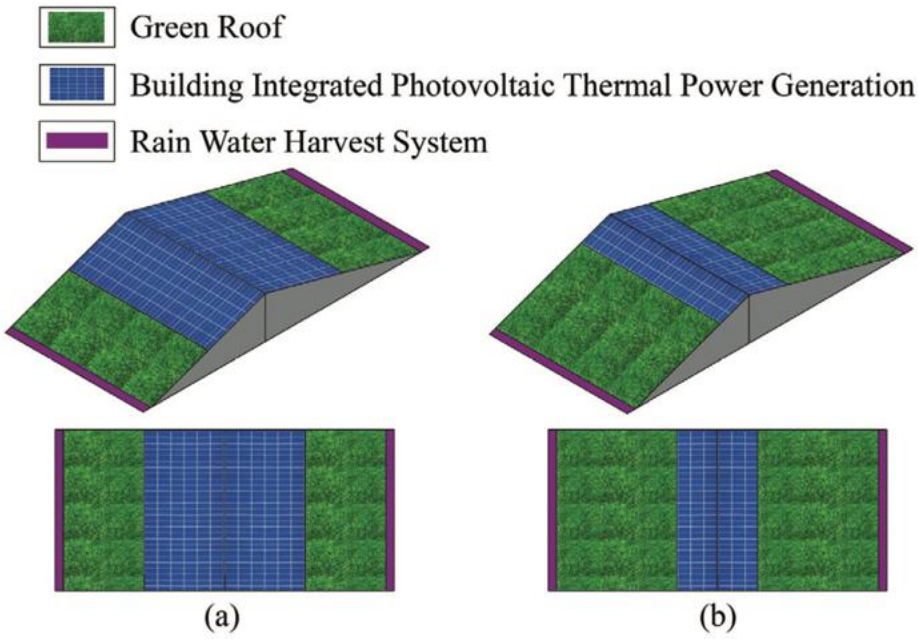

Figure 3. Examples of division within ISRD, taken from Sheng et al. (2011)

For Goal 1, this paper discusses two policy options. The first policy option is the regulatory policy instrument that would require research institutions to share their research and cooperate with other institutions. Research has shown that such an open innovation framework is important as a lack of collaboration closes the overall learning processes (Pustovrh & Jaklič, 2014). Optimal innovation systems would thus avoid this and instead encourage learning processes. Pustovrh and Jaklič (2014) give an example of such a policy in the EU, where the focus is on international collaboration between research institutions, but also companies, universities, as well as other actors. These open innovation systems are created for the development of a particular technology. A similar policy could be in place within The Netherlands to create such an open innovation framework for the ISRD. This policy would then require research institutions, universities, and companies to share their research on the ISRD system. This sharing could occur in a government-provided platform and any institution that researches the ISRD system is required to provide their results on the platform.

The second policy option is for the government to provide financial incentives in the form of R&D subsidies to incentivize research institutions to start researching the ISRD system. Such a policy assumes that if something is subsidized and becomes cheaper, more actors will have the incentive to make use of that. Commonly accepted economic theory indeed supports this assumption (Acemoglu, Laibson, & List, 2015). Moreover, research has found that subsidies do increase R&D activities (González, Jaumandreu, & Consuelo, 2005). Further research is needed to find the optimal subsidy rate.

Goal 2 policy options

After making sure the technology can be applied efficiently and optimally to the Dutch housing stock of row houses, Goal 2 is to make sure it gets implemented within this housing stock. This is relevant because most people might agree to the normative notion of environmental sustainability, but when they have to change their homes, they might not be as willing to do it. The paper discusses four policy options.

Regarding the existing housing stock, there are two options discussed here. One option is a regulatory policy which would require the homeowners to get the ISRD system. The policy would state that for each year a homeowner refuses to get the ISRD for their home, they get a fine. Even though this could be effective, it might not go over well with homeowners. For example, the mandatory flood insurance in the US has caused outrage because people cannot afford to pay the insurance fees (Anderson, 2013). Moreover, a study found that homeowners opposed energy efficiency measures because of the high cost (Zhao, Bell, Horner, Sulik, & Zang, 2012). By making the ISRD mandatory, costs are forced upon homeowners and their homes will change. Before considering such a policy, it might be important to gauge homeowners' opinions regarding such a policy to avoid public outrage.

The second policy option regarding the existing housing stock is to provide financial incentives for homeowners to choose to implement the ISRD system. This would be similar to the systems that are already in place concerning financial incentives for solar panels (Second Chamber April 25th, 2019) or the insulation subsidies (Ministerial Decision Aug 23rd, 2016). According to the Law of Demand, such financial incentives should increase the number of people demanding the product (Acemoglu et al., 2015). A study found Dutch homeowners see high costs as a barrier to the implementation of measures (Ebrahimigharehbaghi et al., 2019). Moreover, a study in Greece concerning an energy efficiency program for housing found that implementation increased with higher subsidies (Drivas, Rozakis, & Xesfingi, 2019). These studies combined would suggest that subsidies for the ISRD system would be effective to increase implementation.

The regulatory and financial incentive policy options could be similar when it comes to housing stock that has yet to be built. The first option would be to regulate the construction of new homes. The Netherlands has regulations in place already. For example, the Mijnbouwwet (2002) or Bouwbesluit 2012 (Bouwbesluit, 2011) contain construction regulations. For this policy option, the government would regulate construction by making it obligatory to implement the ISRD roofs in the homes that are built. Alternatively, the government could have a policy that provides financial incentives to construction companies to implement ISRD into the homes they built. However, in this case, the Law of Demand (Acemoglu et al., 2015) might not work. The construction companies have to sell the homes to homebuyers and if these homebuyers do not accept such roofs, the companies will not implement the system. As ISRD implementation is not obligated for this policy option, homebuyers can just choose for another home without it. Therefore, financial incentives for the construction of new homes might not be the best option if the goal is widespread implementation.

Policy-mix proposal

Given the previous discussion, the paper proposes the following policy-mix. For the goal to research adaptation of the ISRD system to row houses, a combination of both regulation for collaboration between research institutions and financial incentives for the research institutions is proposed. Evidence showed that collaboration between institutions promotes the learning process (Pustovrh & Jaklič, 2014). However, research institutions are not used to this type of relationship with other institutions and instead often compete with each other, which has been an issue (Castellacci, 2008). The combination with the subsidy policy could provide a solution. If you make the research subsidy conditional on collaboration, you can incentivize both research in general with just the subsidy, but also incentivize an open innovation framework. The paper suggests the government provides half of the subsidy at the

start of the research, and the other half only after results are provided in the government-provided flatform, to allow for the development of an open innovation framework.

For the goal to implement the technology in the Dutch housing stock, the recommendation is to have a regulatory policy for housing stock that still has to be built, while at the same having a financial incentive policy to incentivize implementation in the existing housing stock. For the existing housing stock, having financial incentives has shown to be effective with, for example, home insulation measures (Drivas et al., 2019). Moreover, if you would try to regulate the implementation of ISRD systems by making it obligatory, public outrage over high costs is not unlikely, as was the case in the US with the mandatory flood insurance (Anderson, 2013). Moreover, forcing such costs on citizens would be impossible to bear for people with lower incomes. As for the housing stock that still has to be built, regulations might instead be more effective than financial incentives. As construction regulations are not unusual in The Netherlands (e.g. Mijnboutwet, 2002; Bouwbesluit, 2011), this means that construction companies are used to such regulations. Additionally, financial incentives to implement such systems in new homes might not be as effective. This is because the construction companies have to sell the homes after they build them, and homeowners could prefer regular roofs which they are used to. If construction companies think they won't sell the homes, they will not use the incentives. Contrarily, if you make it a regulation and thus obligatory, homebuyers may not have the choice anymore as all new homes have the system. However, even though regulation might be more effective in this case, a combination with financial help might help construction companies to pay for it.

Thus, the proposed solution is a product innovation through organizational innovation (Ganzer, Chais, & Olea, 2017). The product innovation would be the ISRD adaptation to row houses while the process innovation would be the open innovation framework. Some limitations are covered in the conclusion.

Anticipating niche and structural change

If this proposed policy-mix to promote the implementation of ISRD systems in The Netherlands would be implemented, then this could lead to a socio-technical transition. It would be a socio-technical transition because there are changes in the technological material, but also the organizational, institutional, political and economic dimensions (Markard, Raven, & Truffer, 2012). The transition pathway would be a transformation path. A transformation path occurs when there is moderate landscape pressure, but the niche-innovations are not yet developed sufficiently (Geels & Schot, 2007). As explained in Section 2, there is landscape pressure. At the same time, the ISRD technology has not yet been developed for the row houses in the Dutch housing stock. Section 2 provided a more detailed overview of the current regime, landscape pressures and niches and showed that the landscape indeed supports a niche such as the ISRD. Additionally, it showed that other niches, such as the regular green roof, are starting to break through in the regime. It thus seems like the ISRD as a niche could break through as well. Of course, there are drivers and barriers to this transition.

Drivers include the fact that landscape developments seem to support technologies to help with climate change mitigation and adaptation, with the climate neutrality goal by 2050 (Government of The Netherlands, n.d.) and the European heatwaves (Zhang et al., 2020), for example. Additionally, the Dutch government already have similar policy structures in place with, for example, the home insulation subsidies (Ministerial Decision Aug 23rd, 2016).

Thus, the government would not have to come up with an entirely new policy structure. Moreover, ISRD technology is already there (Sheng et al., 2011), so research does not have to start from scratch.

Barriers include the fact that current homeowners would have to accept the transition. If a homeowner in the middle of the street refuses to cooperate, then the ISRD systems would have to build around that home, for example. Additionally, if many homeowners would refuse, the total climate mitigation and adaptation effects will also be smaller. Additionally, research institutions are not used to cooperating and usually compete (Castellacci, 2008), which makes the regulatory policy for an open innovation framework difficult.

Conclusion

In conclusion, this paper calls for research on and implementation of ISRD systems in The Netherlands with a focus on rowhouses, as that is 42% of all home dwellings (Pellenbarg & Van Steen, 2005). Through a policy-mix to create an open innovation framework as well as finance research and implementation, this socio-technical transition could be realized. To answer the research question, the paper suggests a policy-mix for an open innovation framework combined with financial incentives to promote research into the product innovation of the ISRD, together with a policy-mix of regulating new construction combined with financial incentives for current homeowners to implement the technology in the Dutch housing stock.

Limitations include, but are not limited to, the following points. First, the possible opposition of homeowners as was the case in the US with the flood insurance (Anderson, 2013). We do not know the public opinion in such a transition, which makes it relevant for future research to poll the public on this matter. More insight into public opinion might result in a revision of the policy-mix. Additionally, public opinion research can help with including desires of the homeowners into the design of the technology to make the public more accepting. Of course, a big limitation is that this solution would not come close to solving all problems it aims to address. First of all, the paper looks at row houses only and does not consider other home dwellings or other types of buildings. Additionally, even if all the row houses in The Netherlands would have this system, it will not solve climate change. It does help with mitigation and heat relief, but climate change is a global problem and just The Netherlands cannot solve it alone. Moreover, even if The Netherlands could solve it by itself, this ISRD system would not be enough. Rather, it will just be part of many solutions. Moreover, a limitation includes the fact that only a limited amount of policy options was considered. Given the scope of the paper, it was not possible to discuss all possible options.

Next to public polling, other future research is also very relevant, especially regarding looking at the effectiveness of the policy proposals through policy evaluation. For example, what would be the most effective subsidy height? This paper was not able to figure that out and it is very relevant. Subsidies can be effective (González et al., 2005), but if you want the most cost-effective policy, you do not want your subsidies either too high or too low. If they are too high, you are not being efficient but if they are too low, it is not effective enough. Research into the willingness to pay can help to figure out the most cost-effective height of the subsidies. In conclusion, this proposal can lead to a socio-technical transition towards more sustainable homes in The Netherlands through a policy-mix. However, it is important to realize the drivers, barriers, and limitations of this proposal.

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Will the EU ever meat us half way?

Salomé Hindriks

Introducing the Problem

The global burden brought by overconsumption of meat and animal based products in the EU, and other industrialised countries, is an appropriate example of the consequences of these regimes' excessive practices of mass production and consumption. Although the EU has set itself the ambitious goal to cut greenhouse gases (GHG) emissions by 40% below 1990 levels by 2030 and to become carbon free by 2050, the efforts so far have been insufficient (European Commission, 2020a).

The livestock sector is estimated to be responsible for about 14% of anthropocentric greenhouse gas (GHG) emissions (Rust, et al., 2020). Global meat demand per capita has tremendously increased over the last 50 year (Sans & Combris, 2015). It has been found that reducing the EU's livestock consumption by 50% would cut the EU's agricultural GHG by 25-40%, which accounts for 12-17% of all EU's GHG (Greenpeace, 2019; Willett, et al., 2019). Additionally, health concerns have been linked to overconsumption of meat such as coronary heart diseases, cancers, and type 2 diabetes. Despite the frightful consequences of livestock, Europeans are some of the largest consumers in the world (Vou, 2019; OECD, 2019). So we wonder; what are the factors inspiring increasing livestock production and consumption?

It is shown that, apart from religion and culture, economic development and urbanisation are leading drivers of livestock consumption (Sans & Combris, 2015). Urbanisation and industrialisation has made livestock producing and selling easier, thus, decreasing prices and increasing availability of meat and essentially its consumption. Meat consumption in OECD countries has arrived to a point where meat is costing outrageously more than it is providing to the population and the earth.

Various scientific research is calling for the EU to drastically reduce its livestock consumption. For instance, a Greenpeace study states that the EU must cut its livestock consumption by 71% by 2030 and by 81% by 2050 (Greenpeace, 2019). The European livestock consumption is expected to decrease, nevertheless, only slightly (Vou, 2019; European Commission, 2017; OECD, 2019). The EU must take serious action to reduce its livestock consumption.

This paper seeks to illustrate the socio-technical pathways towards a sustainable transition of decreasing livestock consumption in the EU. Doing so, the paper seeks to answer the research questions: 1) What are the drivers and barriers to reduce livestock consumption in the EU? 2) What are barriers to environmental regulation in the livestock industry? 3) How can the EU reduce livestock consumption to reduce increasing GHG emissions?. To answer the first research question, we will be using the Multi-Level Perspective (MLP) which helps us identify the important actors involved in consumption patterns and be able to classify them as drivers or barriers. The paper will then use the environmental regulation policy tool as proposed by Blohmke, Kemp & Türkeli (2016) to answer the second research question, this tool will provide a theoretical lense to make deeper sense of the barriers towards environmental regulations in the livestock sector. Once the barriers have been identified, we will be able to understand why livestock consumption isn't further decreasing in the EU and discuss how to potentially promote a decrease. The paper finds that because the livestock sector is a significant part of the EU's economy, it is difficult for the EU to reduce its production and consumption. Nevertheless, the EU should incentivise farmers to begin converting some of the livestock lands into land for vegetables and grain growths.

Transitional Framework

This section begins by introducing the framework used to identify important actors in a transition towards more sustainable livestock consumption. Markard, Raven & Truffer (2012, P.956) define sustainable transition as "long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption.". Hence, the sustainable transition of reducing the consumption of animal-based products is driven by factors at different levels. The multi-level perspective (MLP) as described by Geels (2004), and revised by Geels & Schot (2007), is a suitable framework to analyse the sociotechnical transition pathways of sustainable transitions. Thus, the framework will allow us to answer the first research question by identifying the drivers and barriers in the transition pathway.

MLP identifies three levels of heuristic, analytical concepts; niche-innovations, socio-technical regimes (ST-regimes) and socio-technical landscape (ST-landscape). The transition occurs in the ST-regimes which are composed of policy, culture, science, technology, industry and market user preferences. Thus, ST-regimes form the 'deep-structure' of social groups and are characterised by their stability as they only slightly alter to adapt and adjust to exogenous factors. These exogenous forces are conceptualised as ST-landscapes and put pressure on the ST-regime. ST-landscapes are characterised for their externality, and thus cannot be influenced in the short-run by actors (Geels & Schot, 2007). Changes in the ST-landscapes either take place over a large period of time, like with the climate and the industrial revolution, or are rapid external shocks, such as wars or pandemics. Finally, the niche-innovations are the small network of actors that provide radical novelties. Niche-innovations are spaces, protected from the ST-regimes, that seek to test theories of changes that can then be implemented in the ST-regimes. Niche-innovations are usually organised as a response to changes in the ST-landscape and seek to provide ST-regimes with solutions to adapt.

Application of the framework

This section discusses the relevant players found through the MLP framework and classifies them as either drivers or barriers to a sustainable consumption of livestock produce in the EU.

ST-Landscapes

Ecosystem

The first landscape to discuss for this sustainable transition is climate change and environmental degradation. Our world is finite; all resources are limited and so is the capacity of the earth. Anthropocentric greenhouse gas (GHG) emissions are causing increasing global temperatures and causing irreversible changes to our ecosystems. The earth's climate is expected to rise by 2°C in the next decades, causing lots of disruption of the earth systems and in our livelihoods (Maslin, 2014). Climate change is putting pressure on the ST-regimes to make changes to reduce their current anthropocentric GHG emissions as to reduce future rates of global warming (Maslin, 2014). Livestock production has caused a fair share of the degradation of our ecosystem. Animal agriculture is largely responsible for global deforestation, land and freshwater pollution, and 14.5 M of anthropocentric GHG emissions (EEA, 2019; Rust, et al., 2020). Thus, climate change is putting pressure on the European ST-regimes to reduce unsustainable livestock production and consumption.

Health

The third important landscape in the EU's livestock consumption is European health. Europe's disease burden surged from the increasing deaths (86%) and feeble human capital from noncommunicable disease (WHO, n.d.). Overconsumption of meat has been linked to many of these health issues. Although meat contains important

nutrients such as B12, iron and calcium, the current consumption patterns exceed recommended health limits (Rust, et al., 2020). Indeed, overconsumption of meat, especially red and processed meat, increases the chances of developing coronary heart disease, type 2 diabetes, obesity, and various cancers (Rust, et al., 2020). Furthermore, the antibiotics given to livestock during production are contributing to humans increased resistance to antibiotics and chances of infectious diseases (Greenpeace, 2019). Such health related concerns are costing countries in human capital. Indeed, the global health cost of meat is estimated at 0.3% of GDP in the EU (Rust, et al., 2020). Thus, the health and socio-economic burden of the EU's current livestock consumption is putting pressure on the health and economic system.

Niche-Innovations

Vegetarianism/Veganism/Pescatarians/Flexatarians

An important set of niches to our transition are the various diets that are drawing away from the EU's omnivorous/carnivorous diets. For instance, vegetarian diets remove all meat products and attain the needed proteins and nutrients from other sources of foods such as beans, lentils, or soy. On the other hand, vegan diets remove all animal-based foods such as meat, but also eggs and milk. Another type of these diets is the pescatarian diet. Pescatarians do not consume any meat for the exception of fish which are (usually) more environmentally friendly and healthy. Lastly, there are flexitarian diets which are vegetarian in majority but occasionally eat meat.

