Proceedings of the ASME 2021
International Design Engineering Technical Conferences and
Computers and Information in Engineering Conference
IDETC-CIE2021
August 17-19, 2021, Virtual, Online

DETC2021-72065

PRODUCT DEVELOPMENT USING PERCEIVED CORRELATIONS BETWEEN THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS AND SOCIAL IMPACT CATEGORIES

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ABSTRACT

This paper discusses the perceived relations between the Social Impact Categories (SIC) and Social, Economic, and Environmental (SEE) Aspects derived from the United Nations' Sustainable Development Goals (SDGs). Surveys showed high correlations between Health and Safety and Population Change to the majority of SEE Aspects. There were also high correlations between the SICs and economic and environmental factors. Further research will survey perceived relations between all three SEE impact categories.

INTRODUCTION

Sustainable development can be broken down into social, economic, and environmental [1] categories. The effects products have on these factors are difficult to quantify, and progress can be difficult to measure with confidence [2]. These factors are interrelated, and achieving sustainable development will require work in many facets of life [3]. By compiling and analyzing perceived correlations between these factors, designers can have a better understanding of how products affect people and society in general. With this information, designers can link individual products that solve isolated problems to the larger overall impact of sustainable development. Identifying the connections between social, economic, and environmental impacts and sustainable product development facilitates innovation and progress on a global scale.

Design engineers who focus on global development seek to create products that will maximize benefit to their intended recipients. They pursue sustainable development across an impact spectrum that includes social, economic, and environmental categories [4]. However, products that positively affect one category might negatively affect another, and these consequences are often difficult to foresee in the midst of the development process. For example, a product might be cheaper to manufacture and buy, but may negatively impact the customers' local environment. This paper explores and illustrates some of these correlations and relationships to aid sustainable development across social, economic, and environmental categories.

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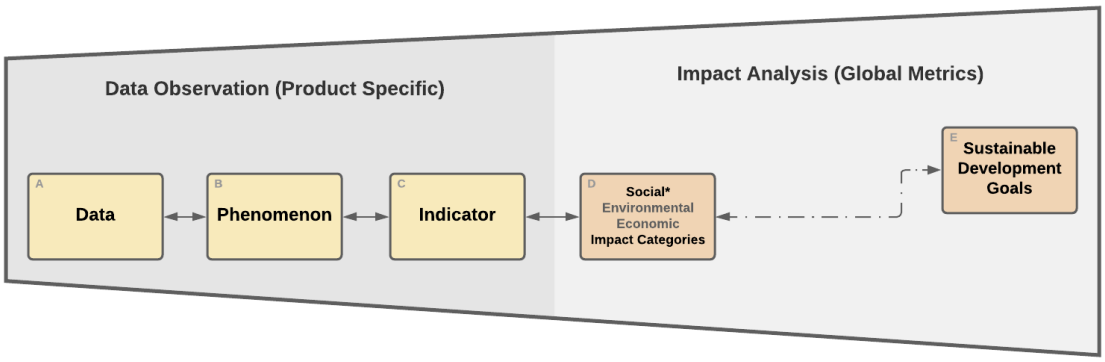

FIGURE 1. Connection map between design and impact analyses elements. This figure illustrates an expanding scope from Data on the left to Sustainable Development Goals on the far right. The first three boxes are generally used by engineers and product designers while the latter two are used by leaders, stake holders, and those who provide funding. *For this paper, we narrow our focus to only the Social Impact Categories however, other impacts, such as economic and environmental are also extant.

Ultimately, our goal is to relate individual products to their global impact more easily, and design products from the early stages of development in a way that catalyzes effective progress and provides beneficial results to all. Fig. 1 shows a mapping of our current knowledge in this field and illustrates where research is lacking.

In Fig.1, Boxes A-C and boxes C and D have been linked in prior publications [5, 6] but the gap in knowledge between boxes D and E is difficult to traverse. The Sustainable Development Goals (SDGs), while most widely used and accepted, are both directional and biased. The SDGs were created to focus on people's needs, but it disregards global impact with respect to products. To make the link between boxes D and E clear, it is necessary to add an additional box that both neutralizes the SDGs and encompasses all three of the impact categories. The intended audience of the ideas proposed in this paper are those at the product design level and those who provide funding for larger projects.

LITERATURE REVIEW

As it is now, the design process is not fully connected to the sustainable development response. Sustainable development can be split into three parts of the Triple Bottom Line (TBL) developed by John Elkington: social, economic, and environmental [1]. Within each of these three factors, studies have shown their respective impacts, however, the social element is least analyzed [5]. Since the social impact of a product is more difficult to directly measure, perceived impact of products has been studied and new metrics for social development have been created. [5–7]. With the growth of social impact awareness and studies, metrics will continue to improve. Current work in this field discusses the social, environmental, and economic impact of products separately. It is challenging to enact meaningful change if the correlation between facets of the Triple Bottom Line is unknown, and designers do not know where their products create impacts in a sustainable society.

Currently, lists of possible indicators that people use to measure societal change exist, but what is unclear is how social impacts are related to the other economic and environmental impacts.

By comparing lists of Social Impact Categories (SICs) [8] and SDGs [9] and exploring their correlations, we can predict the areas of highest related impact. Around 80% of the sustainability impacts of a product are determined during the design stage of that product [10]. A matrix that shows the highest correlations can improve effectiveness and efficiency as designers will have a general idea of what types of impact will occur while still in this designing phase.

