Crowd Sourced approach towards Sustainability and Productivity

Completed Research

Christopher Wood
University of Auckland
cwo0494@aucklanduni.ac.nz

Asfahaan Mirza
University of Auckland
a.mirza@auckland.ac.nz

Gabrielle Peko
University of Auckland
g.peko@auckland.ac.nz

David Sundaram
University of Auckland
d.sundaram@auckland.ac.nz

Abstract

There are many areas within organisations and communities where good sustainable activities are taking place. Conversely, bad practices are also prevalent. Currently there are few mechanism or systems to explicitly identify sustainable, productive, unsustainable and/or non-productive activities across organisational and community borders. We attempt to leverage the power and wisdom of the crowds to identify sustainability and productivity concepts, ideas, cases, exemplars, heuristics, rules, approaches, models and processes. Additionally, the system can be leveraged to identify areas of unsustainability and lack of productivity. This enables organisations, communities, and individuals to rectify and address areas of low productivity or unsustainable practices. The main focus of this research is to propose and implement a crowd-sourced approach for sustainability and productivity. The proposed system will support five distinct processes: (1) Capture (2) Curate (3) Discover & Share (4) Collaborate and (5) Persuade people to adopt sustainability and productivity ideas, ideals, principles, and practices.

Keywords

Sustainability, Productivity, Crowd Sourced, Collective Intelligence, Exponential Technologies, Social Media

Introduction

Once a peripheral notion, sustainability is now at the forefront of discourse in our society. Examination of the academic landscape affirms this and emphasises the universal nature of sustainability. Kajikawa et al. (2007) performed a citation network analysis of 29,391 papers that included the words “sustainability” or “sustainable” in their bibliographical records. These terms were present across 15 major research domains/clusters namely agriculture, fisheries, ecological economics, forestry (agroforestry), Forestry (tropical rain forest), business, tourism, water, forestry (biodiversity), urban planning, rural sociology, energy, health, soil and wildlife (Kajikawa et al. 2007).

For the purpose of this literature review, we will define sustainability as an approach to the development that meets current needs without compromising the ability of future generations to meet their own needs (World Commission 1987). Sustainability is comprised of environmental, social and economic aspects which each share interrelated relationships making isolation of a single aspect challenging. These three paradigms are referred to traditionally as sustainability dimensions or the Triple Bottom Lines (TBL) of business management (GRI 2002). However, the Triple Bottom Line transcends business, as our collective approach to sustainability is a centrepiece of developing a wealthy and fulfilled society (Komiyama et al. 2011). Supplementing the traditional Triple Bottom Line, the framework formed by this roadmap will also focus on cultural sustainability – the maintenance of language, diversity and knowledge. As Jones (2017) asserts, current corporate social responsibility initiatives are currently not sufficient. Examination of each of these dimensions of sustainability will provide the requisite insight to combat these issues with information systems at an organisational level.

Perhaps the most common association of our notion of 'sustainability' is our interaction with our natural environment. One framework for assessing sustainability of our actions with our physical surroundings is the nine planetary boundaries posited by (Steffen et al. 2015). These boundaries include climate change, ocean acidification, and freshwater use among other metrics for measuring environmental sustainability. Of these nine, more than half are either at high risk or increasing into this territory. Our current geological period, the Holocene epoch, 11,700-year long Holocene epoch is the only state that we know for certain can support contemporary human societies. Hence, this framework is significant in providing empirical benchmarks which motivate sustainable environmental practices.

Other common environmental sustainability benchmarks include the ISO 9000 and 14000 standards, as well as The Global Reporting Initiative and Carbon Disclosure Project. These are quality management systems which analyse the process through which products are made and whether they meet an objective sustainability standard (Clements 1996). While these frameworks provide benchmarks, an understanding of human psychology will also be used to motivate change towards making these adaptions. Currently there is a literature gap in the explanation of pro-environmental behaviours exclusively in the workplace (Aziz et al. 2017). However, broader studies of human nature are still relevant to this literature and will be used to support this roadmap.

Placing a benchmark on social sustainability is also of significance to businesses. The social paradigm of the triple bottom line impacts stakeholders at local, national and global levels. Internally social policy determines the happiness and efficiency of workers, while externally it develops the image of the company and impacts our wider society. Within the last century, reform has taken place primarily in response to inequality of race and gender in the workplace. The GRI Social Performance Indicators attempts to classify key performance aspects of businesses including labour practices, human rights, society, and product responsibility (GRI 2006). These labour practices are regulated by standards such as the Conventions of the International Labour Organisation (ILO) and United Nations Universal Declaration of Human Rights (GRI 2002). However, institutional biases still prevent equitable opportunity for workers performing in firms across industries. For example, of Harvard Business Review's *Top 100 CEOs of* 2017, only two of these are women (Mcginn 2017). A 2005 analysis of 46 meta-analyses conducted by Dr. Janet Hyde discovered that males and females are more alike than different with the majority of psychological variables measured including cognitive ability and leadership (Hyde 2005). Hence, this overwhelming disparity between men and women holding top senior positions can be considered unequal and inequitable. Similarly, the race of a prospective employee can often unfairly create a glass ceiling. Research regarding labour market discrimination has found job applications with Anglo-Saxon names receive, on average, 50 percent more call-backs for interviews than African American names (Bertrand and Mullainathan 2004). Social aspects such as these illustrate that while a base level of regulation may exist, it is not sufficient to provide equitable opportunity to each individual entering or participating the workforce. Hence, further social initiatives are required to mitigate these social issues as these are not sustainable for developing into a fully functioning and equitable society.