These diverse examples of diets are seen in all countries and social classes, however, usually representing a minority of diets in the Western world. These niches exhibit the ability for humans from various countries and socio-economic status to reduce their livestock consumption whilst staying in good health.

Meat substitutes

Another important niche to our transition are the various meat, cheese, or milk substitutes that provide the same essential nutrients. Meat substitutes include the simple soy, tofu, beans, lentils and other sources that naturally provide the beneficial nutrients gained in meat (Research and Markets, 2019; WHO, 2020). Milk substitutes include oatmilk, coconut milk, almond milk and many others. In response to the growing population of non-meat eaters and the demand for other sources of protein, the market has adapted by increasing types of meat-substitutes (Vou, 2019). The range of livestock substitutes are ever-increasing. Livestock substitutes and the increasing creativity in recipes and foods that are livestock free are driving a decrease in livestock consumption in the EU.

ST-regime

Science

There has been increasing scientific research concerning some undesirable consequences of mass livestock consumption and production on our health and the environment (Greenpeace, 2019). Changes in the widely accepted Western food pyramid and dietary recommendations have been made over the years; from questioning the necessity to consume meat and dairy produce, to discouraging the consumption of those to gain the necessary nutrients as they also come with unwanted consequences (WHO, 2020).

Additionally, increasing scientific research on the environmental impact of livestock has been widely accepted in the regime (Rust, et al., 2020). The research goes into more detail on the various forms of damage meat and animal-based production has on the planet and our future. Furthermore, these diets drift away from the widely popular Western food pyramid which would depict the need to consume meat daily and dairy produce. Indeed, the pyramid has been revisited and shown that healthier diets exclude all animal produce (WHO, 2020). Scientific findings that are exhibiting the burden of our current standard of livestock consumption are drivers to reducing the consumption in the EU.

Culture

The EU as a whole is a neoliberal capitalist entity with its single market allowing free movement of people and capital across countries. Freedom and little government intervention are well perceived. The idea being, one fights for oneself and another's problem is not ours; competition runs high. Cultures with this political economy are often associated with cultures of mass consumption, production and waste. Industries are able to produce at increasing rates with little regulations, meaning prices are lower and overconsumption reigns. In such, government regulations that seek to better fit long-term global interests are poorly received. Thus, the neoliberal culture in the EU is a barrier towards decreasing meat consumption. Meat consumption represents freedom and wealth for many neoliberals.

Nevertheless, concerns about animal welfare, environmental impact and the origin of the meat consumed is growing in European culture (European Commission, 2017; Wunsch, 2019; OECD, 2019). The EU is seeing a slight growth in population of vegetarians, vegans, pescatarians and flexitarians in response to growing knowledge of the environmental impact of meat (Vou, 2019). Indeed, an estimate of 2-10% of the European population has adopted a vegetarian or vegan diet. Hence, the niche-innovations have made way towards some parts of the regime's culture. Nonetheless, it is worth mentioning that although the population of vegetarians and vegans in the EU has increased, EU culture remains highly carnivorous. Additionally, vegetarian diets continue to be stigmatised as difficult, not enjoyable and expensive (Bryant, C. J., 2019). Thus, the culture surrounding livestock consumption is mixed throughout the EU and can be both a driver and a barrier.

Technology

Technological innovation since the Industrial Revolution is responsible for the upturn of the meat sector in the EU and globally (OECD, 2019). Industrialisation sought for technologies that achieved higher production and cost-efficiency to provide cheaper and more accessible meat. For instance, more recent technologies such as genetic modifications to extend the life of meat have surfaced. On the other hand, due to the increasing concern of livestock production and consumption on environmental and human health, recent innovative technologies aim to produce meat in more sustainable ways. For instance, using more sustainable sources of energy or reducing the use of synthetic fertilizers (de Vries, et al., 2015). Technological innovations can increase livestock consumption; increasing the availability and by finding more sustainable ways for agriculture rather than reducing the production.

Market, users preferences

The production of meat substitutes such as soy, tofu, tempeh, textured vegetable protein (TVP) and seitan are increasing due to their health and environmental benefits (Research and Markets, 2019). In response to the growing population of non-meat eaters, the market has adapted by increasing the supply of meat-substitutes (Vou, 2019). Now, the EU comprises 39% of global meat substitutes (Wunsch, 2019). The global meat substitute market is expected to grow from $4.8 billion in 2018 to $6.6 billion by 2024 (Research and Markets, 2019). This is a driver towards a considerable change in EU's meat consumption as protein options and meat alternatives are made more available.

In terms of meat demand, however, the global meat demand is still expanding with developing countries industrialising and increasing their livestock consumption (European Commission, 2017). Currently, 90% of the meat production in the EU remains in the EU. Nevertheless, if the EU meat demand decreases whilst the global meat demand increases the EU will be increasing its meat exports. Increasing exports and expanding markets may risk the EU's livestock production to increase or remain; hence, no changes in GHG emissions from the livestock sector. Additionally, following the sudden decline in meat demand, it is expected that the price of meat will also decrease (OECD, 2019). Therefore, the market preference in the EU remains highly meat and other livestock prone, thus being a barrier to reducing consumption.

Industry

The EU's agricultural sector has contributed to 1.1% of the EU's GDP in 2018 (Eurostat, 2019). The livestock sector is a major part of European food industry contributing to about 45% of agricultural activity (ATF, 2017;

Greenpeace, 2019). European livestock farms are decreasing in number by 26% from 2005-2013. However, the farms are increasing in sizes thus slowly turning the livestock industry into an oligopoly. Livestock farming is also regional, with Germany, France, Spain and the UK producing around 50% of all EU livestock. Hence, the EU as an economic power largely relies on the livestock industry which is controlled by only a few power players. This is an important barrier towards decreasing meat consumption as the EU's economy relies on it.

Policy

The Common Agricultural Policy (CAP) is a European level policy, meaning it is funded and managed by the European Union (European Commission, 2020b). The agricultural sector is the only sector where there is a common policy. Farming, although important for a country's self-sustenance and growth, can be a risky and unrewarding business. Farming relies heavily on fluctuating weather patterns and market-prices. The CAP provides subsidies to farmers to ensure a steady income, increase employment in the area and to address specific challenges facing rural areas. In 2018, the CAP awarded farmers with €58.82 billion, thus, 26.7% of the EU budget in 2018 (ibis). Since the livestock industry accounts for 45% of agricultural activity in the EU, the CAP is providing a large sum of those subsidies to farming intensive livestock production. Similarly to the industrial factor, the CAP is a large barrier towards reducing livestock consumption as it provides incentives to farmers for producing livestock.

Environmental Regulations for the Livestock Industry

Now that we have identified important actors involved in the socio-technical pathway towards reducing livestock consumption in the EU, we can begin by understanding these barriers, in particular towards the barriers for environmental regulation. Blohmke, Kemp, & Türkeli (2016) establish a framework that unscrambles the causal structures behind environmental policy. This will allow us to make sense of the various stakeholders and their relations to a transition to reducing the livestock consumption in the EU. Although this framework is country-specific, the EU is chosen as a whole to analyse, seeing that the agricultural sector, and hence the livestock industry, is regulated under the same framework of CAP (European Commission, 2020b). The theory comprises three factors: political-institutional, cognitive-informational, and economic. Political-institutional is concerned with the communication between policymakers and non-state actors in the policy process. In other words, whether environmental activism from the local, community and private scale is being heard by the policymakers. Second, the cognitive-informational factor represents the citizens' environmental knowledge and their values of the environment -- whether the regime's culture is aware and concerned with environmental degradation. Lastly, the economic factor reflects the capability of the government to undertake environmental regulations. Factors such as foreign direct investment, trade openness and corruption may affect the government's economic freedom to introduce environmental regulations. Looking at these three factors and the actors previously mentioned, we can make sense of the barriers.

In terms of political-institutions, green advocacy within the EU policy-making is increasing and reflected in the EU's ambitions towards more sustainable modes. The EU seeks to become a leader for sustainable development and environmental action globally (Oberthür & Groen, 2016). The EU has established strict environmental regulations over the years in various sectors and is seen as having one of the highest environmental standards. Nevertheless, in terms of tackling climate change by reducing the member states' livestock consumption, the EU has not acted. Thus, green advocacy needs to increase the activism towards reducing meat consumption for a healthy environment and population. Furthermore, the livestock substitute industries remain smaller and less powerful than livestock industries. The livestock industry plays a major role in the European economy in terms of employment, self-sufficiency and exports (European Commission, 2017). Environmental regulations aimed at decreasing the consumption of meat in the EU would clash with the EU's active processes to increase livestock production. For instance, the EU received tremendous backlash after subsidies towards livestock production were put into advertising of meat (Boffey, 2020). Indeed, the campaigns were a response to the decreasing meat consumption due to health and environmental worries. Although livestock is an important part of the economy, the EU must actively transition agricultural production into a more plant-based industry.

Overall, the EU citizens value environmental protection. As previously discussed, awareness and concern of the livestock industry's environmental impact is increasing. (European Commission, 2017; Wunsch, 2019). Likewise, the

demand for meat has decreased. Furthermore, it is shown that citizens with environmental concerns are more likely to reduce transportation or use green transport, recycle, and cut down their energy consumption rather than to cut down their meat or milk consumption (Golob & Kronegger, 2019). The perception that big industries are responsible is much larger than consumer power. Hence, the EU lacks awareness and knowledge on not only the immense impact of meat on the environment, but also on consumer's power in the reduction of livestock industry.

Finally, in terms of economic conditions, seeing as the EU is neither dependent on Foreign Direct Investment nor necessarily corrupt this factor is not a barrier towards environmental regulations. Additionally, although the livestock sector is a large part of the EU's economy, only 9% is traded outside of EU borders (European Commission, 2017). Hence, the EU is not blocked by trade agreements outside its borders in terms of the livestock industry. The EU's economic conditions allow for environmental regulations concerning livestock consumption.

Conclusions and Limitations

This paper seeked to answer the research questions; 1) What are the drivers and barriers to reduce livestock consumption in the EU? 2) What are barriers to environmental regulation in the livestock industry? 3) How can the EU reduce livestock consumption to reduce increasing GHG emissions?. Doing so, we used the MLP framework as described by Geels (2004) and Geels & Schot (2007) to identify important actors in the socio-technical transition pathway of livestock consumption. The paper then used an environmental regulation framework as an analytical lense to explore the barriers towards reducing livestock consumption in the EU (Blohmke, Kemp & Türkeli, 2016). The paper found that the livestock industry remains a protected sector due to the EU's agricultural policies and economic demands. Hence, to achieve a drastic reduction in the livestock consumption, the EU must remove subsidies and aid to the livestock producers and transfer it to plant-based farmers or other meat substitutes industry. This way livestock substitutes will be cheaper than livestock products, the EU population will be driven to conusme less meat and milk and the EU's economy can gain from plant-based agriculture.

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Energy in the Desert: The MENA Region and Sustainable Energy Transitions

Sam Gerritsen

Introduction

How is the renewable energy transition of the MENA (Middle East- North Africa) region facilitated by the political economy situation and governance in the region?

Renewable energy is a massive challenge for the Middle East and North Africa (for this essay, the MENA region is considered to be the countries of Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, Palestine, and Yemen)

For most of its modern-day history, it has been known as a fossil fuel powerhouse, home to more than half of the world's proven crude oil and more than a third of natural gas reserves (El Kaitiri, 2019). However, the presence of issues like climate change and the growth of renewable energy in other parts of the world means that this once fossil fuel dominant region will have to undergo transitions towards renewable energy sources.

What is inherently unique about this region is the current political economy, as a still developing region, with one major export product and high levels of government intervention in the economic decision-making process, but with the want to diversify its economy, allow foreign investment and avoid the catastrophic environmental, social and economic consequences of climate change.

The three-pronged approach of ideas, interests and institutions interpretation by Hall (1997) can be used to analyse the MENA region and its current economic standing in the world. From this and applying the framework of Frantezeskaki, Loorbach and Meadowcroft (2012) on sustainability transitions one can look at how its government views economics and the transition to sustainable energy, one that is very important in that region of the world and making clear that this is in fact a sustainability transition. This paper will after a general introduction and overview of the topic and discussion of the various analytical angles, analyse the case studies of Iran and Morocco and how their successes could be used in the transition of the rest of the MENA region.

In doing so, this essay will answer the research question "How is the renewable energy transition of the MENA (Middle East- North Africa) region facilitated by the political economy situation and governance in the region?" with respect to the following sub questions (a), What is the current political economy in the MENA region?, (b), How can the region apply the transitional management model in pursuit of sustainable energy?, and (c), How do the case studies of Iran and Morocco indicate change (or not) in the region?

Background: The Energy System in the MENA Region

The MENA region is a developing region, economically, but with much disparity between countries that do and do not have fossil fuel resources. Countries in the Gulf (United Arab Emirates, Saudi Arabia, Kuwait etc.) and at the northern tip of Africa (Algeria, Libya etc.) have much higher GDPs as a result of fossil fuel export to Europe and Asia (ANSAMed, 2019).

Fossil fuels have been a way of ensuring economic prosperity for the region since the discovery of oil in the 1930s, today accounting for more than 80-100% of export revenue in some countries. This also positions the region favourably in playing an important role in global energy supply. According to BP energy statistics (BP 2017), the region is host to 51.5 percent (879 billion barrels of oil) of global proven oil reserves as of 2016, as well as 47 percent (87 trillion cubic metres) of global proven gas reserves as of 2016. (Menichetti, Gharras, & Karbuz, 2017)

The value of fossil fuels is particularly important to these countries and as a result is heavily subsidised by the state. Radon and Logan (2016) discuss the beginnings of resource nationalism in the region in the 1950s and 60s where state ownership and control of oil operations became normal over fears of international oil companies undercutting the state economically. States in the region today whose national oil companies play a central role in the (political) economy include Saudi Arabia (Aramco), Kuwait (Kuwait Petroleum Corporation) and Algeria (Sonatranch). As part of this nationalisation, there was also a social contract created in which oil companies would deliberately sell resources at a lower cost to redistribute wealth.

This system is, unfortunately, failing. Because of the economic crisis that still lingers from 2008, and the volatility of oil prices (which reached prices of over USD$100 a barrel at that time) meant countries were spending record amounts of money on subsidising the oil industry and fossil fuels (El-Kaitri & Fattouh, 2017). This is money which could fair better be spent in the development of a renewable energy network.

Analytical Frameworks

Political Economy- Interests, Ideas and Institutions

The first analytical framework used to approach the stated research question is Peter Hall's 1997 work on interests, ideas and institutions in the political economy. First, we need to define the political economy, which in this case is *"the study of the social relations, particularly the power relations, that mutually constitute the production, distribution, and consumption of resources."* (Mosco, 2009, pg.24).

Using this understanding of a political economy, we can then further divide it into three categories to better analyse it as a whole. Interests can be understood as "the real, material drivers in the (political) economy" (Hall, 1997). Ideas are described by Hall (1997) as the cultural variables within economic policy and lastly, institutions refer to the "primary causal factors behind economic policy or performance in the organisational structures of the economy" (Hall, 1997).

Using these definitions, we can then look at the MENA region and apply these concepts to get an understanding of the political economy there. We can link Mosco's definition from earlier to the three different concepts that will be discussed and specifically . Interests links to the production of oil, institutions links to the distribution of that oil, by mainly government controlled and run corporations and ideas links to the consumption patterns of oil, as well as the cultural contexts of these societies.

As an oil-rich region, it is understandable that the primary interest of these countries is oil production and export, with these countries having oil account for more than one-third of their combined GDP and two-thirds of their total exports (El-Badri, 2012) oil drives these countries forward. It is a trend very prevalent in the region, with four MENA countries (Kuwait, Libya, Saudi Arabia and Iraq) having their economies more than 40% dependent on oil (see figure 1)

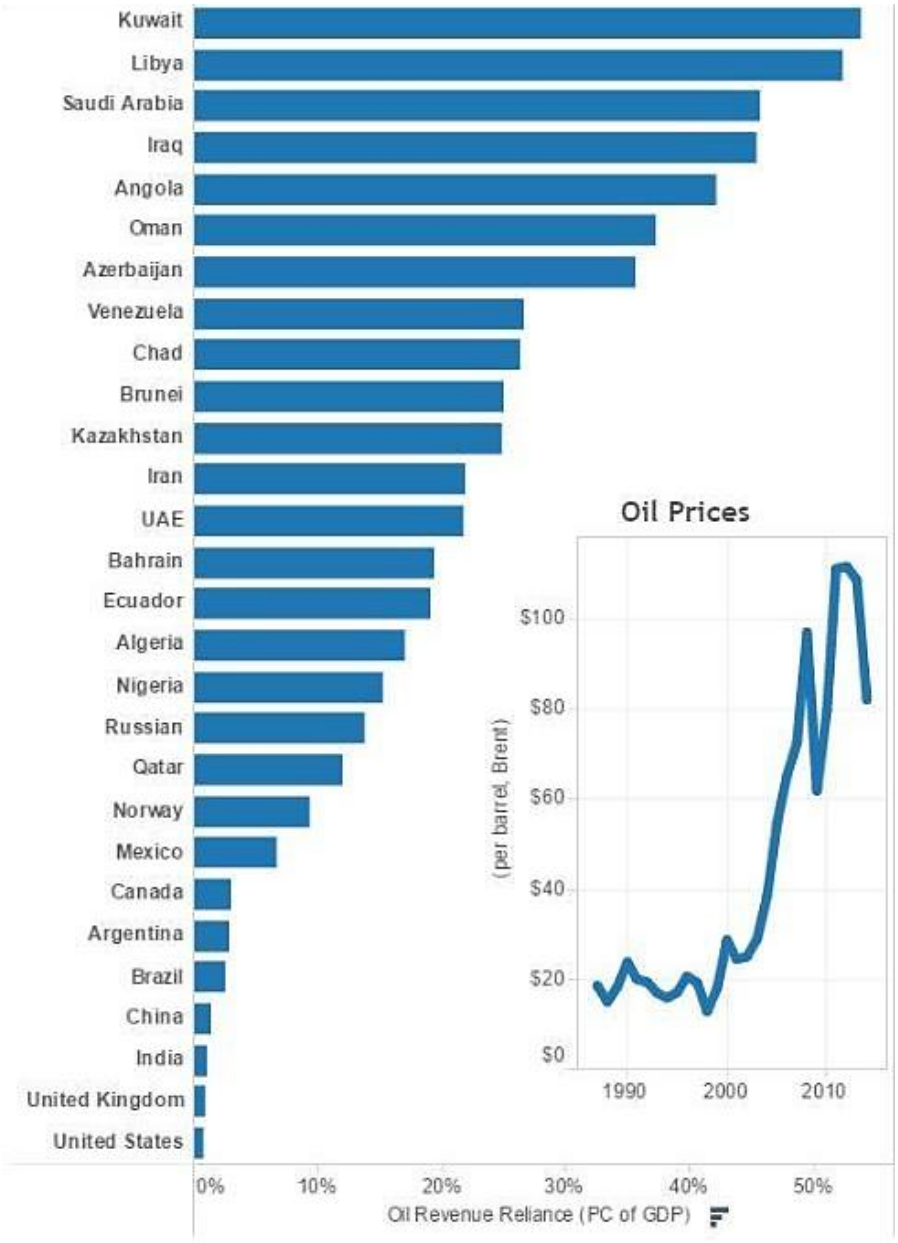

Figure 1: Countries dependent on oil to fuel economic growth (Value of crude production as a share of GDP). Retrieved from https://www.weforum.org/agenda/2016/05/which-economies-are-most-reliant-on-oil/

The second core part of the political economy are the ideas, which in the MENA region are closely connected to economic success of the countries. With the whole region classed as a developing economy (it does acknowledge the unequal contributions made as a result of exporting fossil fuels) by the World Bank. As a result, its focus is on growing GDP, economic competitiveness with the world and a growing awareness of the civilian population that oil reliance and a fossil fuel-based economy cannot continue.