Thus, if designers know that a product meant to impact one category relates to other categories across the TBL, the product can be adjusted and improved earlier to maximize benefit across multiple TBL elements.

In 2015, the United Nations (UN) published 17 Sustainable Development Goals [9]. They include specific targets to increase equality in the world and expand an individual's quality of life. The UN SDGs are well known and agreed upon by at least 70 countries, and although not universally accepted, they are reasonable statements about what development efforts aim to achieve [11–13].

The 11 Social Impact Categories, developed by Rainock et al. [8], are shown in Tab. 1 and are a recent development to assist how and what designers should consider earlier in the design process in terms of the social impacts of their products. We hypothesized that not only are these 11 social impacts highly corre-

TABLE 1. Social Impact Categories

Social Impact Categories	Definition
Stratification	Society's hierarchical ranking of groups of people (economic, religious, racial)
Health & Safety	Living conditions, security, physical and mental health and safety
Human rights	Protection of legal rights of various groups of people
Networks & Communication	Relationships and connections between people, organizations and communities
Crime & Conflict	Both formal and informal conflict between individuals and communities
Cultural Identity & Heritage	Customs of living passed through tradition
Family	Changes in daily living; Interactions, stresses, and relationships with those you live with and the family's role in society.
Gender	Gender roles and perceptions
Education	Quality and availability
Paid Work	Employment and wages.
Population Change	The immigration and emigration of people from countries, regions, and communities.

lated to the social categories the UN developed, but the economic and environmental SDGs as well. Our analysis investigates how these 11 social impacts also affect established social, economic, and environmental factors in order to extend the potential of these sustainable development tools to directly assist the designer and indirectly improve the quality of life of members of society.

The SICs show facets of society. These illustrate how products affect people and society as a whole, with either positive or negative consequences. A product's impacts and consequences are measured and categorized by their primary, secondary, and tertiary responses. The primary is the immediate and direct effect which can usually be predicted with a high degree of accuracy. The secondary responses may be delayed with time and give indirect and less directly measurable effects, but metrics are being created to do so [5]. The tertiary are often difficult to predict or relate to a singular product, and may come about due to multiple conditions, interactions with other products, or external influences. For each of these effects, specific indicators are identified and measured, which can then be analyzed, leading to meaningful correlations between social, economic, and environmental factors.

METHODS

Because the SDGs are listed as goals, many of them are stated in a way that biases attention toward positive impact, potentially obscuring negative impacts from decision makers. To reduce this bias, we recast the SDGs as Social, Economic, and Environmental (SEE) Aspects, as neutral facets, that are neither positive nor negative. Initial projections of the location of the 19 SEE Aspects with respect to the TBL are presented in Fig. 2.

In general, the UN SDGs and the proposed SEE Aspects relate directly from one to the other, however a few goals were combined or split into two to ensure independence. As these SEE Aspects are neutral categories by themselves, the actual impacts on that category could fall on a spectrum from negative to positive. If a product could cause impacts in both directions of this spectrum, the category was split up, as shown in Fig. 3. For example, a weapon technology and associated products might increase the strength of an institution, but the willingness of the people to follow that institution might decrease. Therefore, the UN SDG of Peace, Justice, & Strong Institutions was split into the SEE Aspects of Strength of Institutions and Response to Authority to account for such situations.

There are expected correlations between the SICs and the Social Aspects; we additionally analyzed the strength of the unexpected correlations between the SICs and the Economic and Environmental Aspects. Consolidating these perceived correlations would illustrate the connections between all three members of the Triple Bottom Line.

In surveys supported by Qualtrics, participants evaluated and shared their perceived correlations between the SEE Aspects and SICs. Participants included engineers who work in sustainable development as well as acquaintances of the researchers, through online distribution. In the first survey, with 107 responses, participants compared the 19 SEE Aspects to nine of the SICs. See example question from the survey in Fig. 7 in the Appendix. A shorter second survey (about 10 minutes) compared the 19 SEE Aspects to Paid Work and Population Change but only had 21 responses. We acknowledge the second survey did not have as many responses nor was as varied demographically. However, the shortened survey time limited survey fatigue and potentially improved the quality of the results. A third survey, which randomly assigned the order of the 19 questions to prevent surveyor fatigue, had 66 responses. In total, we had 194 responses.

We recognize that a truly unbiased data set does not exist. The survey was in English and mostly sent throughout North America but a series of demographic questions illustrate a variety in participants.

Of the 194 participants across all surveys, 50% were female, 35% were male, and 15% were non-binary or preferred not to say. People who participated in the survey represented White (71%), Black (12%), Asian (6%), American Indian (1%), or other races (10%) and were located in North and South America (82%), Africa (12%), Europe (5%), Asia (.5%), and Oceania (.5%), with ages ranging from under 18 to 76.