A sustainable business decision-making system requires the addressing of economic issues and measurement through performance indicators to guide the economic dimension. This has been established as organisational aspects which consider all financial costs and cashflows as well as efficient employment and job creation (Hall 2011). It is notable that the former factors refer to economic growth while the latter pertains to economic development. Hammer and Pivo (2017) make this distinction as the definition of economic sustainability in literature is not concrete; economic growth refers to a change in the size of the economy, whereas economic development describes the qualitative improvements in societal conditions. This paper is structured around both of these, which are central to developing sustainability in organisational contexts. Economic sustainability is of clear importance to a business for profit creation, but equally so to the economy as a whole. The allocation and sustainability of jobs drives the efficiency of an overall economy and inadvertently impacts the social sustainability of a society. An aggregate of economically unsustainable businesses in a society – through poor job creation abilities for example - not only decreases the output of the economy but is likely to result in social unrest. This manifests in areas such as, higher crime rates which are correlated with higher unemployment rates (Phillips and Land 2012)

Cultural diversity and its longevity face an equal threat. On our current trajectory more than half of our 7,000 current languages will no longer be spoken in 80 years (Mirza and Sundaram 2017). However, the implications of this stretch beyond simple communication, unique culture – art, music and writing – are

all threatened. As with the other dimensions of sustainability, the time frame is minimal which puts an emphasis on speed and efficiency to change organisational practices.

Sustainability within organisations is a priority as our economies and societies expand towards capacity. As discussed, an approach to solving these issues surrounding sustainability must be comprehensive in addressing all three of these dimensions of the triple bottom line – economic, social, and environmental, as well as cultural. This is because the three aspects share an intrinsic relationship, that is, sustainability in one dimension cannot be fully achieved without doing so in the other two. Our current trajectory is not sufficient for providing business sustainability solutions and therefore, literature review a proposed road map is necessary for collectively guiding our society. One avenue is literature such as this which proposes a roadmap for comprehensive addressing of sustainability.

Practical Problems

The nature of the organisational sustainability is a multi-dimensional one meaning that any linear approach is insufficient. It is currently cumbersome to compile business solutions for each dimension. This is the primary issue of existing systems – an individual dimension is addressed, but it is not comprehensive. Crowdsourcing eliminates this issue by allowing the system to efficiently draw information from the various areas and form multi-faceted processes. Traditionally crowdsourcing has excelled in aggregating content, providing question and answer forums, and providing a basis for crowdfunding. These functions are foundational to the Sustain-Ability system and will provide the organisational sustainability problem with a multi-dimensional solution.

One particular issue which reoccurs in literature is the time constraint which change in environmental practices must be implemented before damage is irreversible. For example, in reaching CO_2 stabilisation early prevention has more significant effect than aggressive decarbonisation in a later timeframe (Vaughan et al. 2009).The high risk planetary boundaries also pose time constrained risks, such as biochemical flows of nitrogen and phosphorus (Steffen et al. 2015). These are problems that the sustainability framework aims to overcome through the utilisation of crowd-sourcing and social media. The framework is complemented by the app format which has an emphasis on fast networking communication necessary to form processes.

The failure to address unsustainable economic practices currently occurring presents problems in a similar vein. This is especially true in the case of technological advancements reducing the need for many manual labour jobs. While it is not irreversible in the sense that unemployed workers can be re-employed, significant structural unemployment has long-standing social implications which can take generations to repair. In New Zealand alone, research estimates 885,000 current jobs will be automated in the next 20 years across all sectors (Thomas 2016). Existing social welfare systems do not have the capacity to manage such events and will result in unprecedented dead-weight-loss. A framework is a necessity to increase the speed of dialogue mapping solutions - one example could be integrating a Universal Basic Income.

Socially unsustainable practices are an issue globally for organisations. The implications of such practices are twofold – internally there is organisational inefficiency and externally business practices can cause civil unrest. Organisational corruption such as nepotism and more broadly, inequitable treatment of different groups are at the centre of this. These issues occur to varying degrees in each country but ultimately lead to injustice and inefficiency. Verisk Maplecroft, a major risk consultancy firm, outlines the inefficiencies resulting from social unrest including: disruption of business operations and transport, inefficient security spending and destruction of property (Martin 2016). Implementation of the Sustain-Ability framework provides a platform for addressing such issues and analysis of existing business practices.