Remaining economically competitive is a very important idea to these countries as they want to overcome the economic challenges that they had faced through war, make use of their massive resource wealth and improve quality of life for its citizens. As the World Economic Forum (2018) notes *"The region's growing young, educated, and*

technologically connected population presents an unprecedented opportunity to foster development…. Most economies in the region still need to implement a range of reforms to encourage the development of a more dynamic and sophisticated private sector"

Vincenti (2016) comments on this saying *"The explosion and proliferation of social mobilization, although violently repressed by regimes and 'deep state' systems, have prompted the public to directly engage in many policy arenas — including environmental policy-making*", and in doing so brings up an important point about the role of government, the state and its institutions in the political economy and decision making sphere.

Institutions make up the third level of the political economy, and they are organisational structures of the economy. As was mentioned earlier, in the oil-dominated Middle East, the role of the government is larger than that of other developing economies, and interestingly also in the provision of subsidies on energy (Hertog, 2017).

As a result, these countries rely heavily on government intervention in the economy to stimulate growth. Given the dominance of oil in the region it is unsurprising to see that many MENA countries have national oil companies, which were started for both political and economic reasons, including wanting to break away from colonial ties, protection of their own resources and to correct market failures. (Radon and Logan, 2016). This can for example be seen in the pricing of electricity in these countries, which is significantly lower in MENA countries than the rest of the world, as a result of the region-wide policy of providing low-cost energy supplies to households and businesses (El Kaitiri, 2019). This comes as a result of the aforementioned subsidies which are a measure that sets the selling price of the commodity at below the cost of production, and uses increased collection from business to meet the shortfall (El-Kaitiri & Fattouh, 2017)

In summary and to answer sub-question one, the political economy of the Middle East and North Africa is still changing and developing. As the world globalises, it is shifting to fit in with this. However, there is much change still needed. The hope is that it will seize its youthful population, advancement in technology and opening of markets to create a new, sustainable political economy.

Sustainability Transitions

The need to transition to a more sustainable future is obvious. However, achieving it, is not always easy. A transition approach is simply defined by Frantzeskaki, Loorbach, & Meadowcroft (2012) as *"recognition of the necessity of large-scale structural change in one or more societal subsystems"* (pg.20). This fits this case well, as there is many large changes throughout politics, society and infrastructure that would need to change to achieve sustainable energy in the MENA region.

Further to this idea of simply a societal transformation, is the need for this to be sustainable and contribute to sustainable development. Frantzeskaki et. al (2012) define this as *"ensuring economic welfare, social equality and ecologic quality across society, and over generations into the future."* What this means for the MENA region is that moving away from fossil fuels to renewable energy should be done without disrupting the opportunity for economic growth, all the while ensuring fair and equitable access to and pricing of electricity, through ideally renewable energy options.

As highlighted in the previous section, the issues of oil reliance, heavy government involvement and subsidies present a challenge in implementing the 'large-scale structural changes' needed to transition to renewable energy. So how will these countries implement such a transition? In Iran and Morocco, there is a break away from the dominant government-controlled energy market, as the benefits of this transition are realised. These include

infrastructure development, employment and the obvious environmental benefits. The respective governments plan to open up investment to the private sector, breaking away from the dominant stance of political economy which discourages liberalisation of markets.

Scholars have recognised that investment in renewable energy will be difficult but given that consumption of energy in the region is set to increase as it industrialises, resulting in more carbon emissions it seems essential. It is even seen as an "undeniable deficiency" in energy policy in the region (Aslani, Naaranoja & Zakeri, 2012).

In answering sub-question two , we need to look at what the benefits of this transitional model are and how can it be seen as truly "sustainable". Frantzekaki et.al (2012) argue that this transitions approach means the current top-down governance mode needs change and reorientation in order to allow a shift towards sustainability. This is exactly what has been identified in the current political economy and proves that in order to start the transition to renewable energy, there needs to be less government involvement and a bigger role for the private sector. Only then can we regard this as a true sustainable transition, setting it apart from a smaller scale transition.

Case Studies- Morocco and Iran

Why these two countries?

These two countries were chosen for their cross-representative view of the MENA region, as Iran is in the Middle East region and Morocco is part of North Africa. While they are in differing stages of development in regard to renewable energy, they are both making steps towards loosening the government control in the economy and investing in renewable energy as noted by the BTI Transformation Index 2018 (Bertelsmann Stiftung, 2018). Literature on both countries was also sufficient for analysis.

Morocco

The energy transition in Morocco is one heavily based on the private sector and the liberalisation of the energy sector. The current system is reliant on fossil fuels and the demand for energy is also increasing as Choukri, Naddami & Hayani (2017) explain this saying

> *"due to demographic and economic growth, electricity demand grew at an average annual rate of 6.6% in 2015, leading to an energy consumption of 34,413 GWh at the end of 2015. In 2015, the amount of electricity produced totaled 29,914.2 GWh. Renewable sources generated 13.4% of the energy, while 49% came from coal, 16.6% from natural gas, and 6% from oil "*

Morocco, having recognised the growing urgency of things like climate change and ensuring a stable energy supply in the future, has begun to implement a plan to transition away from fossil fuels. As Schinko et. al (2019) explain they have set an ambitious target to have 42% of their electricity generated from renewable sources by 2020, and 52% by 2030. This shows their clear commitment to change, however this it is estimated roughly USD 30 billion in investment will be needed to fund the deployment of RES in Morocco, according to the Ministry of Energy, Mines, Water, and Environment (Schinko et.al, 2019). This huge bill is not easily foot by the government and therefore to begin its transition and as part of this process, deregulation, privatisation and the capital of the private sector is paramount. Hertog (2017) also makes this observation saying, "*Morocco stands out in having been less ambitious in both*

distribution and public service provision and in relying more strongly on private-driven development". This is a characteristic unique to the normal governmental regime in the MENA region.

This process begun in the 1990s with the first stage of liberalisation of the energy and power generation sectors. This was successful in that it increased access to electricity in rural areas, with 99.42% connected to the grid in 2016 (Schinko et.al, 2019). Since then a law has been passed (13-09) which has established the targets around generation from renewable sources.

Future goals include further use of the Independent Power Producer (IPP) system, whereby privately-owned companies generate and sell electricity to consumers. Additionally, as Roscoe (2018) explains investment from European companies in wind and solar have seen massive wind and solar farms crop up all over the country, for example a five-location wind farm developed with companies in Italy and Germany which is set to generate 850MW of electricity, due to be online in 2020. All of this is part of the plan to reach the ambitious target of 42% renewable energy generation by 2020.

Iran

Iran is in a similar position to Morocco in that its energy system is also heavily dependent on the use of fossil fuels and consumption is also increasing as a result of development and a growing middle class. Currently its energy mix is heavily hydrocarbon dependent, providing 98% of the energy supply in the country (Aslani, Naaranoja, & Zakeri, 2012). Furthermore, sanctions placed on Iranian oil by the United States have further contributed to an economic downturn for oil. The current renewable energy generation is small at only 0.2% of total production.

Again, as in Morocco, the economy is mostly governmental, and energy is provided as an economic-social service. However, to tackle the financial, infrastructure and demand challenges, investment of the private sector is required. The government is therefore also in the process of deregulating and marketizing the energy sector. (Aslani, Naaranoja, & Zakeri, 2012).

To that end, the Energy Ministry in Iran made a variety of changes aimed to support the opening up of the market. This was done through a variety of internal measures and foreign investment.

Internal measures included guarantees to purchase the output of renewable energy plants for 20 years and providing tax exemptions for renewable energy plants for between 5 and 13 years. Additionally, the government increased guaranteed purchase price by 30% for companies that use domestic technology and facilitated the permit issuance process.

Foreign investment was until the Iran Nuclear Deal of 2015, heavily restricted. Despite the controversy surrounding the US decision to withdraw from the agreement in 2018, the European Union especially has ramped up investment in the country. Renewable energy projects worth billions driven by European companies started appearing, with research showing that "from January 2016 to April 2017, EU countries invested $3.6bn in the country's energy sector." (Jan, 2018).

Future renewable energy goals and investment include that renewables will generate around 10 percent of Iran's electricity production requirements within five years. a five-year government growth policy includes a stipulation that its installed R.E. capacity should grow by 5,000 MW by 2018, and investment goals of $10 billion by 2018 and $60 billion by 2025. (Middle East Institute, n.d)

Implications/Lessons for the rest of the MENA Region

Other countries in the Middle East and North Africa are not so lucky. Countries such as democratically failing Algeria or partially blockaded Qatar suffer as their governments are less willing to open up their economies. Research by the Dusek (2019) supports this, as he argues the Arab world is split between a dynamic, engaged private sector in open economies, as we see Morocco and Iran beginning to do, and held back by a "bloated private sector, with controlled and closed economies". The transition to sustainable energy is just the beginning for so many of these countries.

In answering sub-question three, we can look at how the case studies of Morocco and Iran **do** in fact indicate change in the MENA region. While maybe not leaders or the only countries that are beginning to make change, what research has shown is that these countries are following a model that should perhaps be considered by other countries in the region, as it is helpful in not only growing the economy, it also is important in considering its implications for furthering renewable energy worldwide and allowing for the MENA region to do its part in fighting climate change in a way that doesn't hurt their economies, creates jobs and fosters better international cooperation and trade.

Conclusion

In conclusion this essay has looked at the challenge of transitioning to renewable energy sources in the Middle East and North Africa region. Using the analytical frameworks of 'interests, ideas and institutions" to explain the political economy of the region, in which it was determined that while the region is blessed with rich amounts of natural resources, which are considered very important. The need to transition to renewable energy is hampered by this obsession. There is a struggle between the need to diversify and the massive amounts of money, fossil fuels still contribute to these economies. Institutions are also focussed on maximising this, and as state-owned entities, the ideas and interests remain unchanged. Changing this system, requires significant transformation, towards sustainability and a sustainable future, akin to what Franteskaki et.al (2012) describe in their work on sustainability transitions, and specifically on changing the top-down governance approach. Using the case studies of Morocco and Iran, has highlighted the interlinkages between the changing political economy in these countries and the massive changes they are making towards sustainable futures through renewable energy generation. The question that remains is that of how to realise this transformation in the rest of the region and how it can also be seen in other areas.

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Pathways for the United States to Transition to a Circular Economy

Seth Douglas

Abstract
Climate change has become a global crisis, demanding large transitions to take place throughout our society. The current discourse focuses heavily on clean energy, but production and waste play a large role in environmental degradation. Circular economies offer the opportunity to grow the economy. They also encourage more conscious production and consumption methods that have less demand for raw materials. This paper examines the existing waste management issues in the US, and what policies must be passed to encourage this transition. In order for the US to transition to a circular economy, there must be federal and local policies that encourage conscious production and consumption as well as more sustainable waste management infrastructure.

Introduction
Climate change has become a central issue in politics around the world. Though the conversation on environmental harm has largely centered around carbon emissions and transitioning to renewable energy, the issue is much more complicated. The United Nations' (UN) International Panel on Climate Change (IPCC) wrote in a special report that there must be "far-reaching transitions" that "are unprecedented in terms of scale" (UN, 2018). These transitions cannot be limited to simply "greening" the electricity grid, but must also include transitions to a circular economy. With a global economy, the resources being used in production are sourced from all over the world. Since resources are limited, nature becomes increasingly disrupted as the need for goods requires more resources. The end result is a growing waste management issue, with countries in the Western world producing an enormous amount of waste while continuing to consume at high levels. The country most at fault in this regard is the United States. According to Holden (2019) the United States produces more garbage and recycles less of it than any other country in the world. This largescale production of waste has considerable long-term effects on the natural world, because a failure to reuse or recycle waste leads to large landfills. The issue of waste management is one of significant environmental and social justice importance. Ash and Boyce (2018) find that racial and ethnic minorities are more exposed to air and water pollution in the US due to poor regulation of these landfills. This has led to the development of the idea of a circular economy.

Circular economies work to find new uses for waste, keeping these items in the circle, rather than ending up in landfills. As explained by the Ellen MacArthur Foundation, "a circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems". One example of implementing this system into the economy is recycling, but these programs are limited and only provide a small decrease in environmental harm. Circular systems must become more robust and diversified in order to better address these issues. Frequently in waste discourse there is an overreliance on the individual's obligation to consume responsibly. This has led to the creation of education programs around recycling and advocacy encouraging individuals to reduce their carbon footprint. Though these actions are well intentioned, individuals do not have the knowledge or ability to truly change waste management systems. The focus of this paper is to evaluate the balance between individual action and systemwide change. The research questions for this paper are: "what role do individual consumers play in transitioning to a circular economy?" and "what policies can the federal government create that will better achieve a circular economy?".

The paper is structured in three parts. First, the paper outlines the existing waste management systems in the United States, and how they compare to the rest of the world. Second, the paper investigates the current waste systems discourse. Finally, the paper explains what the US should do moving forward, and where responsibility lies in transitioning to a circular economy.

Background on Waste Management in the US

The United States is one of the world's largest polluters. According to the Environmental Protection Agency (EPA, 2016) the US generates 252 million tons of municipal solid waste (MSW) and recycles 87 million tons a year. This is equivalent to a 34% recycling rate, which is a significant increase from 5.6% in 1960. A similar increase has occurred in the per capita production of MSW, with the current per capita rate being 4.4 tons compared to 2.68 tons in 1960. The peak MSW per capita production was in 1990 as the EPA, and the federal government as a whole, placed a

larger emphasis on decreasing waste production. As a result, US waste production has leveled off in the 21st century, but is still considerably higher than other countries (EPA, 2016). An emphasis has been placed on dealing with waste issues in two ways: 1) source reduction and 2) recycling and composting. These ideas are both central tenants in the circular economy and the growing focus on these two ideas shows the beginning stages of transitioning away from linear consumption methods, an idea explored further in the next section of the paper.

One method of recycling waste in a sustainable way has been mass burn of waste. In this process MSW is burned and the heat produced is used to create steam, and thus electricity. The ash produced is then brought to landfills where there are steps taken to prevent water and air pollution. Early garbage incinerators posed risks to local air and water, but the Clean Air Act has led to the better regulation of these facilities (EPA, 2019). There are still only 75 of these facilities in the United States processing roughly 13% of MSW annually. The large amount of land in the US makes the need for sustainable waste management less urgent as traditional landfills are cheaper and easier in the short-term (EPA, 2019). The slow adoption of this method represents the lagging transition to a circular economy. Too little work has been done in facilitating and encouraging this transition. A report from Verisk Maplecroft (2019) found that the US is failing to properly commit to growing recycling capacity, having lower rates of recycling than both the UK and Germany. The report places the blame on the US's failure to invest in infrastructure and craft policy with long-term recycling goals. Further, the US lags behind other nations when it comes to the amount of waste produced in the first place. Other nations produce significantly less waste than the US. The average American produces 728.5 kg of MSW annually (EPA, 2016) compared to 489 kg in the EU and 511 kg in the Netherlands (Eurostat, 2019). American's produce far more waste than any other economically developed country.

The primary focus of the EPA and many advocating for a circular economy is on two main pillars: 1) source reduction and 2) recycling and composting. The US fails in both regards and has stalled in recent years to produce policy that would invest in the growing of this infrastructure. To better understand the difficulty the US has faced and what must be done moving forward it is important to investigate the current waste systems discourse.

Current Waste Systems Discourse

Linear Economy

A linear economy is one where raw materials are extracted and then processed, sold, used, and discarded at the end of its lifetime (Ghosh, 2019). This is the standard method of production and consumption for much of the world and has resulted in large-scale need for raw materials and landfills filled with waste. This has become untenable for the global environment and causes significant local pollution. Though federal and state standards exist to limit air and water pollution, low enforcement strategies and poor alternatives lead to significant issues (Pecci, 2018). Linear economies may have some form of recycling or sustainable waste management systems, but the majority of waste ends up in landfills. Further, linear systems have extraction and production systems that are not built for recycling, reuse, or sustainable disposal. The United States is largely a linear system, with little attention to environmentally conscious extraction or production and few resources devoted to sustainable waste management. Cell phones are a good example of the linear economy that nearly everyone in the economically developed world is a part of. Most smart phones are built with "planned obsolescence", meaning they are built to be replaced within a few years. This building style means that companies can guarantee people will buy new phones within a certain amount of time (Hadhazy, 2016). Smartphones are built to be hard to take apart and replace parts, meaning if one part breaks the whole device has to be replaced. This economic structure lacks conscious planning or environmental consideration. Instead, a linear economy focuses on production and consumption, with the environment as a secondary consideration.

Circular Economy

A circular economy replaces or supplements a linear economy by taking the various elements while decreasing the reliance on raw materials and finding a more beneficial use for waste. A growing population has led to an increase in the reliance on raw materials, and a circular economy offers a method to recirculate resources (Ghosh, 2019). The circular economy could save between $380-630 billion in the European manufacturing sector alone. A circular economy includes circular design, innovative business models, and enables cross-sector collaboration (Ellen MacArthur Foundation, 2013). Circular economies also decrease price volatility as there is less reliance on raw material extraction. This shift away from raw materials leads to a decrease in externalities in the production-

consumption process. A circular economy goes beyond recycling and is focused on building a restorative industrial sector that sees waste as a potential resource (Ghosh, 2019). In practical terms, a circular economy aims to use durable materials that can be repaired or taken apart as they are used. Further, materials that cannot be reused are repurposed in other products or managed in a sustainable way. Returning to the smartphone example, a circular economy would have companies that build devices that are easier to take apart and fix. Finding ways to end planned obsolescence is one goal of a circular economy. A circular economy aims to find conscious production and consumption patterns that create less waste and has less need for raw materials.