The surveys asked demographic questions and then gave an

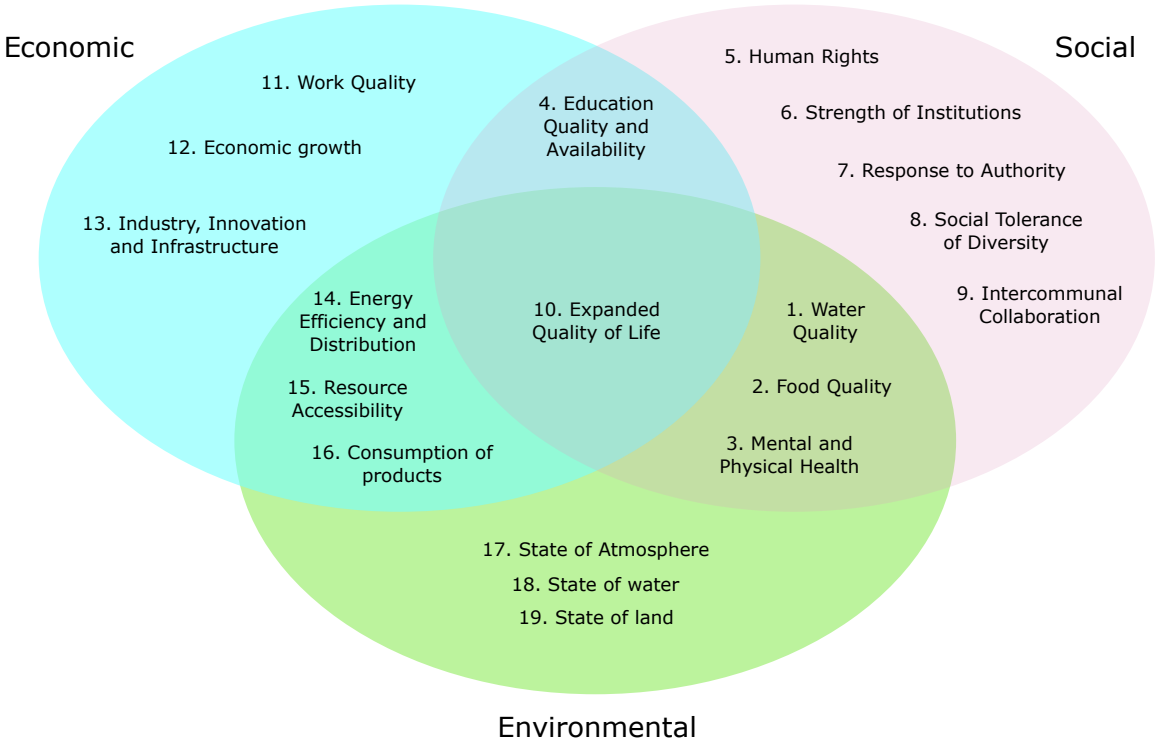

FIGURE 2. Venn Diagram of the Distribution of SEE Aspects with respect to the Triple Bottom Line.

explanation of the SEE Aspects and SICs. There were 19 questions in matrix form asking people to choose if the SIC and SEE Aspect had a high, medium, or low correlation to one another. We also included an "I don't know" column to filter out guesses and those categories that were unfamiliar.

Because these are perceived impacts, the life experiences of individuals will affect their responses. In order to have a wide sample the survey was sent to various people around the world; the diversity increases the likelihood of similar responses if the survey was repeated.

Efforts to share with additional individuals and collect more data are ongoing to increase the sample size and further validate the results.

RESULTS

The data presented in Tab. 2 in the Appendix shows the percentage of people surveyed who designated either a medium or high correlation with each of the SICs and SEE Aspects. The top half of the table underneath each SIC shows the percentage of people who saw a high correlation with the specified Aspect. The bottom half shows the combined percentage of people who thought the correlation was either medium or high.

The data from this survey validated previous assumptions that the social SEE Aspects would have high correlations with most of the SICs. However, there were several unexpected insights from the data as well.

In order to parse the data, the results from the bottom half of Tab. 2 are visualized in Fig. 4 for increased readability and analysis. The larger the horizontal bar, the more people consider there to be a strong connection between each SEE Aspect and SIC. Thus, most people perceived meaningful correlations between Health and Safety and the majority of the SEE Aspects, but did not see a similar connection between Aspects such as Gender and those related to the environment.

75% of the participants ranked the Health and Safety SIC as having either a medium or high correlation to all but one of the SEE Aspects. These findings are generally consistent with the findings of perceived social impacts on specific products [6]. The authors' research showed that people perceive Health and Safety as being highly correlated to most products, more so than any other SIC. At least by initial and uninformed perception, people recognize how Health and Safety correlate to other TBL factors, especially poverty [14]. Further validation could support whether this SIC has definite primary effects on each of the SEE Aspects or if people are just more aware of health and safety.