Indeed, the ability to maintain each dimension of sustainability is persistently fading. A dynamic platform for developing sustainability is therefore required within organisations. The use of crowdsourcing technology is central to efficiently approaching such issues and this roadmap outlines how this will occur practically.

Research Problems

Presently there are few comprehensive systems for identifying and addressing unsustainable activities across organisational borders. At an individual level there are certain isolated metrics for tracking sustainability variables, such as daily carbon footprints (Turner 2014). However, at an organisational level

there no overarching system to indicate how a business is contributing the longevity and wellbeing in society. Here we shall examine the systems research and analyse where research gaps exist, while also highlighting effective aspects of current systems.

This sustainable business model is motivated by a win-win-win strategy between the three sustainability dimensions. While there is certainly the possibility of trade-offs between the three, this roadmap aims to optimise all three. The Parliamentary Commissioner for the Environment (2002) asserts that a strong vision and clear goals is the fundamental support for developing these win-win-win strategies. To achieve this, analysis of existing frameworks is essential. This will allow for a framework promoting sustainable action in businesses which streamlines prior ideas and models, while utilising modern technology.

It is also crucial to understand the psychology which has driven these sustainability issues to occur on a macro level. As (Ahmed 2009) aptly notes: "Un-sustainability does not arise out of ignorance, irrationality or greed. It is largely the collective consequence of rational, well-intended decisions made by people caught up in systems – ranging from families and communities to corporations, governments and economies – that make it difficult or impossible to act in ways that are fully responsible to all those affected both now and in the future." An understanding of this perspective on what motivates unsustainable action is of paramount importance for understanding how to motivate sustainable action. Creating a societal shift in behaviour is required. A multi-dimensional systems perspective can achieve this and will be guided by existing models.

The Sustainability Strategic Management Hierarchy proposed by Ahmed (2009) follows a traditional pyramid structure with Functional Level Strategies and Processes being the greatest contributor to a business for developing sustainable practices. Functional level strategies and processes are organisational plans prepared across all areas of a company's structure including finance, marketing and sales. This encompasses commitment to sustainability, maintaining a corporate level sustainability portfolio – altering practices appropriately, as well as employing competitive level strategies which market to the three dimensions. Such a framework emphasises the way in which a corporation may reinvent an organisation from the bottom up to promote and instigate sustainable practices. The ability for businesses to identify and implement functional level strategies and processes is one approach for shifting towards more sustainable practices efficiently.

Further examination of literature exposes nuanced aspects to enhance the crowd sourced sustainability and productivity platform and ensure it is comprehensive. The International Institute for Sustainable Development (1992) provides a system for businesses to develop sustainable practices in *Business Strategy for Sustainable Development: Leadership and Accountability for the 90s*. Naturally, the platform's road map aims to modernise these existing concepts, but its supporting ideas are fundamental. In essence, the business framework operates as outlined in Figure 1.

Figure 1: Sustainable Enterprise Management (Adapted from The International Institute for Sustainable Development, 1992)

This process shares similar elements to aforementioned sustainability frameworks. Analysis of current practices for a company is a clear element which must be included in the Sustain-Ability system to ensure organisations can optimise sustainability of practices. Information systems are at the centre of this process of review and reform, as asserted by The International Institute for Sustainable Development (1992). Key performance indicators are one aspect of information systems in such frameworks which is required for motivating change. The New Zealand Business Council for Sustainable Development outline a number of these in their report *Business guide to sustainable development reporting* (NZBCSD 2002).

Design and Implementation of a Crowd Sourced Sustainability and Productivity Platform

The window for a sustainable future is persistently fading. The aim of this research is to design and implement a crowd sourced system to help promote sustainability and productivity. We adopted a design science research methodology to help develop concepts, models, processes, frameworks and architectures (Hevner et al. 2004; Nunamaker Jr et al. 1991; Nunamaker Jr and Chen 1990). This builds on the existing theory of Gregor and Hevner (2013) by informing knowledge to the user base through new channels. Subsequently, a crowd sourced platform will be designed and implemented leveraging key principles of crowd sourcing to facilitate vital sustainability and productivity processes: (1) **Capture** – sustainability practices as text, audio, images, and video, (2) **Curate** – filter and approve captured practices, (3) **Discover & Share** sustainable practices, (4) **Collaborate** – discuss knowledge among social circles and organisations, and (5) **Persuade** individuals to conform to sustainability and productivity.