US Policy Moving Forward

The United States needs to begin restructuring the waste management systems and begin consciously transitioning to a circular economy. Policy on regulation of waste has largely occurred at the local level. Recent examples have been the banning of single use plastics such as straws and plastic bags at the city or state level. Though these policies are well intentioned, they are limited in actual impact and do little to address the root problems (Ghosh, Guran, Mersky, 2019). When different economic and policy futures are modeled, the laissez-faire scenarios result in the least change. This shows that federal policy is needed to address this issue in a uniform, industry wide manor (Sørensen, 2017). This section will explore three ways the US can confront this issue and begin the transition to a circular economy.

The Responsibility of the Individual

Much of the environmentalist discourse is focused on structural change rather than individual action. The action of individuals pales in comparison to the size of the problem and the needed solution. Typically this means that individual responsibility is ignored within the environmentalist discourse. However, in policy making, there has been an over reliance on individual's taking steps to recycle or reduce waste. Though individuals cannot be the only variable that changes, consumption habits must be shifted if the circular economy is going to be achieved. Individuals take more responsibility for their environmental impact when they feel that it is actual making a difference, and there are larger structural supports to their actions (Eden, 1993). This means that individual change will occur when there are incentives and opportunities. The US's increased recycling over the last few decades has partially been due to increased public awareness about recycling. This public awareness has been coupled with larger recycling programs. One way to incentivize individuals is to price externalities. Placing a fee on linear goods would incentivize consumers to look for cheaper circular options and incentivize businesses to offer circular goods to compete (Dolinsky & Maier, 2015). Placing a Pigouvian tax on goods is a market-based method of changing consumption and purchasing habits. These modest taxes allow for the push needed to get consumers to demand different goods. The downside of this method is that goods become more expensive and a viable alternative may not be readily available. In this way, a Pigouvian tax would still place responsibility on the consumer that many individuals cannot bear. In the long run, opportunities and incentives should be established in order to change individual consumption habits.

Upgrading America's Manufacturing Sector

In recent decades America's manufacturing sector has largely moved abroad. Lower wages, less regulation, and a cheap currency have made China, and much of southeast Asia a prominent location for businesses to relocate (Bartash, 2018). This means that regulations and standards for production can be ignored by businesses. In order to transition to a circular economy the US must invest in a clean manufacturing sector, updating infrastructure that has been left unchanged for decades. After the Great Recession, China invested half of its $650 billion stimulus into clean energy and electric cars. This investment led China to be the leading producer of clean energy, electric cars, and lithium batteries (Bledsoe, 2020). China's ability to scale up these markets in the last decade offers a good blueprint for how the US can follow suit in clean manufacturing. The United States, and the entire global economy, are in the middle of a recession, and possibly a long-term depression, due to COVID-19 (Pickert, McIntyre, Qui, 2020). The stimulus money that will rebuild the economy offers a great opportunity to follow China's lead. Rather than punish polluters and raise taxes, the current situation offers an opportunity for the government to give tax incentives for circular production and consumption. Investments in clean projects have a higher return on government investment than standard stimulus programs (Harvey, 2020). The post-COVID economy could be a circular one if the stimulus to rebuild the economy focuses on conscious and sustainable production and consumption methods. This manufacturing shift would prioritize two major shifts in production methods: 1)

remanufacturing goods to develop a closed loop and 2) resource conservation in production methods. Remanufacturing is the recovery of products or resources in order to limit the need for new raw materials. Durable products are restored to be reused and create a closed-loop supply chain. Resource conservation is prioritizing production methods that find less need for raw materials, and fewer materials in general (Lieder & Rashid, 2016). Product conservation and durability are not new ideas in manufacturing as businesses conserve in order to lower costs. Yet the focus has not been on reaching these goals for sustainability or creating long-term shifts in production. This contributes to the idea of industrial ecology, which posits that the industrial sector is a type of ecosystem with stocks and flows (Erkman, 1997). The complex relationships should be shifted in a circular economy to better allocate resources and decrease the overall need for raw materials. The industrial ecosystem should recognize product lifestyles and account for cross-sector cooperation to reduce the overall systems need for raw materials. This represents the larger, long-term manufacturing shift that must occur. The circular economy is built upon a circular manufacturing system that is incentivized and jumpstarted through government investment.

Expansion of Clean Waste Infrastructure

Though a circular economy's goal is to create a closed-loop, waste will inevitably be produced. Current waste management includes circular processes such as recycling, but ultimately most waste in America ends up in a landfill (EPA, 2016). In order to transition to a circular economy, federal and local authorities must establish waste infrastructure that helps close the loop and find uses for waste. As mentioned earlier, one method is mass waste burn which burns waste to produce energy and stores the ash in a safe way. Clean air and water legislation protects the local environment, providing a green energy source that finds a use for what would otherwise be thrown out. Alternatively, energy capture systems can be established that capture methane as waste decomposes. These programs have proven to be just as environmentally sustainable and often cheaper than waste burn (Dijkgraaf, 2003). These systems can be incentivized by state and federal grants for the development of methane capture systems. In New York State, these facilities produce only 716,000 mWh of electricity annually, revealing how little these systems currently are (NYSDEC, 2018). These programs should be expanded in coming years to provide more sustainable pathways for waste. By creating a clean waste system, the circular economy can be rounded off by using waste in a productive manor when no other options are available.

Conclusion

This paper concludes that though individual consumption patterns will change in transitioning to a circular economy, large-scale reform must be initiated at the federal level in order to create durable changes. The United States has a serious problem with managing waste in a sustainable way. Changes must be made in production of goods in a circular way that seeks to reuse rather than extract more raw materials. Products should also be made to be fixed, making them durable and long-lasting. Consumption patterns must also shift. The individual consumer should not be expected to change a systemic problem, but improvements can be made to consumption habits. On the other end of our linear process there should be sustainable waste management to recycle or find second use for goods at the end of their lifecycle. Federal and local governments need to begin expanding sustainable waste management infrastructure and incentivize the production of circular goods. In order to fully close the loop, manufacturing must be viewed as a complex ecosystem that has limited access to resources. Governments and businesses must recognize the limits to raw materials and the environmental harm that comes with extraction. Production methods must be updated to confront the global issue of climate change. Rather than focusing narrowly on clean energy, the environmentalist discourse must expand to talk about transitioning to a circular economy.

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Lab-Grown Meat: A Niche Innovation to Feed the World's Disease Vulnerable Populations and Replace Current Meat Production Regimes

Suraa El Gazzar

Introduction

FAO (food and agriculture organization) estimates that by 2050, the world population will reach around 9.1 billion people. Most of this growth is expected to occur in developing countries and it will bring along an increased demand on food production as consumption will increase drastically. In order to accommodate this rapid growth and demand, FAO estimates food production must increase by around 70% percent (FAO, 2009). It is common sense to assume that the demand on livestock production will also increase as meat consumption will most likely rise amongst the world's growing populations. On the other hand, WHO warns that the increased demand for animal protein is one prominent factor contributing to the increased risk of the emergence and spread of pandemics (WHO, 2004). The risk of disease emergence and spread is of more relevance than ever as the whole world is currently struggling to combat the most recent pandemic, COVID-19. If one lesson COVID-19 has taught us, it is that we are far more vulnerable to the spread of diseases than we have initially thought.

In light of the current situation, the increased demand on livestock production which is likely to be a result of the world's growing populations presents us with a set of complex and problematic environmental, ethical and food safety challenges. Not only do we have to find new ways to feed the world's growing populations but we also have to ensure that these ways do not compromise the health or increase the risk of disease amongst our significantly vulnerable populations.

Finding solutions to this critical problem will require us to think beyond the scope of the conventional means of livestock production as they have long been resulting in environmental, ethical and food safety complications. Complications have led many people to view the current livestock industry in a very negative manner (Stephens, Di Silvio, Dunsford, Ellis, Glencross, & Sextonf, 2018). We are in need of new and innovative solutions which can shift the current regimes of livestock production in order to protect the environment, promote more ethical treatment of animals and ensure access to safe and healthy food for the world's growing populations (Tuomisto, & Mattos, 2011).

Lab-grown meat is an emerging technology which provides rather promising solutions to the environmental, ethical and food safety problems caused by conventionally produced livestock. However, since lab-grown meat is yet to make its way to the consumer market. Any forward-looking promises provided by supporters of the technology are of a speculative nature. In that regard, the technology might face a range of complications which can limit it from delivering its promises of a better future. It is important to identify these limitations in order to ensure that they are addressed in the right time. This way the technology can be developed on the basis of a proper foundation that can ensure the best possible outcomes for the future.

This paper is going to address the environmental, ethical and food safety problems resulting from conventional livestock production and the solutions lab-grown meat can offer to these problems. Furthermore, the multi-level perspective will be used in order to contextualize the potential for lab-grown meat to shift the current regime of meat production. This will also be done to establish stronger grounds to why lab-grown meat can be the next regime shifting niche innovation and how it has potential to align with existing sustainability concepts. Finally, a light will be shed on the multiply of limitations that could face the uncertain future of lab-grown meat.

The problem

Globally, the production of livestock is one the largest contributors to environmental degradation and climate change (Tuomisto, & Mattos, 2011; Tuomisto, & Roy, 2012). Livestock raised for the production of meat makes use of around 30% of the global ice-free land, in addition to 8% of global freshwater repositories. Livestock production also produces 18% of global greenhouse gas emissions, generally consisting of methane and carbon dioxide (Tuomisto, & Mattos, 2011). Moreover, the production of livestock largely contributes to a plethora of environmental impacts including the degradation of wildlife habitats, loss of biodiversity, deforestation and eutrophication of waterways (Tuomisto, & Mattos, 2011; Tuomisto, & Roy, 2012). The environmental impacts can depend on the type of meat that is being produced. For example, beef has been shown to have the highest impacts on the environment, followed by poultry and fish (Tuomisto, & Mattos, 2011).

Asides from the dangers it poses on the environment, livestock production is a source of concern for food safety, health and unethical animal treatment. Nowadays, intensive animal agriculture takes place in what is known as factory farms. Factory farms are occupied by large amounts of animals, which are usually kept in very close distances to one another. Hygiene is often insufficient and stress levels of said animals are high due to the poor treatment they undergo. Such conditions make factory farms a good place for the take off of zoonotic diseases to (Leenaert, n.d.). Zoonotic diseases are caused by harmful germs such as viruses, parasites, bacteria, and fungi. What makes zoonotic diseases so dangerous is their ability to be transformed from animals to humans (CDC, 2017). Further resulting in various illnesses in humans, some which can be mild and others which can result in severe illness and death. Zoonotic diseases can spread from animals to humans in many ways such as direct or indirect contact with a diseased animal or a contaminated area. They can also spread through the consumption of contaminated foodstuffs and drinks (CDC, 2017). One reason that makes zoonotic diseases difficult to deal with is that depending on the type of disease an animal is carrying, it can sometimes appear to be healthy (CDC, 2017). Thus making disease detection quite challenging. While not all zoonotic diseases can become pandemics, a lot of them have the potential to become ones. Take for example COVID-19, the most recent pandemic which has brought the whole world to a halt. COVID-19 is in fact a zoonotic disease which is believed to have originated from China's known "wet-markets" where many humans come in contact with a variety of wild animals which have the potential of carrying many diseases (Leenaert, n.d.)

The agriculture industry, with its widespread factory farm conditions is another place where humans come in very close and direct contact with diseased animals. Further increasing the risk of the spread of zoonotic diseases. Many fatal epidemics and pandemics such as the swine flu (H1N1), bird flu (H5N1) and the Spanish flu which is one of the biggest recent pandemics all emerged from pig, chicken and bird farms. Animal diseases are constantly emerging globally and it can be a matter of time until a new fatal disease spreads among humans (Leenaert, n.d.)

If we intend to meet the world's increasing demand for animal protein, we need to find better ways of doing so. That is because the conventional system of livestock production has proven to be problematic for the reasons mentioned above. Not addressing these problems can result in disastrous outcomes for the environment, animals and humans all together. It is therefore our responsibility to find solutions to these problems while we still have the time to do so.

The solution

Lab-grown meat is one emerging technology with a potential of offering solutions to the environmental, ethical and food safety problems caused by conventionally produced livestock. Lab-grown meat, also known by many as cultured, clean and in vitro meat is a seemingly recent technology. It is produced through placing stem cells extracted from animals in a nutrient rich serum which encourages the cells to develop into muscle-like tissue (Irealnd, 2019). The upcoming sections will discuss the environmental, ethical and food safety solutions which can be offered by lab-grown meat in greater depth.

a) Environment and sustainability

First of all, lab-grown meat can offer far more environmentally friendly means of meat production when compared to conventional livestock production (stephens, et.al, 2018).

Lab-grown meat is estimated to produce 78-96% less GHG emissions, use 82-96% less water and make use of 99% less land in comparison to conventionally produced meat (Tuomisto, & Mattos, 2011). Lower land use can also offer solutions to further environmental issues such as the eutrophication of waterways. Additionally, lab-grown meat can utilise food waste resulting from conventional livestock production. This is because producers have the choice of producing only the prime-cuts that are usually consumed in controlled portions. And thus not having to kill a whole animal and then disposing of parts that are not consumable (Stephens, et.al, 2018). Sustainable means of production and better waste management will allow the technology to relieve the current regime from the environmental burdens that it is producing and hopefully transition it towards a more sustainable system.

b) Ethics and animal welfare

When it comes to animal welfare, lab-grown meat makes use of significantly lower numbers of animals than those used for conventional livestock production (Stephens, et.al, 2018). Animals are usually only needed for the

extraction of small amounts of cell samples and the extraction of said samples is claimed to be a very simple process that is relatively harmless. This means that a significantly lower number of animals will need to be held captive in factory farm conditions that have been mentioned in earlier sections. Moreover, since animals are mainly needed for the extraction of small amounts of cell samples, the whole process of production is less likely to result in the mass domestication and killing of animals. This can result in a higher appeal for people interested in animal rights as the technology appears to be far more concerned with animal welfare (Stephens, et.al, 2018). In general, lab-grown meat appears to have the potential of establishing a regime of meat production that is far more involved with the ethical treatment and wellbeing of animals than it's conventional opponent.

c) Food safety and disease control

Another potential benefit of lab-grown meat is that it can be less prone to disease because it undergoes strict production processes which allow for higher disease control (Stephens, et.al, 2018). This is because the majority of production activities occur within a controlled lab environment and require far less direct contact between animals and humans when compared to conventional livestock production. Moreover, since lab-grown meat does not require the mass domestication and killing of animals, factory farm conditions normally finding place within the conventional livestock industry will be less likely to exist for the lab-grown alternative (Mattick, Landis, Allenby, & Genovese, 2015). Therefore, lab-grown meat has the potential of drastically decreasing the risk of the spread of zoonotic diseases. Another health benefit of lab-grown meat lies in the ability to control the nutritional value of the meat being produced. Resulting in a type of meat that is higher in quality and nutritional value (Post, 2012). When it comes to the challenge of feeding the world's growing populations, lab-grown meat can offer great solutions as it does not rely on geographical factors such as land quality or climate to be produced (Stephens, et.al, 2018). Meaning that people within disadvantaged geographical locations might be able to have access to potentially disease free, more nutritious and higher quality meat.

Multi-level perspective analysis

According to the multi-level perspective (MLP), systemic transitions occur as a result of the relationships and interactions between three main levels: niches, socio-technical regimes and the socio-technical landscape (Geels, 2011). A level is seen as higher when it is more stable, mainly due to the number of actors and the degrees of alignment between its various elements. At the very top is the socio-technical landscape, it consists of technical and material backdrops, political ideologies, societal values and much more. It offers the wider context that is of influence to the dynamics between niches and regimes. While changes in this level are possible, they usually take a longer time to occur (Geels, 2011). The socio-technical regime is in the middle, consisting of established rules and practices which guide and stabilize existing socio-technical systems (Geels, 2011). When all elements and actor-groups within a system are properly aligned and functioning in harmony; the system is sought to be 'dynamically stable'. This stability locks in the system, allowing only minor innovations to occur within a regime (Lawhon, & Murphy, 2011). However, there are times when regime or landscape elements might become misaligned. Often creating tensions that pressure a regime and result in a state better known as destabilisation. Destabilisation 'unlocks' a regime, allowing technological innovations that have been developing within niches to make their way into the regime (Geels, 2011; & Lawhon, & Murphy, 2011). Finally, at the lowest level are technological niches. Niches can be envisioned as 'nurseries' where actors work on developing and growing radical innovations. These innovations are seen as radical because they deviate from the status quo of existing regimes. And they are often developed with the intention of offering sustainable alternatives which can become part of or even completely replace existing regimes (Geels, 2011; & Lawhon, & Murphy, 2011).

a) Transitioning towards a better regime of meat production

Following the reasoning provided by the multi-level theory of sustainable socio-technical transitions (MLP). At its current state, Lab-grown meat can be said to be a niche innovation. This is because the technology is rather recent, only a few actors (start-ups and investors) globally are working on its development and while it does provide a lot of promise for the future, most research done on it is speculative (stephens, et.al, 2018). Additionally, lab-grown meat differs drastically from the current regime of conventional livestock production. Thus adding to its instability, which is one of the main characteristics of niche innovations (Lawhon, & Murphy, 2011).

The current regimes of livestock production, which is led by the global livestock industry has come under increasing scrutiny in recent years due to its negative environmental, ethical, and human health impacts (stephens, et.al, 2018). Consumers are becoming more aware and critical of the current regimes, while demand for meat substitutes is constantly increasing within the market (stephens, et.al, 2018). This can also urge higher level actors into realizing that moving towards a sustainable and healthier future for meat production is impossible to achieve using current systems. These changes are creating a state of tension within the regime but also at the landscape level. It can be said that the tension is destabilizing the current regime and opening it up for niche innovations. This is the perfect opportunity for lab-grown meat to make its way into becoming part of the current regime or potentially replacing the whole regime. While rather hopeful, replacing the current regime can be feasible since it consists of many gaps, making it rather impossible to move forward in meat production without making incremental adjustments to the current regime.

b) Gaining momentum

Lab-grown meat can develop by making use of existing concepts and initiatives that aim to achieve a sustainable and healthier world. This will allow the niche innovation to perfectly align with the political ideologies, societal values and technological expectations that have been changing within the regime and at the landscape level. In addition to allowing it to develop with a set of solid core values and foundations that revolve around respecting and supporting the wellbeing of nature and humans. In doing so, lab-grown meat will gain a strong momentum. Enabling the technology to launch into the current regime without being weakened by its state of destabilization. And giving it the proper chance to offer solutions that will fill the gaps produced by the current regimes while offering support to existing concepts and initiatives. Examples of such concepts could be the Sustainable Development Goals, which consist of a set of universal goals that aim to address and find solutions to urgent global environmental, political and economic challenges. Examples of additional concepts with a high potential of alignment are planetary boundaries and the doughnut economy. On the longer run, lab-grown meat will finally stabilize tensions on the landscape level and eventually replace older regimes.