Additionally, Population Change had over a 75% Medium/High correlation for all but three SEE Aspects. The SICs of Stratification, Human Rights, and Education also had over 75% Medium/High correlation for the majority of SEE

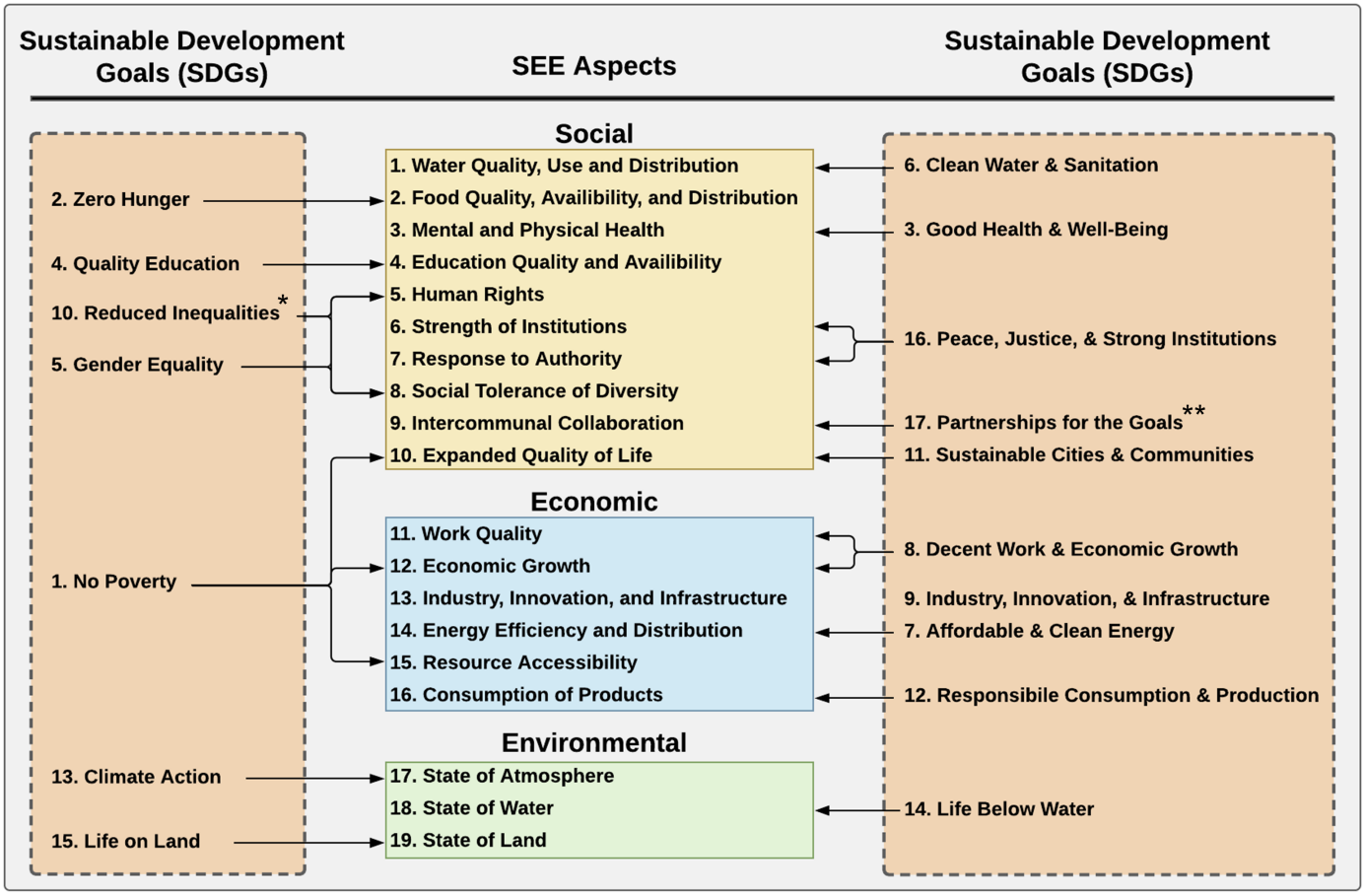

FIGURE 3. 19 SEE Apects connected to the 17 Sustainable Development Goals. *SDGs Gender Equality and Reduced Inequalities were combined by the shared concept of universal equality. This grouping was then split into both social and legal ramifications, Social Tolerance of Diversity and Human Rights respectively, since the Aspect was too broad to compare using only one spectrum. **Intercommunal Collaboration was derived from Partnerships for the Goals, but they are fundamentally different categories. SDG #17 was meant to detail the different organizations that were working towards completing the UN goals. However, SEE Aspect #9 deals with self-contained societies being able to work with one another toward sustainable development. The SDGs are split to the left and right side for image clarity only.

Aspects. The high correlations of the above mentioned SICs are significant as only 10 of the SEE Aspects (just over half) are considered social impacts. What this may suggest is that people perceive social change as significantly impacting environmental and economic factors as well.

Among the 11 SICs, Culture and Gender did not have very high correlations to most of the categories. This suggests that most people do not see strong connections with these specific SICs to the 19 SEE Aspects derived from the UN SDGs. These connections might be viewed as indirect, secondary, or inconsequential for a generalized product or innovation. This also suggests that a future product that may seek to satisfy an Aspect or Goal isn't expected to translate to social impact in Culture and Gender. However, other studies have suggested that cultural stigmas can have a negative affect on other factors, like Health and Safety [15]. A study in Europe showed gender roles greatly influencing Health and Safety and Paid Work. [16]. Further research could expand why this is observed and if products do have lower impact in these categories, or if perceptions of impact in these three categories are just low, based on the availability heuristic, historical trends, or bias.