Key Concepts and Processes

The crowd sourced concepts and processes to harness sustainability and productivity practices and promote its usage are illustrated in Figure 2. The model is created by synthesising concepts from collective intelligence, sustainability, and productivity literature (Kajikawa et al. 2017; Mirza and Sundaram 2016, 2017; NZBCSD 2002; Stead et al. 2004; Steffen et al. 2015; The International Institute for Sustainable Development 1992). It consist of five stages and related workflows namely: capture, curate, discover, collaborate and persuade. These workflows and their respective implementation are described in the subsequent sections.

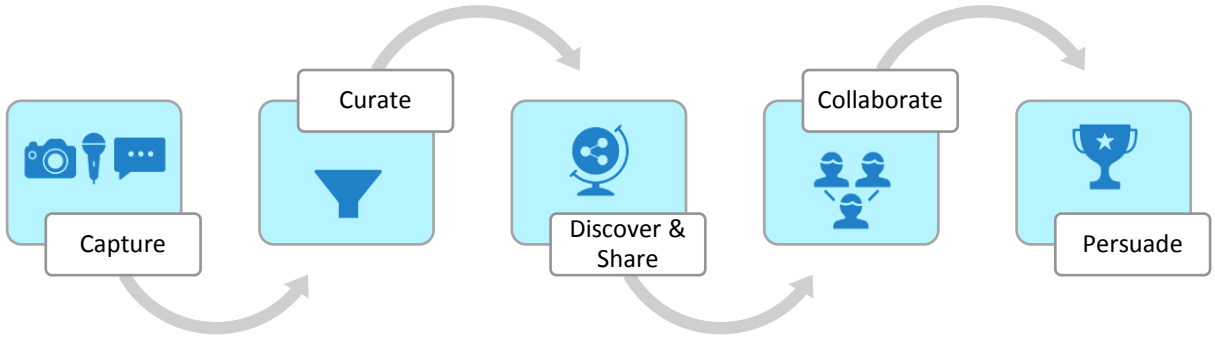

Figure 2: Concepts and Processes to harness and promote sustainability and productivity practices

Exponential technologies and ubiquitous devices provide many advantages: flexibility, low cost, mobility, user-friendliness, connectivity and multimedia capabilities (Diamandis and Kotler 2015; Godwin-Jones 2011; Poslad 2011; Sorensen et al. 2005). These advantages significantly help in implementing the crowd sourced platform to promote sustainability and productivity practices. The platform extends upon fundamentals from collective intelligence, exponential technologies and ubiquitous devices to create a highly interactive platform as shown in Figure 3. It allows individuals and organisations to capture, curate, discover, share, collaborate and persuade to implement sustainability and productivity practices in their daily lives.

The users can switch both the *perspective* and the *dimension* within Sustainability and/or Productivity via the Main Navigation (See Figure 3). *Perspective* refers who it impacts such as individual, family, organisation, supply chain, community, region, nation and society. The platform will support two-level *dimensions:* (1) Traditional dimensions of sustainability – economic, environmental, and societal; and (2) UN's 17 sustainable development goals (SDGs) – No Poverty, Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Reduced Inequality, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace and Justice Strong Institutions, and Partnerships to achieve the Goal (Griggs et al. 2013; Holden et al. 2017; UN General Assembly 2015; United Nations 2018).