Limitations

Despite having the potential to relieve the livestock industry from some of its environmental, ethical and food safety burdens. It is very difficult to judge the future of lab-grown meat and understand what it's consequences might be, especially if it becomes a market commodity that is produced at a large-scale. As the technology is rather recent only a few start-up companies are currently working on its development and most of these start-ups do not make information about their progress readily available to the public (stephens, et.al, 2018). Due to the same reasons, most of the research body available on the benefits the technology offers remains to be speculative (stephens, et.al, 2018). Meaning that all promises of it being more sustainable, ethical and healthier are nothing but predictions which can easily shift given certain circumstances.

For example, large-scale production of lab-grown meat might introduce yet another phase of industrialization with newer environmental burdens (Mattick, et.al, 2015). To be produced, lab-grown meat requires a lot of energy (Mattick, et.al, 2015). Even more energy in contrast to some conventionally produced livestock such as poultry (Tuomisto & Mattos, 2011). The concern lies in the source of energy being used for production, if the main source of energy is unsustainable then the risk of high amounts of pollution and greenhouse gas emissions might become as high as that of conventionally produced meat. Moreover, if lab-grown meat is presented to the market as a mere addition which encourages higher consumption levels of meat rather than actually substituting conventionally produced livestock. We will be presented with something known as the 'addition effect' (stephens, et.al, 2018), which will increase meat consumption while adding on to the environmental burdens as we will have both lab-grown meat and conventionally produced livestock in the market. This scenario can have disastrous outcomes for the environment as it will add on to the already existing burdens. To avoid this, lab-grown meat should remain focused on replacing conventionally produced livestock. Especially those produced at a large-scale.

In addition to environmental concerns, lab-grown meat raises a few ethical concerns as well. One of them is regarding the relationship between humans and animals. The introduction of lab-grown meat to the consumer market can provide many consumers with a guilt free alternative to conventionally produced meat, which can encourage many to consume it in bigger amounts. Eliminating the guilt aspect from the equation of meat consumption will prevent many people from addressing crucial moral and ethical questions related to the way they

believe animals should be treated as such questions will no longer be relevant (M. Kiefer, personal communication, January 21, 2020). Ignoring such questions might have many negative consequences on the relationship between humans and animals. Moreover, it can result in emphasizing an existing relationship pattern that is centered around the domination and use of animals for the benefit of humans. This is rather dangerous as it can support views assuming that belonging to the human species grants us a superior moral status over other species (Singer, 2009). And thus favouring the wellbeing and dignity of humans over that of animals.

Lab-grown meat can also introduce inequalities in food access and safety since it is claimed to have better health benefits and to be of higher quality than conventionally produced meat. If equal access to lab-grown meat is not ensured, it might place those who have no access to it at a disadvantage. Increasing their risk of having poor health and life quality, in addition to exposing them to a higher chance of contracting zoonotic diseases. This is especially the case for countries with limited resources or ability to produce lab-grown meat. Lab-grown meat can be considered a viable and ethical solution to solving the food safety and access crisis for the world's growing populations under the condition that it is made available for all people, regardless of their background (stephens, et.al, 2018).

It is important to keep in mind that while the limitations can create new challenges, they can also be seen as an opportunity to learn and improve. Since the technology is still developing, it offers a lot of freedom for people working on its development to design the technology in the most optimal ways. Which if done early on, will establish a solid foundation deeply intertwined with a set of core values that care for and prioritize the wellbeing of nature and humans. This can potentially safeguard the future of lab-grown meat, make it resistant to the domination of big agricultural corporations and allow it to achieve a shift towards more sustainable and ethical regimes of meat production and consumption.

Conclusion

Lab-grown meat is a niche innovation with a high potential of replacing current destabilising regimes of meat production. The technology might offer solutions to the environmental, ethical and food safety burdens created by conventional livestock production. However, it's future is challenging to predict as it is still in the development phase. Future research should focus on addressing possible limitations and transforming those limitations into opportunities to learn and improve. In order to allow the technology to meet up to its potential.

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A Proposal to Encourage Participatory Democracy within the Global Humanitarian System Through a Decentralized Accountability Platform

Paris Cosma, Elaine Donderer & Ezekiel Stevens

Abstract

Establishing a decentralized accountability mechanism for the humanitarian system is important for the success of localization commitments under the Grand Bargain. Data from local actors can complement the self-reports of IOs and thereby democratize the humanitarian system. Many studies have looked at the benefits of bridging the gaps between top- and bottom level actors in the humanitarian system and found that there is great potential in nested networks and collaboration. However, yet there is a limited understanding of the opportunities new technologies can offer in this context. To address this gap and inspire innovative thinking, this study asks: How can an organizational process innovation decentralize accountability mechanisms within the global humanitarian regime, and thereby, encourage participatory democracy? To answer this research question, this call for change explores the humanitarian regime and its actors. Subsequently, it develops performance indicators and tools for the proposed platform. Lastly, it discusses limitations and specifies a plan for implementation. It is expected that this innovation can reconfigure the global humanitarian regime and thus, encourage other models of participatory democracy through open source technology.

Keywords: Grand Bargain; Humanitarian System; Organizational Process Innovation; Localization; Decentralized Accountability Mechanism, Participatory Democracy

Section One: System and Actor Analysis

By Elaine Donderer

Introduction

Environmental risks have dominated the WEFs Global Risks Report for the past seven years (WEF, 2019). The progressive increase of disasters is characterized by a great number of casualties (Cinque, Fiorentino, Esposito, Carrasco & Matarese, 2015). Hence, the increasing risks require more effective disaster management to protect humanity. Localization has grown into a buzzword in the humanitarian community (Metcalfe-Hough, Fenton, & Pool, 2019). Hence, to improve disaster relief, 61 of the largest donors and humanitarian organizations committed to give greater means into the hands of people in need (ibid.). Under the Grand Bargain, signatories have reached the consensus that local actors have a greater potential to assess the situation and context of a disaster better than even the best-intentioned international agencies (Gingerich & Cohen, 2015). Thus, local actors can give great insight into the particular needs and best strategies for particular relief operations (ibid.). Therefore, the Grand Bargain signatories seek to close the humanitarian financing gap between the top-level donors and bottom-level humanitarian organizations. Ambiguously, foreign aid regularly escapes rigorous cost-benefit analysis and often relies solely on self-assessments, thus, preserving the status quo (Hancock, 2006). Scholars such as McGoldrick (2011), observe a widening gap between what humanitarian actors say they will do and what they are able to do on the ground. Hence, the humanitarian system requires an innovation that can enable local participation as well as the accountability of top-level actors. New technologies present opportunities to change the way humanitarians work together, with specific regard to data collection and sharing.

Therefore, this proposal outlines an organizational process innovation to hold actors in the global humanitarian regime accountable through open source data gathering. By this, the proposal calls for a change in global risk governance and promotes the notion of participatory democracy and self-regulated governance through big data sharing. Thus, the study asks: How can an organizational process innovation decentralize accountability mechanisms within the global humanitarian regime, and thereby, encourage participatory democracy? In answering the question, the study applies different methodologies to develop a solution that captures the complexity of the humanitarian regime (see Annex, Figure 14). Firstly, it analyses the actor dynamics in the aid regime, as well as their needs in order to identify key challenges for the humanitarian regime. Subsequently, it outlines specific requirements

for the innovation. Further, it introduces performance indicators and potential methods for data analysis. Lastly, the findings reflect on the limitations of open-source accountability mechanisms and develop a concrete proposal for the implementation of the project. Hence, this study inspires researchers and practitioners to develop this innovation further and critically reflect on innovative solutions for participatory global risk governance.

Theoretical framework

This section reviews the main theoretical elements and definitions. Firstly, the proposed platform innovates how humanitarian actors organize processes within the regime. Thus, it can be classified as organizational process innovation which does not only incorporate a technical, but also a social dimension. This paper applies the multi-level perspective by Geels and Schot (2007) to classify the proposed socio-technical transition. The MLP looks at transitions through the interaction at three levels: a) development of niche innovations, b) landscape changes, and c) socio-technical regimes and their degree of destabilization (Geels & Schot, 2007). For instance, climate change and increasing disaster risk introduces a landscape pressure onto the humanitarian regime. If the regime does not have the sufficient tools to alleviate this pressure, it becomes destabilized. The destabilization of the regime creates a window of opportunity for niche innovations to build internal momentum and introduce themselves. Consequently, the adopted innovations address landscape pressures and reconfigure the structures of the regime. This framework is deemed most appropriate because it employs a narrative that can to capture the complex interactions of process innovations (Geels, 2011).

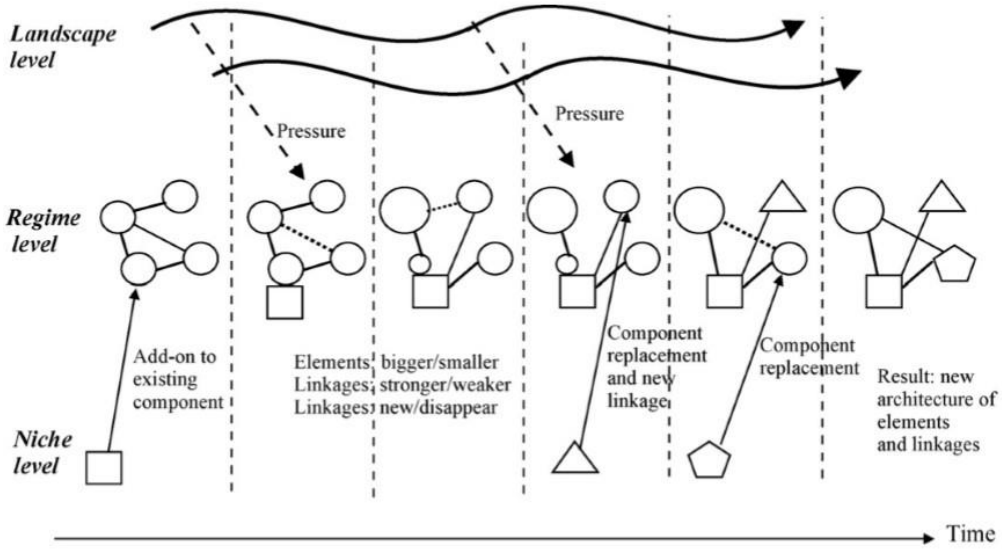

Figure 1: The interaction of the three levels for the reconfiguration pathway (Geels & Schot, 2007, p.412)

The proposed organizational process innovation is situated in the reconfiguration pathway, as introduced by Geels and Schot (2007) (Figure 1). This is because the proposal aims to outline a potential symbiotic relation of the innovation with the humanitarian regime in order to be easily adoptable. The research addresses the three core processes of niche innovations to explain the potential reconfiguration (Geels, 2011). Firstly, it articulates and adjusts the expectations towards the innovation to develop a future vision. Additionally, it illustrates the necessary learning and articulation processes while proposing social networks for implementation (ibid.). This organizational process innovation is introduced to solve the specific problem of accountability. Although the platform leaves the rules of the humanitarian regime unchanged, the adopted innovation might enable further adjustments. The innovation impacts the dynamics of regime actors and inspires them to explore further technical changes or innovations of regime actor practices (Geels & Schot, 2007). Hence, the interplay of various technologies for a decentralized accountability mechanism could eventually trigger fundamental changes in the architecture of the humanitarian system. As noted by Markard, Raven and Truffer (2012), socio-technical transitions give not only rise to changes in the technological dimension, but ultimately impact user practices and institutional structures.

Thus, the paper applies the participatory governance framework by Borrás (2012) to capture the socio-

democratic dimension of the transition. Borrás (2012) observes a tension between the role of citizens and scientific experts when it comes to decision-making concerning collective problems and their solutions, especially when involving technology. Furthermore, he observes a shift in the patterns of authority and institutional arrangements in the field of science and technology (Ibid.). This crisis in public management leads to a greater involvement of civil society. In other words, the regime gradually transitions from governments to global governance (ibid.). Indeed, citizens increasingly collaborate to share their social and economic capital, as well as information. This shared knowledge can potentially empower citizens and foster public understanding of science, hence, bridging the gap between experts and citizens (ibid.). According to Borrás (2012), actively participating science citizens would allow for an informed public debate on socio-technical transitions. The empowerment of citizens and experts through participatory mechanisms builds the cornerstone of the proposed organizational process innovation, ultimately promoting a model of participatory global governance.

Humanitarian System Analysis

The following articulates the current landscape of the humanitarian system to define the scope of the transition. As noted by Borton (2009) in "Future of the Humanitarian System: Impacts of Internal Changes", a defining feature of the humanitarian system is a lack of consensus on what it consists of and where its boundaries lie. Hence, there is no universal conceptualization of the humanitarian regime. For instance, some scholars reject the notion of 'system' altogether since it would presuppose a common goal of the involved actors (Borton, 2009). In the light of these skeptics, Borton (2009) defines the humanitarian system as the "multiplicity of international, national and locally-based organizations deploying financial, material and human resources to provide assistance and protection to those affected by conflict and natural disasters with the objective of saving lives, reducing suffering and aiding recovery" (p.5). Thus, the humanitarian system exemplifies a complex web of interactions with highly political implications. Hence, an interactive problem definition is decisive for the design of the project. Humanitarian relief environments engage a large number and variety of actors, each with different missions, interests, capacity, and logistics expertise. (Balcik et al., 2010) (see Figure 2).

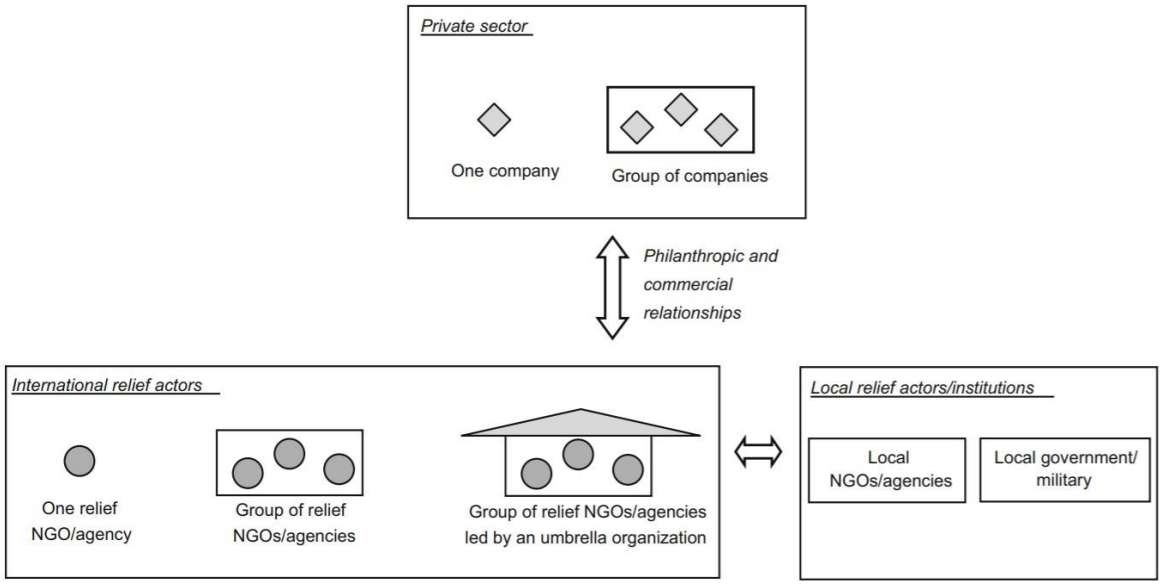

Fig. 2. Relief chain relationships.

Figure 2: The humanitarian relief supply chain relations (Balcik et al., 2010, p.26)

Notably, aid has become an industry with an increasingly crowded marketplace of organizations competing for funding (McGoldrick, 2011). The majority of relief organizations relies completely on donor funding and can only carry out their work once funding becomes available (Seaman, 1999). Hence, the donors constitute the key decision makers within the relief supply chain because they supply the financial means for the operations (Beamon & Balcik, 2008). However, funding is provided voluntarily and thus, frequently attached to certain conditionalities. Therefore, donors are commonly regarded as customers of aid organizations. Due to their position

as *customers* of aid organizations, donors are subject to less scrutiny by third parties. Nevertheless, recent developments have shown a greater demand for accountability (Balcik et al., 2010).

Key actors and needs

The following maps out the top- and bottom level actors of the humanitarian regime to assess their needs and relevant challenges. For the purpose of this paper, actors are people and possibly institutions that play a relevant role in the socio-technical regime. In the case of the humanitarian system, this includes actors on the top-level, such as the state consisting of ministers, bureaucrats, etcetera. Furthermore, non-state actors such as the United Nations' specialized agencies, other civil society organizations, donors, research institutions and, the private sector play a decisive role specifically in the context of developing countries (Masango, Gwarinda & Taylor, 2015). On the bottom-level, humanitarian responses inter alia include local NGOs, households, aid recipients and aid workers. Recent global developments show the increasing interaction of state, market, and civil society actors as well as a growing diversity of actors involved in the humanitarian system (McGoldrick, 2011). The needs analysis is based on scientific literature and qualitative interviews with experts in the field of disaster management. The aim is to maintain the strictest possible separation between short-term interests, and underlying needs in terms of capacities. This research tries to bridge contradictions by pushing the latter into focus (see Annex, Figure 14).

Top-level actors in the humanitarian system

Firstly, the following maps out the top-level actors and their relations in the global humanitarian system. Notably, there is no supranational authority in the humanitarian system because that would compromise state sovereignty. Nevertheless, during the last century states have brought a great variety of international organizations to life in order to address poverty and vulnerability. The most prominent are the United Nations with its specialized agencies, inter alia OCHA and the UNDRR (Barnett, 2009). The UN system is the closest approximation to a supranational authority but in contrast to states, there are little accountability mechanisms. Thus, traditional modes of governance fail here. This lack of global governance creates instability in the regime and hence, requires alternative models, such as participatory governance (Borrás, 2012).