Additionally, family had over 62% medium or high correlation to all the SEE Aspects. While there were only 9 SEE Aspects with over 75% High/Medium correlation, Family is one of the most consistent across all 19 Aspects. In the social sciences, there are several studies on the impact health has on rela-

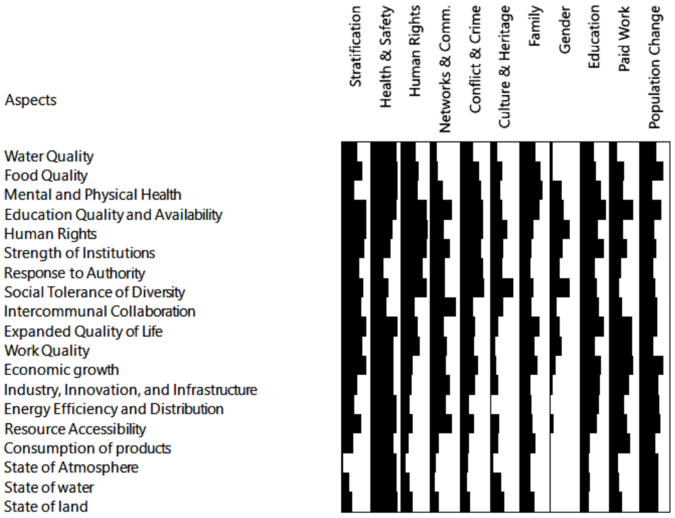

FIGURE 4. Visualization of the Survey data between SEE Aspects and Social Impact Categories taken from Tab. 2.

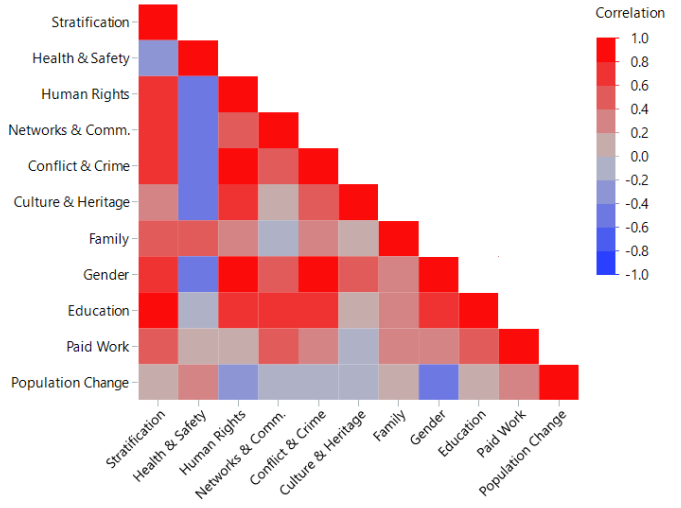

FIGURE 5. Correlations between Social Impact Categories survey respondent percentages.

tives, [17, 18] but little in the product development space. However, one study showing the impact of vacuums on families illustrated that familial behavior changed significantly due to the introduction of a new technology [19]. The perceived correlations exist; further research should pursue the extent of family on different SEE Aspects.

Thus, because these results are perceived correlations, the knowledge and experience that participants have with these SICs affects their responses. From the demographic results, 47% of the people surveyed were students and 68% were ages 18-30, which could influence their awareness of stratification, human rights, and education. It is likely that people in general are also more aware of health and safety and population change, as those are physical impacts with visible repercussions, and failures and product recalls are more common in news and media outlets. Observed changes in stratification of communities, family lifestyles, and human rights, for example, might be less obvious and not as defined. Developments in more concrete indicators of changes in all the SICs would increase the reliability of the results.

Lastly, the correlation between the percentage vectors from the survey is also illustrating how participants respond to the questions. In Fig. 5, red cells are indicative of high correlation between SICS, while blue represents negative correlation. Again, the SIC of Health and Safety stands apart from the others suggesting participants view it as unique and perhaps within their domain of experience. This may be reflective of historical trends, legislation, and overseeing agencies which have passed laws or defined standards for products such as the FDA and with globally recognized ISO standards. Interestingly, Population Change seems to be the one SIC most closely correlated with Health and Safety but neutral or negatively correlated with most other SICs.

DISCUSSION

These connections and matrices result in various transformations (see Fig. 6) between the domains that designers can leverage to generate concepts, explore the design space, and evaluate performance and impact metrics across interrelated dimensions.

A number of potential uses for these connections and matrices might include the following proposed process, with the designated letters referring to Fig. 6: (A) Begin with the particular product being designed (e.g. stoplight). (B) Find 1-3 similar products within the matrix described in Ref. [6] and note the SICs that are most likely to be affected (e.g. Conflict and Crime). (C) Once the SICs have been selected, use Table 2 and Fig. 4 to determine which SEE Aspects are most directly correlated (e.g. Response to Authority). (D) Use Fig. 3 to determine the most relevant SDGs based on the chosen SEE Aspects (e.g. Peace, Justice, & Strong Institutions). Use this information to identify additional data, sponsors, application areas, and collaborations with other entities to increase success and impact of the specific product.

In a reverse order, Fig. 6 can also be used to narrow in on which kinds of products will impede or improve work on a specific SDG (D) by applying Fig. 3 (C) to first determine the SEE Aspect(s) that encompass the chosen SDG. Then, Tab. 2 and Fig. 4 (B) can be used to select a small number of SICs that have the highest correlations to the Aspects. Finally, the matrix from Ref. [6] (A) can be used to show a number of example products that relate to the relevant SICs. Other processes and orders are likely possible and form part of the future work of this research.