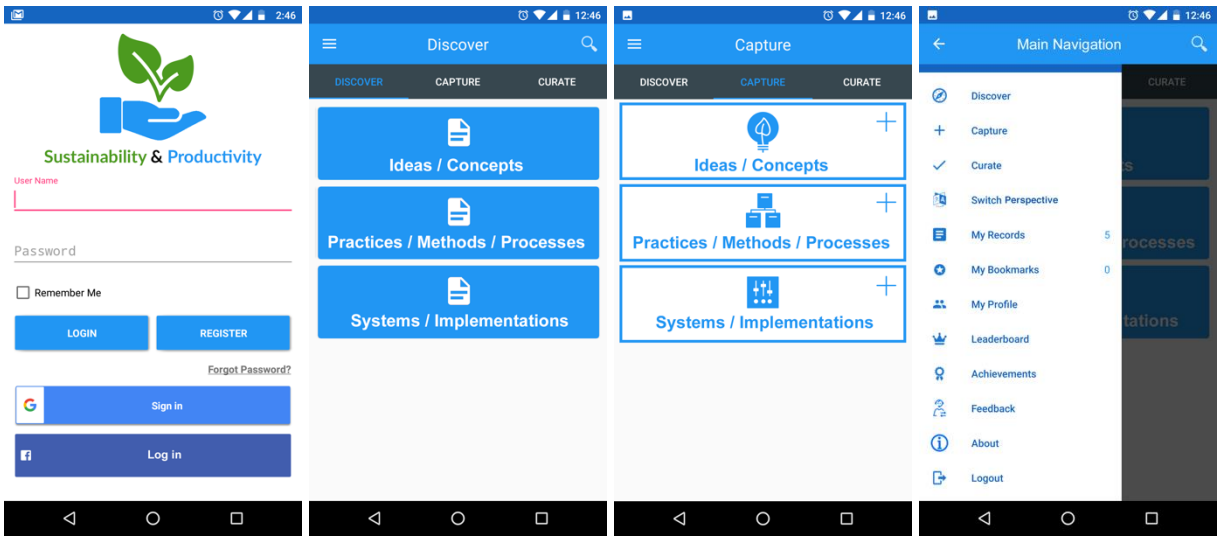

Figure 3: Crowd Sourced Sustainability & Productivity Platform

Capture

In order to capture knowledge of sustainability practices, it is crucial that crowdsourcing functions are utilised within the crowd sourced platform. Following the models of other social media platforms such as *Reddit* and *Trip Advisor*, a forum approach is one of the centrepieces of capturing knowledge. A free-flowing forum style will allow for text, videos, pictures and gifs to drive the capturing and thus, transfer of information and knowledge regarding sustainability. This is a central aspect of the framework for shifting views and paradigms to more sustainable alternatives socially, economically, environmentally and culturally. Such a system is also able to capture and expose systems and practices which are not sustainable within organisations. Through the crowdsourcing of this information, pressure can be effectively applied within an organisation to alter negative practices and promote positive ideas. The platform will allow contributors (individuals and organisations) to create/capture sustainability and productivity: (1) ideas/concepts, (2) practices/methods/processes, and (3) systems/implementations. These can be gathered in multiple formats including text, image and video as shown in Figure 4. Each of the artefact captured can be categories under multiple perspectives and dimensions as mentioned in the previous section.

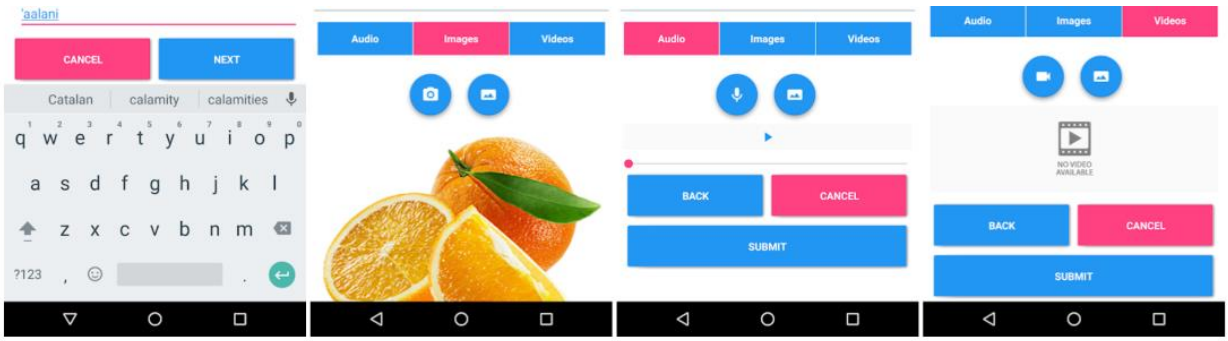

Figure 4: Capture Audio, Images and Videos

Curate

The strength of this curation model is also in its ability to curate these artefacts to optimise the multidimensional approach to sustainability. The platform will facilitate the knowledge of professionals from each respective area rather than a one-dimensional approach of addressing all the issues from one

perspective. Experts can curate the media content posted in the forum style, as 'moderators' can be assigned to check ideas/concepts, practices and systems/implementations.

In this regard, it is a process of education. Following from this is the ability to develop a reward system for those who contribute positively. As with other apps, a competitive element is crucial for driving the process of capturing this information, hence a scoring system in the form of 'likes' or an equivalent will allow a form of recognition of quality. One limitation of the system is the ability of manipulation by bots with any form of upvote or like system. However, the use of moderators with credentials in a given area can prevent this. By giving an elevated status to moderators who are experts in one dimension, quality content is able to be maintained.

Discover & Share

The ability to make the platform a cross media platform is imperative for systematically changing business practices across industries. As with other social media platforms, the integration of multiple services such as Facebook, Twitter and YouTube promotes access to a wider audience. Furthermore, this will allow users of the app exposure to different ideas and approaches to sustainability – for example, a YouTube video may evoke different reactions than a detailed written piece of media on Facebook. By integrating functions which support and develop these other social media platforms and the ability to share content, sustainable practices within organisations can be altered more quickly and effectively. The use of location services can also aid the discovery process as ideas can be found in other surrounding organisations.

The platform will allow users to discover knowledge from the dynamic repository and then share the content to the wider community using social media as shown in Figure 5. The user would first select if they want to explore ideas/concepts, practices or systems/implementations. On selection, they would need to select one of the sustainability dimension – economic, environmental or societal. In Figure 5, environmental dimension has been selected. Consequently, the four related SDGs/dimensions are displayed. Once the secondary dimension is selected, the related concepts/ideas will appear in a list format. On selection of the list item, a detailed view is displayed. The user can browse, contribute or share artefacts including audio, images and videos.