Scholars such as Barnett (2009) refer to the UN cluster as the *humanitarian club*. This is because UN agencies disproportionally dominate the funding resources (Gingerich & Cohen, 2015). In the words of Gingerich and Cohen (2015): "They are by far the largest first-level recipients of humanitarian assistance." (p.27). Critics point out that these actors retain all the power and thus, do not facilitate participatory governance for those affected by crises, but merely supply their money, staff and expertise to those it serves (Gingerich & Cohen, 2015). Although states remain to play a key role in disaster relief, they have little or no way of holding these international organizations accountable. This is highly problematic, considering the great impact these international actors have on communities. Hence, localization has grown into a buzzword in the humanitarian community. As a consequence, the Grand Bargain set the goal to close the humanitarian financing gap between the big donors and humanitarian organisations in humanitarian aid (Metcalfe-Hough, Fenton, & Pool, 2019).

In particular, recent developments have shown a trend towards a greater involvement and coordination with a wider range of humanitarian actors (Metcalfe-Hough, Fenton, & Pool, 2019). For instance, the humanitarian system establishes growing networks with the private sector. The private sector can offer technologies such as remote-sensing and renewable energy for platform servers which can improve humanitarian responses. This trend is partly fueled by increasing public demands for corporate social responsibility, the concept of self-regulation of industries according to democratic values such as ethically oriented practices. The private sector can support relief operations both through monetary transactions, as well as philanthropic support (Bolcik et al., 2010) (see Figure 2). The private sector can thus diversify sources of funding. Additionally, new technologies can address the lack of coherent, and accurate data by often competing humanitarian organizations (McGoldrick, 2011).

Bottom-level actors in the humanitarian system

Secondly, this research looks at the bottom-level actors in the global humanitarian system. Under the Grand Bargain, signatories have reached the consensus that local actors have a greater potential to assess the situation and context of a disaster better than even the best-intentioned international agencies (Gingerich & Cohen, 2015). Thus, local actors can give great insight into the context-specific needs and best strategies for relief operations (ibid.). Nevertheless, merely 30% of national NGOs and 26% of local NGOs surveyed in four countries perceived that

they could influence relief agendas or were treated as equals during negotiations (Metcalfe-Hough, Fenton & Pool, 2019). Therefore, the global humanitarian system exemplifies a lack of agency of local civil society and aid recipients, thus, hindering mechanisms of accountability through participatory democracy.

Additionally, national, and sub-national civil society organizations face disadvantages in accessing funding (McGoldrick, 2011). It is noteworthy that certain UN-funding mechanisms are not accessible to independent NGOs at all, making it impossible for them to operate in complex settings such as Somalia (McGoldrick, 2011). Hence, the disproportionate bureaucratic effort, the greater scrutiny of their credibility and legitimacy, as well as the lack of funding create hindrances for a global participatory democracy (Borrás, 2012). It is therefore imperative of the current actors to strengthen local humanitarian leadership and involvement, as well as vertical coordination to bridge the gap between the top and bottom level actors of the humanitarian system (McGoldrick, 2011). For instance, giving greater agency to aid recipients through open source platforms could potentially challenge the mandate-based data of humanitarian organizations and thus, gradually reconfigure the global humanitarian system (Geels & Schot, 2007).

Bridging the gap between top- and bottom-level actors

One of the key barriers to national and sub-national NGOs' access to funding roots in a lack of vertical engagement of top- and bottom level actors (Metcalfe-Hough, Fenton, & Pool, 2019). This constitutes a lack of participatory governance of local bottom-level actors within the global humanitarian system, and thus, a lack of agency of, for instance, aid recipients. Modern global governance is characterized by a steady expansion of the areas of life which it addresses. Therefore, this collective responsibility for humanity can only be governed by a more complex architecture of governance and requires new forms of knowledge (Borrás, 2012). Institutions of global governance became increasingly dedicated to humanitarian practices. Hence, it is necessary to establish the accountability of these supranational institutions to the populations they serve.

As illustrated in the Grand Bargain (Metcalfe-Hough, Fenton, & Pool, 2019), there lies a potential value in linking global networks and local nodes. By definition, the humanitarian order includes any actor that is concerned with the well-being of humankind (Barnett, 2009). Indeed, in the last few decades, the variety of actors in the humanitarian system has expanded, including a greater range of actors with different interests and respective levels of power (ibid.) Hence, the Grand Bargain argues that humanitarian organizations must expand their networks and involve a more diverse set of actors, specifically on a sub-national level, to respond adequately in diverse contexts (McGoldrick, 2011). In other words, "change cannot be effected without the full involvement of all stakeholders and the adequate representation of their views and perspectives." (as cited in Warner, Waalewijn & Hilhorst, 2002, p.15). For instance, local agencies are understood to be more knowledgeable about the cultural context and needs of certain communities. In addition, bottom-level actors can deliver more diversified data on the appropriateness of funding in the field and thus, improve the knowledge capital of the global humanitarian system. Despite this potential, local NGOs face difficulties in getting involved with relief implementation, for instance, because meetings were held in French or English without translation into local languages (Bolcik et al., 2010). Notably, umbrella organizations such as the United Nations can support other agencies in their relief coordination efforts. However, the installed communication mechanisms for accountability are commonly horizontal. Hence, an online open-source platform to assess the performance of donor funding could decrease bureaucracy while increasing flexibility (Bolcik et al., 2010). Additionally, this innovation has the potential to ensure accountability to affected populations by making use of open source data sharing as a mechanism for participatory democracy (McGoldrick, 2011).

Key challenges

The following section outlines the key challenges of the humanitarian system that can be addressed by an open-source accountability platform. Firstly, the Grand Bargain establishes a need for increased funding towards decentralized disaster responses. This trend becomes specifically relevant in the face of global pandemics such as COVID-19 because international actors face even greater difficulties in reaching remote settings. In this sense, the humanitarian system shows a normative shift towards localization and national disaster response (Metcalfe-Hough, Fenton, & Pool, 2019).

However, there remains a lack of third-party data on the progress that donors make towards the Grand Bargain goal (Hancock, 2006). Indeed, the progress tracking of the Grand Bargain relies solely on self-reports by the donor organizations (Metcalfe-Hough, Fenton & Pool, 2019). Thus, there is no overarching entity that could control the commitments under the Grand Bargain. Since aid constitutes large financial investment, "it would (...) seem sensible, at the very least, for the official agencies to be directly accountable to the public – to be 'transparent', open and honest in their dealings" (Hancock, 2006, Introduction). However, a defining characteristic of the humanitarian system is that it is unregulated (Balcik et al., 2010). Thus, one must give special attention to potential mechanisms for regulation and specifically, accountability. To address the lack of diversified data and the accessibility of this data, the Grand Bargain signatories made commitments to engage with the open data community and support a diversity of actors in accessing and publishing data (Metcalfe-Hough, Fenton, & Pool, 2019). Open source technology has the potential to improve data collection.

Future vision

Lastly, this section of the proposal illustrates a utopian future vision of the humanitarian system. Thereby, it shows how the proposed organizational process innovation can approximate this vision. The future vision constitutes the ideology of this call for change and might inherit cultural bias due to the Eurocentric make-up of the research team. Hence, this section should be read critically. Nevertheless, the overall vision is necessary to set out the path for a self-regulated global participatory democracy based on the principle of humanity.

The following illustrates how the success of the proposed open-source process innovation would look like for the Grand Bargain. Notably, the global humanitarian landscape experiences pressures to democratize, as well as localize its efforts (Metcalfe-Hough, Fenton, & Pool, 2019). Therefore, it requires mechanisms for legitimacy and accountability through participatory evaluation. Empowering citizens through open-source reporting services can complement the internal reports of international organizations. Tracking and publicizing data on the funding given to national and sub-national actors can create greater transparency (Gingerich & Cohen, 2015). This is highly relevant since it allows those affected by crises to get involved as so-called science citizens and consequently, it has the potential to reduce the landscape pressure on the regime (Borrás, 2012). It has been established above that civil society organizations and citizens must extend their collaborations with INGOs and the public, as well as the private sector, holding actors at all levels accountable. According to Ikeda and Nagasaka (2011), bottom-level actors that are linked both horizontally and vertically with other actors can improve risk management through information sharing. Situated knowledge, localized experiences, and folk wisdom can supplement scientific expertise. For the future, "it is envisaged that including a multiplicity of voices leads to more democratic, integrated forms of resource management" (Warner, Waalewijn & Hilhorst, 2002, p.21) Hence, this call for change aims to inspire a global system of self-regulation based upon participatory accountability principles. We believe that accountability improves organizations' abilities to meet people's needs. Ultimately, the proposed organizational process innovation calls to reconfigure the humanitarian system according to the principles of participatory democracy (Borrás, 2012). Nevertheless, a vision means little if not sufficiently developed. Thus, the subsequent section will show how innovative technologies can substantiate the notion of a global participatory humanitarian system.

Section Two: Structured Design

By Ezekiel Stevens

This section analyzes the features of existing platforms for the coordination of humanitarian actors and specifies needs as well as potentials. By selecting single solutions for each requirement new combinations of functions are sought. Thus, the final innovation merges new and existing solutions to create a decentralized accountability mechanism.

The Grand Bargain

The Grand Bargain is an agreement made in 2016 between the largest humanitarian donors and organizations (Inter Agency Standing Committee, 2020.). As an agreement, it focuses on increasing localization in the aid sector, by initiating a series of changes in the working practices of both donors and organizations the Grand Bargain aims to

deliver additional resources directly to people in need (Inter Agency Standing Committee, 2020). As elaborated in Section 1, localization is a process of recognizing, respecting and strengthening the leadership of local authorities and the capacity of local citizens in humanitarian action, to better address the needs of affected populations while preparing actors for future humanitarian work (OECD, 2017, p.1). The agreement comprises 51 individual commitments streamlined into nine workstreams. The Grand Bargain is a non-binding agreement, with currently 62 signatories, whose progress is currently tracked by annual self-report (Inter Agency Standing Committee, 2020).

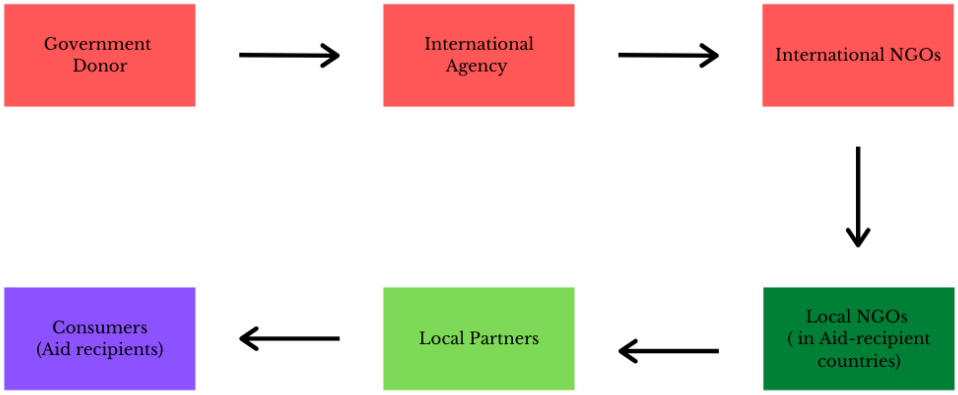

Figure 3: A typical humanitarian supply chain (Adapted from: Oloruntoba & Gray, 2006)

These self-reports are publicly available on the Grand Bargain webpage, commissioned by the Grand Bargain Facilitation Group. An overall annual report is produced by an independent group of consultants based on the self-report (Inter Agency Standing Committee, 2020). The progress is then ranked on a five-star scale from no significant progress to excellent progress. Analyzing the humanitarian supply chain in Figure 3 the Grand Bargain goals are being assessed from the position of the signatories but not from the bottom-level NGOs, partners, and aid recipients - who the Grand Bargain primarily aims to support. Therefore, to ensure accountability and transparency when it comes to reaching the Grand Bargain commitments an improved method of tracking the progress made by signatures is necessary.

Indicators

This section introduces the concept of indicators and discusses three relevant examples. Indicators quantify and simplify experiences to ascertain a complex reality in science, technology, or society (Patlitzianas, Doukas, Kagiannas, & Psarras, 2008) . According to the (OECD, 1993), indicators are defined as a metric that comes from several parameters and gives information about a phenomenon. Indicators are not reflective of reality, but they merely approach the truth, offering a quantifiable method of understanding issues (Schipper, Unander, & Marie-Lilliu, 2000). In several regions, there is a trend to increase the use of indicators to monitor development and track progress and eventually to guide and inform policy (Brown, 2009). Performance indicators are commonly used in business to quantify observations such as company profit and employee satisfaction (Holman, 2009). Thus, indicators can be used in complex systems to track changes over time. We aim to harness this technique to develop a methodology to track progress in achieving the Grand Bargain goals and to provide comparisons between the signatories, in this frame of reference we will analyze different indexes.

To reach EU sustainability targets, researchers combined gaugeable indicators such as emission data and indoor air quality, it was then possible to quantify how a complex sector was contributing to EU targets (Araújo, Bragança, & Almeida, 2013). This approach could be useful in producing an indicator for the Grand Bargain. Another innovative indicator we will review is the United 4 Smart Sustainable Cities. United 4 Smart Sustainable Cities is a recent collaboration between many inter-governmental agencies, aimed to develop a set of indicators to measure progress towards Smart Sustainable Cities, enabling municipalities to reach the Sustainable Development

Goals (SDGs) at the city level (Smiciklas, Gundula, Stano, & Sang, 2017). They managed to distill this topic into three dimensions; Society and Culture, Economy, and Environment to provide a holistic view of a future city. These dimensions are further divided into sub-dimensions and then indicators. Sub-dimensions refer to topics such as education, productivity, or energy. These are then divided into quantitative indicators such as the Unemployment Rate – the percentage of the total city labor force that is unemployed. These individual indicators are collected and form the basis for the U4SSC Smart Sustainable City which provides a comparative ranking of cities.

The Sustainable Governance Indicators (SGI) project monitors the progress made by 41 EU and OECD states in creating sustainable policy. Their focus is directed at three pillars; Policy Performance, Democracy, and Governance, each having unique indices (Schraad-Tischler & Seelkopf, 2015). In total, the index tracks progress in 67 qualitative and 69 quantitative indicators in the 3 pillars (ibid.). By combining both qualitative and quantitative data into one index the SGI avoids pitfalls by only relying on one kind of survey, painting a fuller picture of the complexities at play in this sector. The quantitative data is collected by the SGI project team centrally from official mostly governmental sources (ibid.). The qualitative data, however, is collated from a network of over 100 global experts in a multiphase survey and validation process. Each country is analyzed by two country experts as well as regional coordinators (ibid.). The SGI codebook contains a 1-10 scale based on different levels of implementation for different indicators, both experts separately rank their country based on this survey separately, while adding quantitative data to back up their rankings (ibid.). The regional experts determine the final scores based on the experts rankings and reasoning, this final score is then calibrated regionally by an inter-regional coordinator conference (ibid.). This calibrated final score is evaluated and finally approved by the SGI board. To then allow for comparability of quantitative and qualitative data, all quantitative data e.g. the percentage of the population with a university degree (tertiary attainment) are transformed on a linear 0-10 scale. This allows indexes to integrate a wide variety of data types. A fixed minimum and maximum boundary value must be set. For example with tertiary attainment, the range is 0-60%. This can then be transformed mathematically on a 0-10 scale. This ensures changes in index values can be tracked over time. However, with this transformation values outside the range e.g 70%, are no longer distinguishable from the 60% boundary value, both would be regarded as a model score. The scores for each indicator are then aggregated together into scores for each of the categories, dimensions, and finally pillars.

Building an indicator for the Grand Bargain

This research proposes an innovative performance indicator that integrates decentralized citizen data and vertical data sharing to tackle the lack of accountability within the Grand Bargain. We call this indicator the Grand Bargain Indicators (GBI). It will answer the following questions:

- *How successful are Grand Bargain signatures in reaching localization?*
- *What is the quality of their progress for each workstream?*

To assess how much progress the global humanitarian community is making in reaching the Grand Bargain commitments, we must consider each signator and their respective supply chain individually. This approach is akin to that of the SGI method, where they consider each EU and OECD state individually, it is also of a similar scale (41 states for the SGI, while there are 62 signatures for the GBI). We then consider each of the 9 workstreams separately - this is akin to the pillars or dimensions of the previously discussed indicators. Under each workstream lie the individual commitments, these are the indexes we will use to build a clear picture of the progress the signatories are making. Here the rationale behind the collection methods for this particular indicator will be outlined.

To address each niche of the humanitarian supply chain we will divide it into 5 different data levels namely, Grand Bargain signatories, partner governments and NGOs, local NGOs, aid recipients, and citizens. By dividing the global humanitarian community in this way, we ensure that we pay close attention to every individual niche, taking the experiences felt at every level into account.

After collecting data, both qualitative, and quantitative, the qualitative data must be assessed on a numeric scale - much like the process detailed by the SGI. All data must then be aggregated and finally transformed on a common scale. The main challenges that must be overcome in the creation of the indicator are particularly, the wide variation in data types, the collection methods of data globally, and the aggregation of both qualitative and quantitative data.

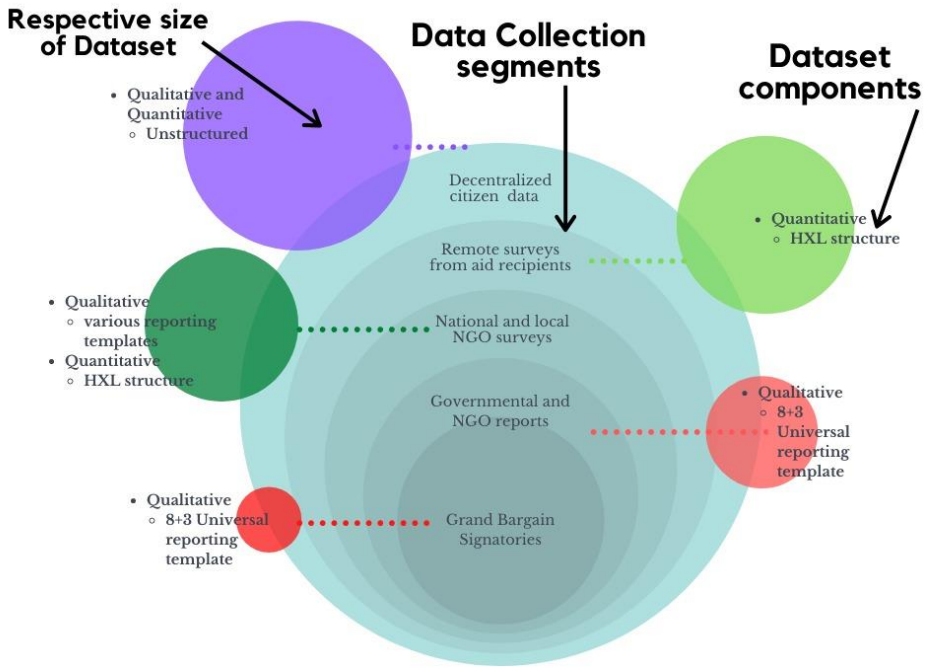

Figure 4: The data structure, collection methods and respective size of the datasets collected for GBI (own elaboration)

Data Structure

The first hurdle that must be overcome in creating the GBI, is accounting for global discrepancies in humanitarian data and collecting data that can be easily compared. This is visualized in Figure 4. By focusing on open-source and widely used data reporting standards already established, it can be assumed that GBI will be able to collect sufficient data to start tracking and comparing the progress made towards Grand Bargain goals.