Although the data collected validated some hypotheses it also inspired additional questions answerable with further re-

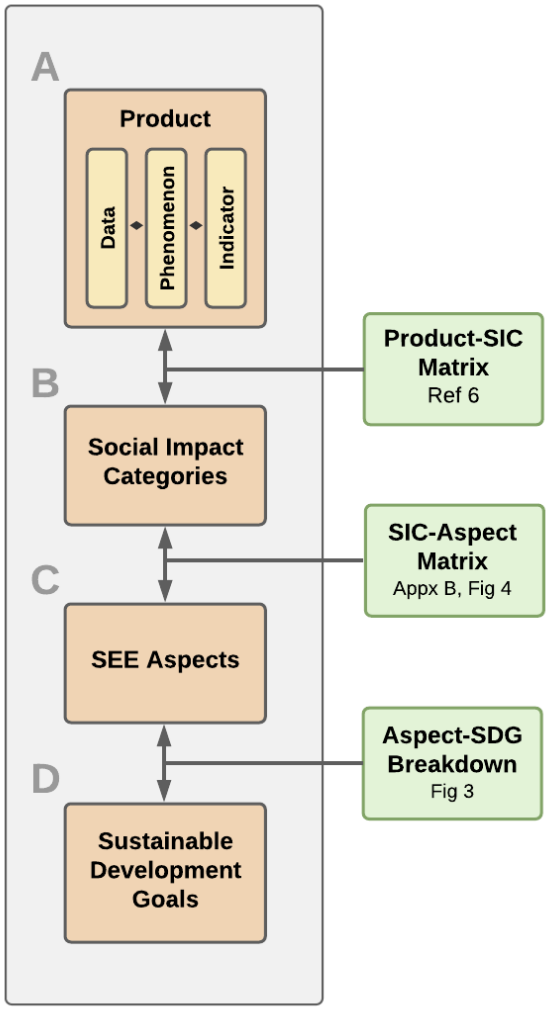

FIGURE 6. Connection and mapping between various design impact abstractions.

search. The surveys were limited to analysis of the social impacts in relation to the SEE Aspects. Regardless, we found that people do see high correlations between SICs and all three of the TBL factors indicating a coupled design space across the TBL, SEE, and SICs, that needs to be studied in more detail.

A natural extension of this research is the development of economic and environmental impact categories (ECIC and ENIC, respectively) and replication of the survey with respect to the SEE Aspects, to confirm if economic and environmental impacts have high perceived social correlations. Currently, the UN SDGs are being studied in relation to business and accounting [20]. Environmentalists acknowledge that elements of climate change can relate to several SDGs and the healthcare industry [21]. There is an interest in the social, economic, and environmental impacts. This research will continue to synthesize studies to create a commonplace connecting all three factors of the TBL.

The results of the surveys validated the hypothesis that changes in social impact are highly coupled to the economy and environment. This gives us reason to pursue this topic further to learn quantitatively the connections between all the categories.

The next steps to validate the perceived results are to test out these connections with actual products, analyzing the effects, and seeing if people's perceptions are in accordance with real-world observations.

Further research will also expand on which of these correlations are primary, secondary, or tertiary effects. Designers will then be able to use this data when planning a product in order to optimize sustainable development.

CONCLUSION

The purpose of this paper was to quantify the correlations between the Social Impact Categories and Social, Economic, and Environmental Aspects, derived from the UN Sustainable Development Goals. The survey asked for the level of correlation between the SICs and SEE Aspects. High correlations were found between the SICs of Health and Safety and Population Change and the majority of the SEE Aspects. Further research will find the perceived correlations between Economic and Environmental Impact Categories and the SEE Aspects.

REFERENCES

[1] Elkington, J., 2004. "Enter the triple bottom line". *The triple bottom line: Does it all add up,* ***11***(12), pp. 1–16.

[2] Epstein, M. J., and Buhovac, A. R., 2014. *Making sustainability work: Best practices in managing and measuring corporate social, environmental, and economic impacts*. Berrett-Koehler Publishers.

[3] Organization, W. H., et al., 2003. *DAC guidelines and reference series poverty and health*. OECD Publishing.

[4] Gennari, C., 2000. "Architectural ergonomics and sustainable design: A model proposition". In Proceedings of the Human Factors and Ergonomics Society Annual Meeting, Vol. 44, SAGE Publications Sage CA: Los Angeles, CA, pp. 36–39.

[5] Stevenson, P. D., Mattson, C. A., Bryden, K. M., and MacCarty, N. A., 2018. "Toward a universal social impact metric for engineered products that alleviate poverty". *Journal of Mechanical Design,* ***140***(4).

[6] Ottosson, H. J., Mattson, C. A., and Dahlin, E. C., 2020. "Analysis of perceived social impacts of existing products designed for the developing world, with implications for new product development". *Journal of Mechanical Design,* ***142***(5).