Collaborate

Collaboration between people and organisations is perhaps the most crucial element for developing these artefacts and sustaining the system. As illustrated below, the Collaboration Model adapted from the OECD model constructed by Clarke (2013) utilises artefacts and information within an organisation. These artefacts are then able to be discussed, shared and analysed by each of the outer layers in a process of broadening collaboration.

Collaborating with each of these entities optimises the ability for each of the other processes – capturing, curating, discovering, and persuading – to function. It also enables the connection of multiple organisations to create initiatives spanning single or multiple industries or regions. The implications of such effective collaboration are the development of unique artefacts and the creation of multidimensional systems within organisations which ensure sustainable practices (Salvatore et al. 2008).

Persuade

Persuasion is the consequence of executing the other aspects of constructing artefacts proficiently. Through effective capturing, curation, collaboration and discovery, the crowd sourced platform will have profound impact on an individual's perspective towards organisational sustainability. This persuasion is the force which motivates change (Corbett et al. 2017). The ability for the platform to persuade can be optimised through integrating certain aspects into the systems perspective and building on current persuasive frameworks such as Carbon Management Systems (Corbett et al. 2017). We have integrated the platform with Google Play services that allows us to persuade the user through gamification (points and badges).

To persuade individuals to conform to these practices of organisational sustainability, focus on Psychological and Self-fulfilment needs must be recognised. That is, in order to convince people within organisations, the processes and artefacts which are constructed must additionally give one a sense of achievement. Achieving this requires the persuasion of the artefacts to be educational – to understand the

scale and significance of sustainability. Giving each individual a sense of purpose and creativity in their ability to contribute through crowdsourcing to solve sustainability issues is at the heart of the persuasive systems perspective. Ultimately, the persuasion of individuals, organisations and society as a whole is the necessary reality to achieve the ever-closing window of organisational sustainability.

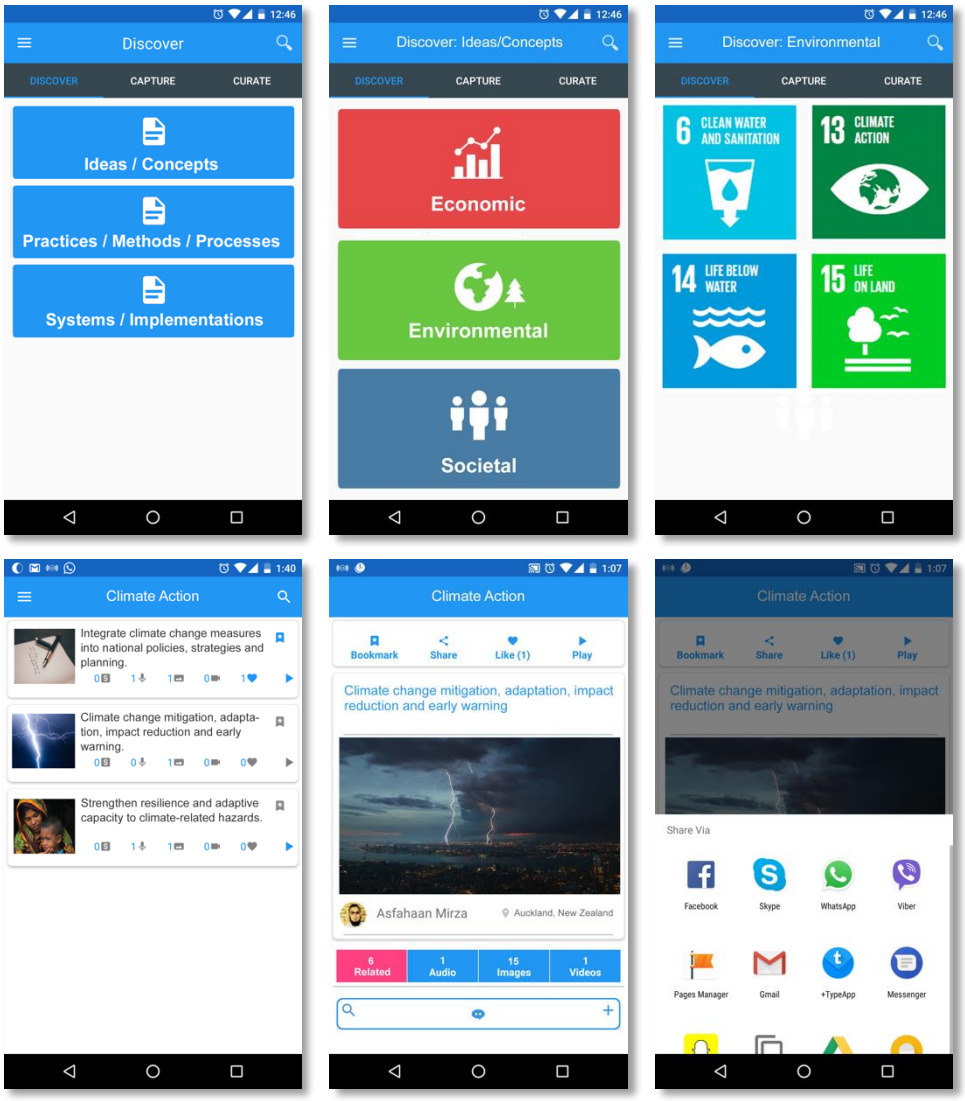

Figure 5: Discover and Share – Ideas/Concepts, Practices and Systems/Implementations