For qualitative reporting data, the 8+3 is a report template designed to standardize, simplify, and harmonize the reporting of humanitarian projects and programs. The template is designed to be relevant for a full range of humanitarian activities, from short-term to multi-annual projects (Inter Agency Standing Committee, 2019). It contains a menu of standardized questions to harmonize the narrative reporting style, this document's progress in a qualitative manner. All signatories of the Grand Bargain have begun to phase in the 8+3 structure, while also encouraging their partner states and NGOs to report in this structure. This allows us to not only have a standardized format that we aim to collect but have a more automatable analysis procedure. In the figure as the qualitative reporting standards i.e. 8+3 is no longer used, the number of information increases, making human interpretation and summarization difficult.

Regarding quantitative data, the Humanitarian Exchange Language (HXL) is a method of standardizing humanitarian data stored in existing spreadsheets. This ensures that humanitarian staff doesn't require retraining to benefit from the extra functionality (OCHA, 2020b). This ensures HXL can reach high levels of operation globally, thus making it relevant when discussing the standardizing of global data. HXL is composed of hashtag titles that you add to your existing spreadsheets as column titles, this in itself allows for the data to be readable by all members of the humanitarian community. HXL also allows users to add their hashtags to share unique data to their organization - for example, to allow an organization in a particular region to record data unique to them. In the initial phase of creating the indicators, the focus will be set on these two kinds of data formats; eventually, different data formats can be added. This limits the potential reach, however, using all possible data formats from the beginning would be too challenging in the collection and analysis steps.

Data Collection

The second topic we must detail and discuss is the methods by which we wish to collect data that can be then processed for the GBI. Grand Bargain signatories' annual self-reports are publicly available online on the IASC website allowing easy data collection to produce the index. Aid recipient government and NGO (partner) reports on aid spending details are typically made available to donors and international NGOs in upward reporting standards. Increasingly there is a requirement for partners to also use the 8+3 reporting standard (Gaus, 2019). Consequently, as part of the GBI, it can be assumed ease of access to these reports. Therefore, the qualitative reports from Grand Bargain signatories, partner governments, and NGOs can be considered easily accessible. The Humanitarian Data Exchange (HDX) is an open platform for the sharing of humanitarian data currently holding over 19,000 datasets from 275 partner organizations globally (OCHA, 2020a). It provides NGOs globally the opportunity to share humanitarian data in the form of HXL spreadsheets with the global humanitarian community (ibid.). This platform will form a vital component of our data collection methodology, allowing a link to local NGOs globally through an established intermediary. To collect data from aid recipients and citizens in general there exist several survey options. For instance, KoBo toolbox is an open-source suite of tools enabling the rapid collection of information during humanitarian crises and in other aid scenarios. It offers the possibility of operating offline or in low-bandwidth situations (KoBoToolbox, 2020). It has already been used in a wide range of humanitarian scenarios including ascertaining the quality of services in Jordanian refugee camps, to track a Dengue fever epidemic, and to aid in a Haitian vaccination program (ANSA, 2018; Health Equity International, 2018; IFRC, 2016). It can be used to collect both quantitative and qualitative data in a decentralized manner. Data can then be collected by local and regional NGOs. By integrating these open-source data structures into our platform it increases the degree of participation, and thus ultimately, democratic governance (Borrás, 2012).

Data Standardization and index finalization

The SGI and Smart and Sustainable City indices both heavily rely on publicly available statistics calculated by national agencies. Additionally, the SGI methodology relies extensively on national experts as detailed above in the quantification of qualitative indexes. In developing a framework to assess the Grand Bargain, it is clear that the cornerstones of the aforementioned indices are not sufficient due to the global complexities of the humanitarian system. Firstly, the humanitarian system remains too complex to track the implementation of the Grand Bargain through publicly available statistics. While the SGI analyses several countries in the same order of magnitude as the GBI aims to achieve for the Grand Bargain NGOs and donors, we cannot ignore multilevel data as easily as other indices, as it is not simply a national policy performance index, and we want to enable multi-level participation, Therefore, this factor increases the number of actors that data must be collected from fivefold, as we need to consider five different data levels. This situation rules out relying solely on humanitarian experts to assess qualitative reports. Furthermore, as we simply cannot completely remove qualitative indices from a sector highly dominated by the narrative reporting standard, another methodology must be adapted to solve this challenge. As a result, this research proposes a combination of human and machine analysis, to provide adequate data summarization and standardization capabilities.

Due to the large scale-multi level data collection necessary to make the GBI index relevant, the use of data science techniques is suited. To emulate the work done by experts in the creation of the SGI platform but in a larger scale qualitative data environment we propose the use of two machine learning natural language processing concepts; semi-supervised topic modeling, and sentiment analysis, also known as opinion mining.

Topic modeling is a branch of natural language processing, where a kind of statistical model identifies abstract 'topics' from a text (Bahja & Lycett, 2016). Within the creation of GBI, topic modeling will be used to group qualitative data into the Grand Bargain commitments which in turn can be further analyzed to assess what citizens and aid recipients feel regarding the topic. Literature review revealed that qualitative research, such as sociological research, and opinion analysis, can profit from topic modeling, by automating text analysis tasks, however, this technique is rarely used (Nikolenko, Koltcov, & Koltsova, 2015). For a body of text, a distribution of words is classified, and from each clustering of words, a topic is identified (Bahja & Lycett, 2016). A particular method, Latent Dirichlet Allocation (LDA), has proven fruitful in the analysis of many real-world texts, such as organizing large archives of journalistic text (Nikolenko et al., 2015). After preprocessing the text into a parsable format, the researcher must specify the number of topics the LDA model should classify (ibid.). LDA is

unsupervised, which means that in the clustering stage, it filters the text into the number of topics specified, however, the researcher cannot select which topics are appropriate, this saves researcher time but leads to less satisfying results in muddier topics (Blei, 2012). Therefore to further improve results a new approach referred to as Guided LDA can be used to set the algorithm in the right direction in terms of filtering the topics (Jagarlamudi, Daumé Iii, & Udupa, 2012; Wang, Thint, & Al-Rubaie, 2012). Using Guided LDA in the structuring of the citizen data, we can replace the work experts do in grouping reports into topics that can be then further analyzed.

Sentiment analysis is another subfield of natural language processing aiming to extract opinions and perspectives from a body of text (Onan, Korukoğlu, & Bulut, 2016). By running sentiment analysis methods on topics that have been clustered, researchers can determine the sentiment attached to this topic. A review of the field showed how sentiment analysis can differentiate between polarised – positive and negative emotions, to nuances like anger and grief (Mäntylä, Graziotin, & Kuutila, 2018) . A recent analysis of hospital data from the United Kingdom was able to link positive and negative sentiment to topics discussed in the feedback, for example, certain hospital services by combining topic modeling and sentiment analysis (Bahja & Lycett, 2016). In the creation of GBI sentiment analysis can be integrated into the expert analyses steps that determine the scoring of data.

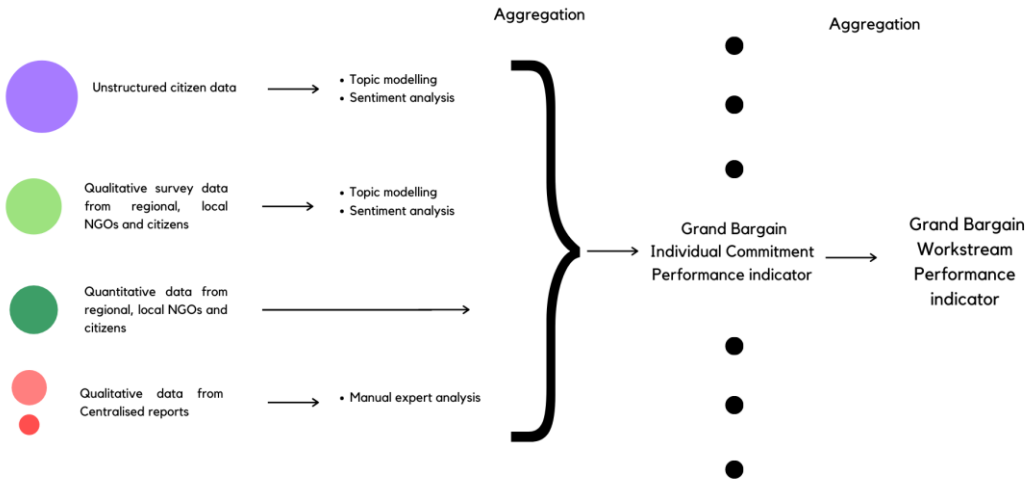

Figure 5: Standardization of data into performance indicators (own elaboration)

For the finalization of GBI Figure 5 summarizes the process for one particular signatory. Each data level previously mentioned is indicated on the left. Since it is a smaller dataset we suggest, to begin with, data from the Grand Bargain signatories and apply a similar approach as the SGI index creation, retaining expert analysis as it ensures a more nuanced grading process. All quantitative data can be aggregated as per other index methods. Both qualitative data from NGOs and citizens and decentralized citizen data are analyzed using Topic Modelling and Sentiment analysis. These grouped data sections can be further analyzed by experts if required. All data can now be ranked on a numerical scale and then aggregated together as per the SGI method. This then results in an indicator for one particular actor's work towards a grand bargain workstream, thus achieving a mechanism of accountability for the global humanitarian system. Nevertheless, this proposal can only be successful by outlining the steps of implementation. Therefore, the subsequent section gives an overview of the potential development of this call for change.

Section Three: Implementation Analysis

By Paris Cosma

A call for change

Socio-technical transition is possible when citizens conceive the existence of a common issue and unite to address it. As elaborated in the first section of this *Call for Change,* such transitions require the collaboration and interaction of multi-level actors and fundamental changes in citizen and institutional practices.

Focusing on the institutional changes required in the global humanitarian regime, the analyzed literature indicates that humanitarian financial aid is one of the least scrutinized spending's of governments and organizations around the globe (see Section 1). Up to date, financial records as well as the allocation of the funds, are managed by internal actors and powerful stakeholders, such as governments and IGOs, restricting the possibility to track spending and allocation accurately and efficiently.

It is thus a timely challenge to change the dynamics of the humanitarian system. It is established that projections about natural disasters and health crises are being amplified by climate change (OXFAM, n.d.). As shown by the WEF (2019), environmental risks and global interconnection deepens. Therefore, we encourage a socio-technical transition to foster capacity building among the various actors of the global humanitarian regime, enable citizen and community participation, and promote political and financial accountability.

This is a call for involvement toward academia and civil society. A call for action toward international humanitarian organizations like ECHO, OCHA, and OXFAM. The socio-technical transition requires partnerships and capacities from all levels of our society to further develop and establish *Homa Reto* as a global tool that provides local actors' agency in decision making and funds allocation of humanitarian aid. We believe in a model of global participatory democracy - collective issues demand collective solutions.

This section, our implementation analysis, will provide a recommended *Plan for Implementation*. Firstly, the paper discusses project branding and determinants for the success of the proposal. Moreover, we propose project ownership to the Climate Innovation Hub, powered by the United Nations University - MERIT. Secondly, we note landmark partnerships that are required for the development and implementation of the project. Thirdly, the main goals, timeline, and activities of the recommended *Plan for Implementation* will be outlined. Fourthly, to provide an overview of the possible limitations of *Homa Reto* multiple scenarios will be analyzed. Lastly, the research team outlines recommendations and considerations relevant to project development and implementation. We urge you to further research possible solutions enabling citizen participation, accountability, and transparency.

Project Branding and Critical Success Factors

Social innovations can be related to innovative ventures in the sense that they require effective leadership, process organization, distinctive objectives, and concrete planning to enable successful implementation and sustainability. Fortune et al. (2011) note that the most common critical success factors of innovation are: (i) clear goals and objectives, (ii) realistic schedule, (iii) senior management, and (iv) adequate funding. This section provides distinctive objectives, recommends funding sources, and suggests project management to the Climate Innovation Hub (CIH).

The research team recommends that future project managers use the name *Homa Reto* for this project. *Homa Reto* is Esperanto language and stands for *human networks* and we employ it to reflect the decentralized and multi-level interactions of top and bottom-level actors within the project. Esperanto is a language created to facilitate world peace and is not connotated with Northern or Southern societies. We believe that the use of an international language, without Western values attached to it, is important to facilitate a feeling of ownership and localization for all communities, states, and other actors involved. According to Sahin et al. (2011), brand identity holds an important role in affecting feelings, cognitions, and behavioral responses. Moreover, brand name affects satisfaction, trust, and loyalty. As noted in the first section of this *Call for Change,* fostering participatory democracy is a fundamental objective of this project. Subsequently, the use of the Esperanto language is recommended for impartial branding.

Project Ownership

Recent developments have shown an increase in trend towards greater involvement and coordination of a wider range of humanitarian actors (Metcalfe-Hough, Fenton, & Pool, 2019). Therefore, we propose project ownership for the incubation phase be attributed to the *Climate Innovation Hub* (CIH), powered by *The Lab* of UNU-MERIT. CIH is a multi-level and multi-actor innovation center, specialized at governance and action mechanism design

contributing towards economic, environmental, and social sustainability (The Lab, n.d.). CIH empowers social innovations and transitions by centralizing various ideas and fosters interactions for concrete issues and solutions at the regional level with a view on global interconnectedness (The Lab, n.d.).

CIH has an *objectives-first approach* in designing societal mechanisms towards the desired result. We believe that an innovation center like the CIH is the most appropriate project owner as it will build a multi-actor and multi-level capacity and host partnerships between politicians, academics, non-governmental organizations and the global humanitarian regime towards achieving a common goal, namely, citizen participation in decision-making, transparency and accountability of the global humanitarian regime. Moreover, CIH provides a fertile and independent ground to address global social issues. Currently, CIH hosts two projects focusing on active citizenship and crisis coordination in developing countries, both focusing on the value of participatory democracy.

Project Partners

Homa Reto is an ambitious project which requires ambitious partnerships to ensure further development and implementation. This section outlines potential partnerships that will be employed as means to gradual social change.

Potential Project Partner	**Field**	**Description**	**Added Value**	**Priority**
Maastricht University	Academia	*Homa Reto* requires the management of big data and addresses fundamental issues of the global humanitarian regime by collecting, analyzing, and visualizing vast amounts of unstructured data. Maastricht University is an established research institution in various relevant fields such as data science, public policy, and law. This proposal notes that Maastricht University should collaborate with the CIH to enable an evidence-based development of the project and provide the human resources and knowledge required to further develop the project and establish *Homa Reto.*	knowledge; human resources; data management.	High

United Nations University	Academia & Policy Research	The United Nations University is a global think tank which aims to resolve global issues of human survival, development, and welfare through collaborative research and education. *Homa Reto* can benefit from a potential collaboration due to its established networks and unique field experts. Moreover, *Homa Reto* is ultimately a project focusing on improving current platforms such as ECHO. The university has collaborated several times with OCHA, which provides *Homa Reto* a degree of insight into potential limitations and priorities that need to be considered upon implementation.	knowledge; network; capacity building; OCHA expertise.	High
European Union	Political and Economic Unions	Article 214 of the Treaty on the Functioning of the European Union provides the legal basis for humanitarian aid supporting countries both within and outside the Union. *Homa Reto* will run pilots in collaboration with EU agencies such as ECHO. Moreover, the Union offers various funding streams relevant to the project.	capacity building; financial support; enables pilot.	High

Figure 6: Potential Project Partners (own elaboration)

Actor Analysis

The first section of this *Call for Change* has provided evidence for the relevant actors. The following table provides an initial comparative analysis for the actors relevant to *Homa Reto* by noting the possible limitations and benefits actors may receive or provide through collaborating with the initiative. Currently, there is sufficient scientific research and literature for stakeholders in disaster response (Mohammad et al., 2014 & Clements et al., 2015). We recommend that a more detailed stakeholder analysis, based upon participatory democracy, accountability, and transparency is being conducted in Phase 1 of the project to distinguish the power, influence, and interests of all actors involved.

Actor	**Importance**	**Interests of the Actor**	**Interests of *Homa Reto***	**Limitations**

United Nations (UN)	Extreme	*Homa Reto* enables a higher degree of financial transparency and accountability for OCHA and UNDRR. Moreover, financial aid from UN Agencies and Donors is projected to increase its relief effectiveness.	*Homa Reto* is a project aiming at improving - rather than replacing- existing disaster relief mechanisms of the UN. Ultimately, the project can only succeed if UN agencies collaborate in data exchange and value the community contributions enabled through *Homa Reto*. Additionally, the UN is the only global, supranational authority that offers a certain degree of global authority, something crucial in enabling the collaboration of all other relevant actors.	Currently, some UN-funding mechanisms are not accessible to independent organizations. Aid-recipients are disconnected from aid-providers and the level of trust varies. The involvement of the UN in *Homa Reto* may decrease the trustworthiness of the project to aid-recipients in instances where aid-recipients experienced lack of access to relief and exclusion in the decision-making process.
Local Organisations	Extreme	*Homa Reto* aims at fostering a participatory environment where local aid-recipients have a crucial role in shaping the decisions and relief they receive during humanitarian disasters. The knowledge and experience of local organizations are not always taken into consideration under the current infrastructures. This project offers a unique possibility of contributing to knowledge and aid-policies.	The project is developed around the notion of participatory democracy. Subsequently, it is crucial to establish capacity with local organizations to enable data sharing with the local communities, increasing their involvement and increasing the degree of local participation in policy development.	The main challenge when involving local organizations is the degree of trust that can be attributed to them, especially in instances where local organizations lack experience and expertise. Moreover, these organizations tend to be easily manipulated by politics and donors, consequently, information received from local organizations must be cross-checked with individuals in the field.
Private Sector	High	Accountability and financial transparency are the two foundations of *Homa Reto*. The	*Homa Reto* challenges the current systems to improve their effectiveness and	Experience shows that the private sector has an extreme competency of manipulating relief

		involvement of the private sector in current relief mechanisms has been proven to prioritize private agendas rather than the maximum effectiveness of donations. Private actors can increase their level of legitimacy in the humanitarian club by adhering to these fundamental values *Homa Reto* aims to establish.	establish ultimate financial transparency and accountability. Involving the private sector in the project is highly important because it will provide diversified sources of funding. The mechanisms proposed under *Homa Reto* will enable a high degree of transparency of the involvement of the private sector, thus reducing the possibility of promoting private agendas against the interests of aid-recipients.	programs for its benefit. The involvement in this project may be considered controversial because it aims at reducing program manipulation.
Grand Bargain Signatories (GBS)	High	*Homa Reto* provides the tools necessary to reach the maximum potential of localization, one of the critical aims of GBS. Moreover, this project focuses on localization and citizen participation. Combined with the decentralized accountability and transparency mechanisms *Homa Reto* provides GBS is projected to be enabled to track localization efforts more accurately and more efficiently.	Currently, GBS constitutes the main alliance for the localization of humanitarian efforts. *Homa Reto* can be benefitted utilizing data exchange in a mutually beneficial interaction as well as experiential learning from the challenges GBS faces.	*Homa Reto* aims to provide the needed capacity to hold GBS accountable. Consequently, some GBS may be hesitant to help develop the project because of the conflicting interests.
States	High	States hold a key role in disaster relief and national fund allocation. However, they have limited influence in the decision-making processes of	State actors can provide valuable information such as national needs and projections, fund distributions, and foster capacity	Political agendas often influence state policies and interactions. This would remain the main limitation in collaborating with state actors.

		international organizations and donors. Through Homa *Reto* they can provide evidence of the effectiveness of "imposed" programs and policies directly from field experience, thus increasing the degree of their involvement.	building.	