[7] Martin, B. L., and Abbott, E., 2011. "Mobile phones and rural livelihoods: Diffusion, uses, and perceived impacts among farmers in rural uganda". *Information Technologies & International Development,* ***7***(4), pp. pp–17.
[8] Rainock, M., Everett, D., Pack, A., Dahlin, E. C., and Mattson, C. A., 2018. "The social impacts of products: a review". *Impact assessment and project appraIsal,* ***36***(3), pp. 230–241.
[9] Assembly, G., 2015. Resolution adopted by the general assembly on 19 september 2016. Tech. rep.
[10] Ahmad, S., Wong, K. Y., Tseng, M. L., and Wong, W. P., 2018. "Sustainable product design and development: A review of tools, applications and research prospects". *Resources, Conservation and Recycling,* ***132***, pp. 49–61.
[11] Biermann, F., Kanie, N., and Kim, R. E., 2017. "Global governance by goal-setting: the novel approach of the un sustainable development goals". *Current Opinion in Environmental Sustainability,* ***26***, pp. 26–31.
[12] Bexell, M., and Jönsson, K., 2017. "Responsibility and the united nations' sustainable development goals". In Forum for Development Studies, Vol. 44, Taylor & Francis, pp. 13–29.
[13] Bali Swain, R., and Yang-Wallentin, F., 2020. "Achieving sustainable development goals: predicaments and strategies". *International Journal of Sustainable Development & World Ecology,* ***27***(2), pp. 96–106.
[14] Price, J. H., Khubchandani, J., and Webb, F. J., 2018. "Poverty and health disparities: what can public health professionals do?". *Health promotion practice,* ***19***(2), pp. 170–174.
[15] Airhihenbuwa, C. O., Ford, C. L., and Iwelunmor, J. I., 2014. "Why culture matters in health interventions: lessons from hiv/aids stigma and ncds". *Health Education & Behavior,* ***41***(1), pp. 78–84.
[16] Sorrentino, E., Vona, R., Monterosso, D., and Giammarioli, A. M., 2016. "Gender issues on occupational safety and health". *Annali dell'Istituto superiore di sanita,* ***52***(2), pp. 190–197.
[17] Cerel, J., Jordan, J. R., and Duberstein, P. R., 2008. "The impact of suicide on the family.". *Crisis: The Journal of Crisis Intervention and Suicide Prevention,* ***29***(1), p. 38.
[18] Lipton, R. B., Bigal, M., Kolodner, K., Stewart, W., Liberman, J., and Steiner, T., 2003. "The family impact of migraine: Population-based studies in the usa and uk". *Cephalalgia,* ***23***(6), pp. 429–440.
[19] Forlizzi, J., 2007. "How robotic products become social products: an ethnographic study of cleaning in the home". In 2007 2nd ACM/IEEE International Conference on Human-Robot Interaction (HRI), IEEE, pp. 129–136.
[20] Bebbington, J., and Unerman, J., 2018. "Achieving the united nations sustainable development goals". *Accounting, Auditing & Accountability Journal*.
[21] Lilienfeld, E., Nicholas, P. K., Breakey, S., and Corless, I. B., 2018. "Addressing climate change through a nursing lens within the framework of the united nations sustainable development goals". *Nursing Outlook,* ***66***(5), pp. 482–494.

Appendix A: Survey Question and Results

The following figure shows an example of how the survey questions appeared in Qualtrics. Below the figure, a table shows the results of the perceived correlations based on these survey questions

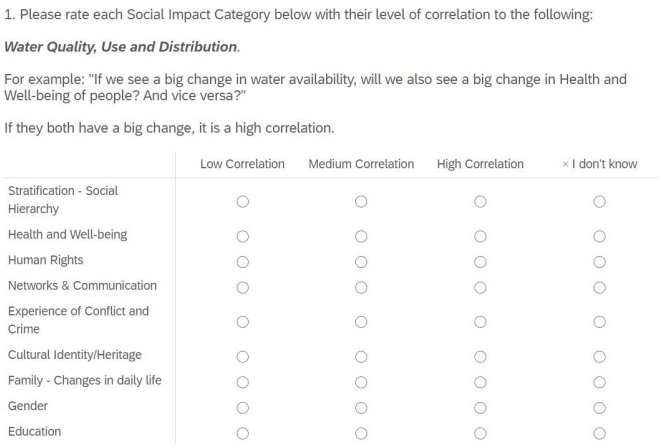

FIGURE 7. Survey Question Example

TABLE 2. PERCENTAGE OF HIGH (TOP) AND MEDIUM+HIGH (BOTTOM) PERCEIVED CORRELATIONS BETWEEN SOCIAL IMPACT CATEGORIES AND SOCIAL, ECONOMIC, AND ENVIRONMENTAL ASPECTS.