Conclusion

In conclusion, this research leverages the strengths of collective intelligence to design and implement a crowd sourced platform to promote sustainability and productivity. We first conducted a literature review on sustainability, which helped us define the practical and research problems. Based on the identified practical and research problems, we adopted an appropriate design science research methodology to propose conceptual and system artefacts. The key concepts and processes include capture, curate, discover/share, collaborate and persuade. Each of these vital processes were implemented to create an intuitive crowd sourced platform. Further research needs to be conducted to evaluate and refine our conceptual and system artefacts.

REFERENCES

Ahmed, M. D. 2009. *Sustainable Business Transformation: A Roadmap, Framework, Architecture and Implementation*, University of Auckland.

Aziz, F., Mahadi, N., and Baskaran, S. 2017. "Fostering Employee Pro-Environmental Behaviour: Does Emotional Intelligence Matters?," *International Journal of Academic Research in Business and Social Sciences* (7:10), Human Resource Management Academic Research Society, International Journal of Academic Research in Business and Social Sciences, pp. 567–575.

Bertrand, M., and Mullainathan, S. 2004. "Are Emily and Greg More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination," *American Economic Review* (94:4), pp. 991–1013.

Clarke, R. 2013. "Challenges Facing the OECD's Revised Security Guidelines." (http://www.rogerclarke.com/SOS/OECDS-1311.html).

Clements, R. B. 1996. *Complete Guide to ISO 14000*, Prentice Hall Direct.

Corbett, Jacqueline, And Sarah Cherki, El Idrissi. 2013. "Assessing the Influence Of Persuasive Systems For Sustainability Across Work-Home-Community Boundaries." In Proceedings of the 25th European Conference on Information Systems (ECIS), Guimarães, Portugal, June 5-10, 2017 (pp. 2874-2884). ISBN 978-0-9915567-0-0 Research-in-Progress Papers.

Corbett, Jacqueline. 2013. "Designing and using carbon management systems to promote ecologically responsible behaviors." Journal of the Association for Information Systems 14, no. 7: 339.

Diamandis, P. H., and Kotler, S. 2015. *Bold: How to Go Big, Create Wealth and Impact the World*, Simon and Schuster.

Godwin-Jones, R. 2011. "Emerging Technologies: Mobile Apps for Language Learning," *Language Learning & Technology* (15:2), pp. 2–11.

GRI. 2002. *Sustainability Reporting Guidelines*, Boston, USA.

GRI. 2006. *Sustainability Reporting Guidelines, Version 3.0, Amsterdam, GRI*.

Gregor, S. and Hevner, A.R., 2013. Positioning and presenting design science research for maximum impact. MIS quarterly, 37(2).

Griggs, D., Stafford-Smith, M., Gaffney, O., Rockström, J., Öhman, M. C., Shyamsundar, P., Steffen, W., Glaser, G., Kanie, N., and Noble, I. 2013. "Policy: Sustainable Development Goals for People and Planet," *Nature* (495:7441), Nature Publishing Group, p. 305.

Hall, T. J. 2011. "The Triple Bottom Line: What Is It and How Does It Work?," *Indiana Business Review* (86:1), Indiana University, School of Business, p. 4.

Hammer, J., and Pivo, G. 2017. "The Triple Bottom Line and Sustainable Economic Development Theory and Practice," *Economic Development Quarterly* (31:1), SAGE Publications Sage CA: Los Angeles, CA, pp. 25–36.

Hevner, A. R., March, S. T., Park, J., and Ram, S. 2004. "Design Science in Information Systems Research," *MIS Quarterly* (28:1), pp. 75–105.

Holden, E., Linnerud, K., and Banister, D. 2017. "The Imperatives of Sustainable Development," *Sustainable Development* (25:3), Wiley Online Library, pp. 213–226.

Hyde, J. S. 2005. "The Gender Similarities Hypothesis.," *American Psychologist* (60:6), American Psychological Association, p. 581.

Jones, N. 2017. "How the World Passed a Carbon Threshold and Why It Matters," *YaleEnvironment360*.