Figure 7: Actor Analysis for Homa Reto (own elaboration)

Funding and Financing

Under this section, we have outlined possible sources of funding for project implementation. Donors and funding agencies of the current humanitarian club have not been included. Moreover, according to McKinsey and Company (2012), information technology projects go beyond their planned budgeting by 45% on average. Consequently, a cost assessment has been omitted from this *Call for Change,* because partnerships have not been established yet and experts of data analysis and platform development have not been consulted. We recommend that future managers assess the costs in detail and realistically after all partnerships in Phase 1 of the project are established. Alternatively, the research team has outlined different potential funding streams that will be compatible with detailed scrutiny, transparency, and accountability of the humanitarian club.

Name of Funding Body	Type	Notes	Further Information
European Research Council	European Research Funding Body	European Research Council (ERC) grants support individual researchers of any nationality and age who wish to pursue frontier research	ERC: European Research Council |
Marie Curie Actions	European Research Funding Body	-	Marie Skłodowska-Curie Actions |
Joint Research Centre	European Research Funding Body	The Joint Research Centre (JRC) is a Directorate-General of the European Commission and comprises seven institutes. Its activities range from the risk assessment of chemicals to the forecasting of natural disasters, from evaluating product safety standards to assisting in humanitarian crises.	Joint Research Centre JRC in brief | EU Science Hub
European Commission - Digital Agenda/DG Connect	European Research Funding Body	The Digital Agenda for Europe (DAE) aims to reboot Europe's economy and help Europe's citizens and businesses to get the most out of digital technologies. It is the first of seven flagship initiatives under Europe 2020, the EU's strategy to deliver smart sustainable and inclusive growth.	Shaping Europe's digital future | Digital Economy & Society
Executive Agency for Health and Consumers - Funding	European Research Funding Body	The Agency works closely with the Health and Consumers Directorate-General as it implements EU programs on health, consumers, and food safety.	Executive Agency for Health and Consumers (EAHC) — Climate-ADAPT

Horizon 2020	European Funding Programmes & Open Calls	Horizon 2020 is the biggest EU research and innovation program ever. It promises more breakthroughs, discoveries, and world-firsts by taking great ideas from the lab to the market.	Horizon 2020 | The EU Framework Programme for Research and Innovation
Belmont Forum	-	A partnership of funding organizations, international science councils, and consortia committed to the advancement of interdisciplinary and transdisciplinary science.	Belmont Forum
The Netherlands Initiative for Education Research (NRO)	Dutch Research Funding Body	The Netherlands Initiative for Education Research (NRO) coordinates the programming and funding of research into education. It facilitates the use of research results in educational practice and policy. By doing this NRO contributes to innovations and improvements in education.	Netherlands Initiative for Education Research (NRO)
EU LIFE CLIMATE ACTION - Climate governance and information	European SME Funding Body	The program funds projects in the areas of awareness-raising, training and capacity building, law compliance and enforcement, knowledge development, and stakeholder participation.	LIFE Climate Action | Climate Action

Figure 8: Potential sources of funding (own elaboration)

Project Goals Overview

Goals Overview	**Goal Name**
Goal 1	Initialization of a research team at the Climate Innovation Hub, UNU-MERIT.

Goal 2	Capacity Building
Goal 3	Partnerships for Homa Reto
Goal 4	Launch a pilot at EU level
Goal 5	Launch a pilot at EU and ASEAN level
Goal 6	Launch Homa Reto globally
Overall Goal	Enable accountability, participatory democracy, and financial and political transparency in disaster response.

Figure 9: Project Goals (own elaboration)

Phases Overview

Phases Overview	**Start On**	**End On**	**Phase Name**
Phase 1	September 2020	February 2021	Research Development
Phase 2	March 2021	December 2021	Project Development
Phase 3	January 2022	December 2022	Pilot Launch
Phase 4	December 2022	January 2023	Launch

Figure 10: Phases Overview (own elaboration)

Recommended Project Activities Overview

Activities Overview	**Phase**
1. Research for capacity building	Phase 1
2. Research for political integration	Phase 1
3. Creation of an Academic Alliance	Phase

4. CEA Analysis	Phase 1
5. Development of data collection and analysis strategy for 5 EU countries	Phase 2
6. Run a limited pilot in 5 EU countries	Phase 2
7. Development of data collection and analysis for EU and ASEAN	Phase 2
8. Run a limited pilot in EU and ASEAN	Phase 2
9. Development of data collection and analysis for a global regime	Phase 3
10. Official Pilot Launch	Phase 3
11. Feedback and Improvements	Phase 3
12. Capacity Building v.2	Phase 3
13. Launch Homa Reto	Phase 4
13. Feedback and Improvements v.2	Phase 4
14. Open Proposal to OCHA to adopt Homa Reto framework and methodology	Phase 4

Figure 11: Activities Overview (own elaboration)

Projected Project Limitations

Homa Reto may face different limitations depending on the approach project developers will adopt. Below, four possible scenarios, and their limitations are noted. We recommend that Project Implementation conducts a Cost-effectiveness analysis on all the following scenarios before pursuing implementation.

Scenario	Description	Benefits	Limitations

S1: a platform consisting of decentralized data gathered from individuals only.	To empower individual citizens to participate in the humanitarian and disaster policies affecting their lives, under this scenario fostering participation is valued higher than credible information. To enable individuals without access to the world wide web, or citizens without registered citizenship, data collection must employ easy and accessible tools as mentioned in the previous section. This scenario provides the best predictions to facilitate participatory democracy.	*field insights; citizen participation; transparency; political and financial accountability.*	*credibility; manipulation of data; political influence; power influence; qualitative data analysis.*
S2: a platform consisting of quantified performance indicators from the Grand Bargain workstreams and individual-country commitments only.	The individual national commitments of the Grand Bargain signatories can be easily tracked through the self-assessment reports of each country or signatory by quantifying the performance indicators. This is an efficient but not effective nor credible scenario since the main issue of the current solutions, the lack of external auditing for the self-assessment reports is not addressed.	*reliable self-assessed national data; accessibility.*	*transparency; objectivity; credibility; political manipulation; biases.*
S3: a platform consisting of decentralized data gathered from international, national, and local organizations.	To enable localization assessment based on money distribution, a strong collaboration between international, national, and local organizations is required. Data is gathered from all three levels enables tracking of the fund distribution. Consequently, the effectiveness and efficiency of the funds can be assessed.	*field-insights; community participation; political and financial accountability.*	*data analysis; network capacity; interlevel trustworthiness; data comparison; data standardization.*

S4: a platform consisting of data gathered from citizens' assessment, Grand Bargain self-assessment reports, and international, national, and local organizations.	Objective and credible indications can be achieved by creating a platform consisting of multilevel assessment and incorporating insights from citizens, communities, national reports, and international, national, and local organizations. This scenario enables the most representative and multi-level participatory approach. However, the amount and nature of the data, as well as the lack of a common humanitarian exchange language at a global level poses a major challenge in analyzing the data in a cost and time-efficient manner.	field insight; citizen participation; community participation; transparency; credibility; political and financial accountability.	*cost; data analysis; data communication and visualization.*

Figure 12: Implementation scenario overview (own elaboration)

Project Limitations and Recommendations

Homa Reto is focusing on participatory democracy. However, several limitations can be identified even at this initial stage. To address intellectual honesty, this section highlights important limitations and provides possible recommendations to future project managers for successful project implementation.

Limitations	**Recommendation**
Language Accessibility	- Homa Reto requires a multilingual setting to enable access to users around the globe. The amount of data employed in the platform does not allow for manual translations. We recommend to the developers of the platform using *Biblo* and *Google Translate* standards in the algorithm.
Data Collection from difficult environments	- To facilitate participation to the maximum possible extent, platform developers must enable data collection from offline environments, including in this way citizens and actors without internet access. *KoBo Toolbox*, as outlined in Section 2, provides the possibility to receive data using the SMS technology.
Cost Assessment and potential added value estimation	- Project managers must refrain to assess the added value of *Homa Reto* using a Cost-Benefit Analysis. Alternatively, we recommend the employment of a Cost-Effectiveness Analysis (CEA) to allow social values to be accounted for more accurately. Moreover, a CEA analysis will contribute to balancing the interests of actors involved, supporting a just approach among efficiency, accuracy, and credibility.
Conceptual Accessibility	- *Homa Reto* will provide diversified information to users. Moreover, partners and contributors will face the challenge of diverse concepts

		and terminologies. To address this accessibility issue, project managers must develop a common language codebook, providing easily comprehensible definitions of all aspects of *Homa Reto,* including the indicators used and the assessment mechanisms.
The credibility of decentralized data sourcing	-	To allow for maximum citizen participation, the project allows for unverified input from citizens. After a CEA assessment, project managers must balance whether the credibility of the data received is valued higher than participation. In such a case, we recommend the employment of a blockchain verification system which will only allow registered citizens to provide data.

Figure 13: Project limitations and recommendations (own elaboration)

Conclusion

The proposal calls for a change in global risk governance and promotes the notion of participatory democracy and self-regulated governance through big data sharing. Establishing a decentralized accountability mechanism for the humanitarian system is important for the success of localization commitments under the Grand Bargain because data from local actors can complement the self-reporting of IOs and thereby democratize the humanitarian system.

One of the key barriers for national and sub-national NGOs' access to funding is rooting in the absence or low levels of vertical engagement of top- and bottom level actors (Metcalfe-Hough, Fenton, & Pool, 2019). This constitutes a lack of participatory governance of local bottom-level actors within the global humanitarian system, and thus, a lack of agency. However, collective responsibility for humanity can only be governed by a more complex architecture of governance and thus, requires new forms of knowledge (Borrás, 2012). Looking at the humanitarian system from the perspective of participatory governance allows us to move beyond traditional notions of state sovereignty and embrace the global community brought about by globalization. Niche innovations as the one outlined in this proposal can reconfigure the destabilized global regime by establishing a decentralized supranational authority based on global citizenship.

Novel open-source technologies offer opportunities to realize these models of participatory governance. In the case of Homa Reto, recombining the methodology of various leading performance indicators with recent machine learning developments and embedding this combined solution into the global humanitarian machinery yields an indicator for the progress made in achieving localization. In doing so, accountability for all actors along the humanitarian supply chain is increased leading to greater incentives for localization. In terms of implementation, social innovations can be related to innovative ventures in the sense that they require effective leadership, process organization, distinctive objectives, and concrete planning to enable successful implementation and sustainability. With the implementation proposal above, we hope to inspire further researchers to investigate the limitations of the project in order to realize its full potential and ultimately, change the dynamics of the humanitarian system towards participatory governance.

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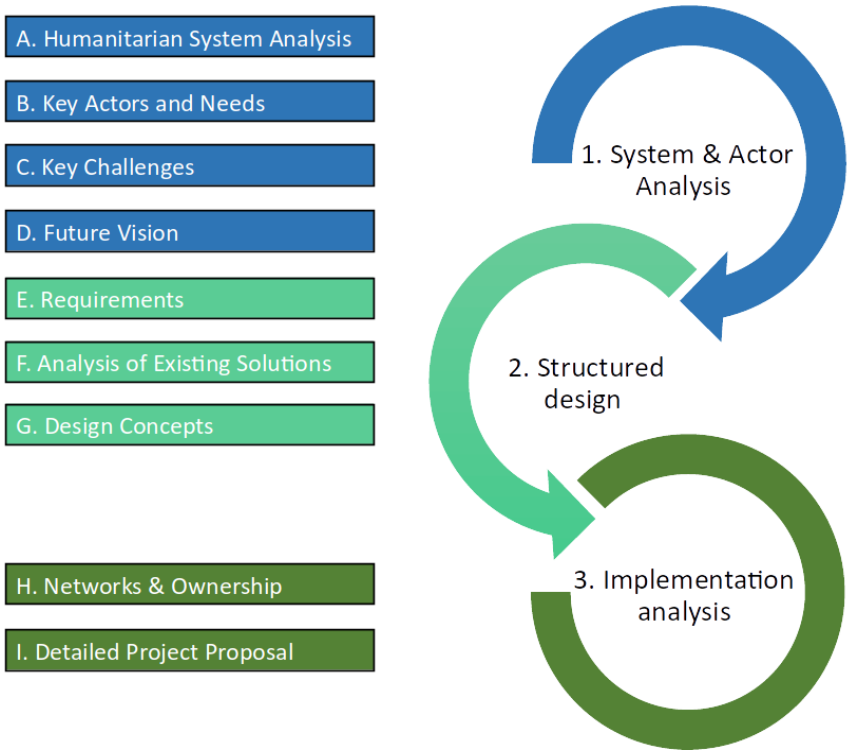
Appendix

Figure 14: Research Process based on Reflexive Interactive Design (RIO) (own elaboration)

Reflexive Interactive Design (RIO) is an approach in development and is indebted to many other methodologies. The added value lies in the combination of these methodologies and the application to the complex global humanitarian system. Figure 14 gives an overview of the different steps in RIO applied to the research focus on humanitarian actors and needs.



1. System & Actor Analysis

In this step, existing practices and systems are analyzed for a number of dimensions, including the institutional structure (stakeholder analysis), and stocks and flows (money, raw materials, products). The system analysis is supplemented with a trend analysis: which changes are imminent in the environment of the system (global, European or national level) that (can) influence or that can be fruitfully anticipated?

This activity requires a significant commitment to research (depending on the availability of already previously conducted good research), and ideally happens in regular coordination with active stakeholders involved. The main result is a series of new targets for possible changes in the system, starting points that link the desired and to break through unwanted effects

A. Humanitarian System Analysis

The first section determines the scope and commitment of the project. Hence, this step of the research process involves the articulation of the current landscape of the humanitarian system. The humanitarian system exemplifies a complex web of interactions. Thus, an interactive problem definition is decisive for the design of the project. .

B. Key actors and needs

Actors are people and possibly institutions that play a relevant role in or to design a reconfigured system. In the case of humanitarian systems, such actors include the United Nations agencies, governmental and non-governmental organizations, as well as aid recipients. Needs analysis is based on scientific literature and qualitative interviews with experts in the field of disaster management and coordination. The aim is to maintain the strictest possible separation between short-term interests (often formulated in terms of solutions in the present), and underlying needs in terms of capacities. RIO tries to bridge contradictions by pushing the latter into focus.

C. Key challenges

This section of the research introduces relevant problems, as well as core challenges. Problems are explained on the basis of the operation of the system as defined under A. Notably, there is no complete agreement on a solution due to a global dissensus on values, political ideologies, or the nature of problems

D. Future vision

Based on the system analysis (A, B), and the challenges (C) a potential (long-term) vision is sketched in which those challenges are solved. For instance, one can manipulate the systemic variables by adding or recombining functions, unlinking wicked links, or redefining the function of the system. Creative visions of global futures have important pull in the rest of the design process. It is not necessary at this stage that all aspects are worked out. The images of the future are even allowed to show somehow provocative elements. Ideally, they are designed in interaction with precursors, but it is important that critical thinking and independence remain guaranteed. Thus, this step involves a critical literature review of future scenarios for the decentralization of the humanitarian system.

2. Structured Design

The design phase provides plausible and attractive concepts for new systems. This part of the research process merges new and existing solutions. In this case, the more the merrier is the guideline. In other words, is particularly desirable to maximize the amount of possible solutions. This process involves a high degree of creativity, for example through creative sessions and brainstorming. It is beneficial to involve a wide range of parties to reflect the multidimensional interests within the humanitarian system.

E. Requirements

Requirements are those functions that are critical to the realization of the objectives set in the visions of the future. This is primarily work for data analysts but is sharpened and enriched in interaction with stakeholders. The key functions determine where the focus of the design activity is being laid. Other functions are supposedly realizable with standard solutions.

F. Analysis of existing solutions

This section analyzes the features of existing platforms for the coordination of humanitarian actors and specifies needs as well as potentials.

G. Design concepts

By selecting single solutions for each requirement new combinations of functions are sought. The selection is based on best practices, academic reviews, and the experiences of experts in the field. This phase can take place in one or more design rounds with stakeholders. Thus, this phase is not completely restricted but reaches into other sections of the research process.

3. Implementation Analysis

This section outlines action points for change. In this section of the research process, the system and actors analysis, the design process are strategically deployed to facilitate actual changes in reality, both on the level of the regime (institutions, rules), as at the level of practice (niche experiments).

The designs in RIO are explicitly not intended as a blueprint, but as a source of inspiration. Experiences with technological innovation teach us that for substantial transitions a lot more is needed than technological innovation alone, the social environment of technology must also be enabling transitions. On the one hand, designs are starting points for practical initiatives and, on the other hand, anchor points for institutional cooperation and agenda setting.

H. Networks and ownership

This section provides a framework for the active participation of stakeholders and other partners. This step involves networking around concepts, and around specific solutions. These networks are the natural result of the interaction in the first two main groups of activities. Nevertheless, experience shows that it is the publication and communication of the result which generates new interested parties. These parties will most probably enter another learning process to appropriate the results. In both cases, time, energy, and budget are needed for networks to develop and to make a change, for instance by establishing financial and social capital for the innovation.

I. Detailed proposal

In this step, the proposal outlines all necessary activities for the implementation of the project. Then, possible obstacles at multiple levels are identified. Notably, multiple dimensions within socio-institutional regimes could potentially enable as well as hinder niche formation and the realization of the concepts. These dimensions inter alia include social values, institutional structures, and cultural relativity. Additionally, this section gives recommendations for the implementation of the project. The final part constitutes a proposal for the implementation of a research project to realize the proposed innovation. The proposal outlines financing instruments, knowledge gaps, as well as potential partners.

.Calls for Change

Volume 2