Aspects	Stratification	Health & Safety	Human Rights	Networks & Comm.	Conflict & Crime	Culture & Heritage	Family	Gender	Education	Paid Work	Population Change
Water Quality	35.63%	92.39%	39.33%	13.25%	17.65%	7.59%	44.94%	14.94%	30.68%	20.37%	43.40%
Food Quality, Availability, and Distribution Methods	54.02%	93.33%	46.51%	15.48%	45.56%	21.18%	50.00%	12.94%	30.34%	34.55%	59.26%
Mental and Physical Health	31.11%	91.49%	38.89%	21.11%	53.93%	20.93%	62.22%	25.27%	51.61%	35.71%	29.63%
Education Quality and Availability	75.00%	50.00%	55.32%	50.00%	49.43%	26.74%	35.16%	36.90%	91.49%	77.97%	57.89%
Human Rights	73.33%	44.00%	89.04%	22.54%	64.29%	38.36%	32.43%	63.01%	43.42%	35.09%	24.14%
Strength of Institutions	72.00%	47.30%	75.00%	47.95%	53.52%	33.33%	24.32%	27.03%	54.93%	30.36%	20.37%
Response to Authority	55.56%	15.71%	54.79%	28.57%	66.67%	23.61%	15.49%	14.08%	35.14%	25.49%	18.00%
Social Tolerance of Diversity	78.67%	31.58%	78.48%	39.19%	56.96%	68.42%	29.49%	53.33%	33.77%	17.86%	34.55%
Intercommunal Collaboration	43.24%	31.58%	41.89%	85.33%	24.64%	41.89%	16.67%	16.90%	52.70%	37.25%	41.51%
Expanded Quality of Life	77.03%	81.08%	40.54%	35.14%	43.48%	19.44%	50.67%	26.67%	71.62%	69.64%	45.45%
Work Quality	58.57%	62.86%	54.93%	33.33%	25.71%	16.18%	30.88%	27.27%	43.48%	71.43%	22.64%
Economic growth	55.22%	51.47%	24.64%	34.33%	41.54%	14.29%	37.68%	17.39%	57.75%	75.93%	54.72%
Industry, Innovation and Infrastructure	50.75%	47.89%	20.29%	62.86%	22.06%	13.04%	19.44%	8.70%	49.30%	56.14%	51.85
Energy Efficiency and Distribution	34.78%	66.18%	21.21%	47.76%	21.54%	9.23%	31.82%	9.09%	33.33%	44.23%	48.15%
Resource Accessibility	54.41%	61.97%	33.33%	63.77%	30.88%	11.76%	20.29%	10.45%	43.94%	50.00%	61.11%
Consumption of products	35.29%	55.71%	8.82%	11.76%	13.64%	17.91%	24.29%	6.15%	17.39%	44.64%	43.86%
State of Atmosphere	16.92%	88.57%	12.12%	17.19%	16.92%	7.81%	13.64%	6.15%	22.73%	21.57%	56.36%
State of water	18.57%	80.00%	24.29%	11.76%	10.14%	21.43%	17.39%	7.04%	20.29%	25.00%	47.46%
State of land	46.77%	73.13%	23.81%	23.44%	23.44%	37.31%	19.05%	9.09%	12.90%	36.00%	58.00%
Water Quality	78.16%	97.83%	76.40%	48.19%	69.41%	46.84%	78.65%	32.18%	72.73%	51.85%	79.25%
Food Quality, Availability, and Distribution Methods	87.36%	100.00%	81.40%	52.38%	84.44%	65.88%	87.50%	35.29%	78.65%	76.36%	94.44%
Mental and Physical Health	72.22%	100.00%	80.00%	72.22%	88.76%	58.14%	91.11%	67.03%	87.10%	73.21%	70.37%
Education Quality and Availability	96.74%	96.81%	97.87%	89.53%	91.95%	67.44%	86.81%	73.81%	97.87%	93.22%	89.47%
Human Rights	96.00%	89.33%	100.00%	74.65%	91.43%	80.82%	72.97%	86.30%	82.89%	73.68%	75.86%
Strength of Institutions	92.00%	86.49%	97.22%	86.30%	88.73%	69.57%	68.92%	70.27%	92.96%	82.14%	79.63%
Respect for Governing Bodies	81.94%	71.43%	90.41%	75.71%	91.67%	68.06%	63.38%	59.15%	77.03%	68.63%	74.00%
Social Tolerance of Diversity	90.67%	82.89%	98.73%	75.68%	93.67%	92.11%	74.36%	86.67%	80.52%	60.71%	78.18%
Intercommunal Collaboration	86.49%	78.95%	72.97%	97.33%	69.57%	71.62%	68.06%	49.30%	83.78%	72.55%	83.02%
Expanded Quality of Life	95.95%	100.00%	79.73%	74.32%	75.36%	52.78%	85.33%	61.33%	93.24%	91.07%	81.82%
Work Quality	87.14%	92.86%	84.51%	79.71%	74.29%	42.65%	76.47%	66.67%	76.81%	91.07%	73.58%
Economic growth	95.52%	92.65%	66.67%	77.61%	83.08%	44.29%	81.16%	46.38%	87.32%	94.44%	94.34%
Industry, Innovation and Infrastructure	77.61%	91.55%	62.32%	85.71%	76.47%	52.17%	63.89%	31.88%	85.92%	85.96%	83.33%
Energy Efficiency and Distribution	72.46%	97.06%	54.55%	77.61%	56.92%	27.69%	68.18%	24.24%	84.85%	76.92%	85.19%
Resource Accessibility	86.76%	97.18%	66.67%	89.86%	73.53%	55.88%	71.01%	37.31%	80.30%	82.69%	88.89%
Consumption of products	66.18%	92.86%	52.94%	54.41%	57.58%	50.75%	78.57%	27.69%	60.87%	87.50%	78.95%
State of Atmosphere	30.77%	98.57%	40.91%	43.75%	50.77%	32.81%	62.12%	24.62%	54.55%	54.90%	83.64%
State of Water	51.43%	98.57%	54.29%	42.65%	49.28%	62.86%	65.22%	25.35%	57.97%	58.93%	84.75%
State of land	64.52%	100.00%	66.67%	56.25%	60.94%	74.63%	76.19%	25.76%	54.84%	70.00%	84.00%