Kajikawa, Y., Ohno, J., Takeda, Y., Matsushima, K., and Komiyama, H. 2007. "Creating an Academic Landscape of Sustainability Science: An Analysis of the Citation Network," *Sustainability Science* (2:2), Springer, p. 221.

Kajikawa, Y., Saito, O., and Takeuchi, K. 2017. "Academic Landscape of 10 Years of Sustainability Science," *Sustainability Science* (12:6), Springer, pp. 869–873.

Komiyama, H., Takeuchi, K., Shiroyama, H., and Mino, T. 2011. *Sustainability Science: A Multidisciplinary Approach*, Tokyo (Japan) United Nations Univ. Press.

March, Salvatore T., and Veda C. Storey. "Design science in the information systems discipline: an introduction to the special issue on design science research." MIS quarterly (2008): 725-730.

Martin, W. 2016. "The 16 Countries with the Most Civil Unrest." (http://uk.businessinsider.com/countries-with-the-highest-risk-of-civil-unrest-worldwide-2016-8/?r=AU&IR=T).

Mcginn, D. 2017. "The Best-Performing Ceos In The World 2017," *Harvard Business Review* (95:6), Harvard Business School Publishing Corporation 300 North Beacon Street, Watertown, MA 02472 USA, pp. 66–71.

Mirza, A., and Sundaram, D. 2016. "Harnessing Collective Intelligence to Preserve and Learn Endangered Languages," in *Proceedings of 2nd EAI International Conference on Nature of Computation and Communication*, P. C. Vinh and L. Barolli (eds.), Rach Gia, Vietnam: Springer International Publishing, pp. 224–236. (https://doi.org/10.1007/978-3-319-46909-6_21).

Mirza, A., and Sundaram, D. 2017. "Design and Implementation of Socially Driven Knowledge Management Systems for Revitalizing Endangered Languages," in *Social Knowledge Management in Action, in the Knowledge Management and Organizational Learning Series*, R. Helms, J. Cranefield, and J. van Reijsen (eds.), Springer International Publishing, pp. 147–167. (10.1007/978-3-319-45133-6_8).

Nunamaker Jr, J. F., and Chen, M. 1990. "Systems Development in Information Systems Research," in *System Sciences, 1990., Proceedings of the Twenty-Third Annual Hawaii International Conference on* (Vol. 3), IEEE, pp. 631–640.

Nunamaker Jr, J. F., Chen, M., and Purdin, T. D. M. 1991. "Systems Development in Information Systems Research," *Journal of Management Information Systems* (1:3), pp. 89–106.

NZBCSD. 2002. "Business Guide to Sustainable Development Reporting."

Parliamentary Commissioner for the Environment. 2002. "Creating Our Future: Sustainable Development for New Zealand."

Phillips, J., and Land, K. C. 2012. "The Link between Unemployment and Crime Rate Fluctuations: An Analysis at the County, State, and National Levels," *Social Science Research* (41:3), Elsevier, pp. 681–694.

Poslad, S. 2011. *Ubiquitous Computing: Smart Devices, Environments and Interactions*, John Wiley & Sons.

Sorensen, C., Yoo, Y., Lyytinen, K., and DeGross, J. 2005. *Designing Ubiquitous Information Environments: Socio-Technical Issues and Challenges: IFIP TC8 WG 8.2 International Working Conference, August 1-3,*.

Stead, W. E., Stead, J. G., and Starik, M. 2004. *Sustainable Strategic Management . New York: ME Sharpe*.

Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., De Vries, W., and de Wit, C. A. 2015. "Planetary Boundaries: Guiding Human Development on a Changing Planet," *Science* (347:6223), American Association for the Advancement of Science, p. 1259855.

The International Institute for Sustainable Development. 1992. *Business Strategy for Sustainable Development: Leadership and Accountability for the'90s*, International Institute for Sustainable Development.

Thomas, R. 2016. "Robots Could Threaten up to Half New Zealand's Jobs in next 20 Years." (https://www.stuff.co.nz/business/81237965/robots-could-threaten-up-to-half-new-zealands-jobs-in-next-20-years).

Turner, J. M. 2014. "Counting Carbon: The Politics of Carbon Footprints and Climate Governance from the Individual to the Global," *Global Environmental Politics* (14:1), MIT Press, pp. 59–78.

UN General Assembly. 2015. *Transforming Our World : The 2030 Agenda for Sustainable Development*, UN General Assembly. (https://doi.org/A/RES/70/1).

United Nations. 2018. "SDGs : Sustainable Development Knowledge Platform." (https://sustainabledevelopment.un.org/sdgs, accessed February 28, 2018).

Vaughan, N. E., Lenton, T. M., and Shepherd, J. G. 2009. "Climate Change Mitigation: Trade-Offs between Delay and Strength of Action Required," *Climatic Change* (96:1–2), Springer, pp. 29–43.

World Commission. 1987. "World Commission on Environment and Development," *Our Common Future*, Oxford University Press New York, NY.