Approaches to Sustainability Framework

Christina Bonanni, Nadine Halabi, Insung Hwang, Mark Kroening
About Us

The Dow Sustainability Fellows Program is made possible through the Dow Chemical Company. Dow supports full-time graduate students and postdoctoral scholars enrolled at the University of Michigan in exploring actionable, interdisciplinary solutions to our current sustainability problems. The program's goal is to identify and prepare future sustainability leaders to make a positive difference in organizations worldwide.

The Dow Sustainability Fellows Masters and Professional Fellowship Program consists of 40 fellows selected from a pool of candidates nominated by Schools and Colleges throughout the University. Each cohort begins in January and concludes in December of the same year. The program includes collaborative activities with all fellows, as well as a substantial interdisciplinary team project. For this project requirement, the fellows self-select into groups of 4-6 interdisciplinary teams and conduct relevant research to develop a comprehensive project or analysis of a particular sustainability challenge.

Christina Bonanni is a third-year law student focusing on environmental law. She plans to work at Pillsbury Winthrop Shaw Pittman LLP in Washington, D.C. after graduation. Her bachelor's and master's degrees are both from American University in Global Environmental Policy and Environmental Science, respectively. Prior to law school, she worked for two years at the U.S. Environmental Protection Agency in the Office of Research and Development. She has conducted environmental research and sustainability projects in Europe, Ecuador and the Galapagos Islands.

Nadine Halabi is a current Masters of Engineering student in Energy Systems Engineering with a 2015 graduation. She holds a bachelor’s degree in Bioengineering from the University of Illinois-Chicago (UIC). She has gained experience in various sustainability related course-work and projects, including the Summer Institute on Sustainability and Energy (SISE) and the Office of Sustainability as an intern at UIC. At the University of Michigan, Nadine is a Graduate Student Instructor for Mechanical Engineering classes on Sustainable Engineering Design and Principles.
Insung Hwang is a second year law student from South Korea. He holds a bachelor’s degree in Biomedical Engineering from Yale University and a master’s degree in Biomedical Engineering from Duke University. Prior to law school, Insung worked on genetic engineering and cloning for four and a half years as a researcher in Sooam Biotech Research Foundation. He plans to practice intellectual property law after graduation.

Mark Kroening is a second year MBA/MPP student at the Ross School of Business and Ford School of Public Policy. Mark is a systems thinker who has identified the power of business and organizational change as his vehicles to drive towards environmental sustainability and social equality. Through his academic pursuits, he is developing tools to enable such change and seeks roles in which to apply them. He can envision and is passionate about catalyzing change to achieve a truly better world for all people. Mark holds a bachelor's degree in Mechanical Engineering from the University of Auckland and has worked extensively in the marine industry as a professional sailor, design engineer, and design team manager.
# Table of Contents

About Us .................................................................................................................. 2
Introduction ............................................................................................................... 6
Methodology ............................................................................................................ 8
  Approaching the Project ....................................................................................... 8
  Research and Development ............................................................................... 8
  Execution and Analysis ...................................................................................... 9
Background Research ............................................................................................. 9
Approaches to Sustainability Framework ............................................................. 11
  Bio-sphere .......................................................................................................... 12
    Traits ................................................................................................................ 13
    Values .............................................................................................................. 13
    Challenges .................................................................................................... 14
    Integration into the model .............................................................................. 14
  Techno-sphere .................................................................................................... 15
    Traits ................................................................................................................ 15
    Values .............................................................................................................. 16
    Challenges .................................................................................................... 17
    Integration into the model .............................................................................. 17
Regulation ............................................................................................................... 18
  Traits ................................................................................................................ 19
  Values .............................................................................................................. 19
  Challenges .................................................................................................... 20
  Integration into the model .............................................................................. 20
Prosperity ............................................................................................................... 21
  Traits ................................................................................................................ 22
  Values .............................................................................................................. 23
  Challenges .................................................................................................... 23
  Integration into the model .............................................................................. 24
Axis formation ....................................................................................................... 25
  Goals ................................................................................................................ 26
Deliverables ........................................................................................................... 26
  Card Game ....................................................................................................... 26
  Workshop ......................................................................................................... 27
Results & Feedback .............................................................................................. 29
  Reaction to the Statements and Traits ............................................................. 29
  Workshop Results ............................................................................................ 30
  Feedback on the Workshop ............................................................................ 33
  Participant Growth ......................................................................................... 35

Bonanni, Halabi, Hwang, Kroening
Introduction

Why is the global population not living sustainably?

The purpose of this project was to tackle sustainability on an intrinsic level and consider platforms or tools to educate people on the importance of sustainability. This required the team to investigate potential competing societal values currently limiting true progress towards environmental sustainability within the United States. The vision for this project was seeing such tools being used as exercises in businesses or academics to educate both employers and employees as well as students and staff members to become more aware about how they approach solving sustainability challenges. In hopes that with a better understanding they can and make more efficient and effective choices that consider the triple bottom line of people, planet, and prosperity. Our mission was to affect change within ourselves and other individuals that may lead to more conscientious choices. Underpinning these statements is the assertion or worldview that living in a sustainable world is an ethically desirable pursuit.

To emphasize this point, as a group we wanted to understand our own individual approaches to sustainability challenges and see how we could better understand other approaches and apply it in our decision making in our respective careers. As a secondary priority, we hoped that this also includes enabling that change in others’ that we encounter, now and in the future.

An investigation in sustainability in the big-picture, as the direction in which our project began, necessitated the identification of, and investigation into, all of the drivers and factors influencing (un)sustainability; specifically highlighting pressure points for affecting change in some of them, the lack of uncertainty and knowledge within this idea, and potential strategies to commence action. It was appreciated that the big-picture could include energy streams, resource streams, and social norms, along with the necessity to ground them in the system in which they operate currently. Sustainability is not organized into silos and success requires the coming together of all parties.

Sustainability means different things to different people. With this project, it was important for to start with a clear, unambiguous definition: sustainability encompasses people, planet, and
prosperity—to live sustainably is to live within the means of the environment without hindering future growth. This definition draws from the work of John R. Ehrenfeld, a progressive thinker fighting the current of popular belief, who states “sustainability is the possibility that humans and other life will flourish on the Earth forever.” Furthermore “…sustainability is a systems property. You don’t measure sustainability; it’s only a possibility.”

Despite an apparent lack of understanding, there are natural limits to the scale and scope of human life on the planet. This concept is explored by the Stockholm Resilience Center. Their research has found that four of the nine planetary boundaries, as they have defined, have been crossed as a result of human activity. These concepts are brought to the mass public by writers such as Jared Diamond with his book “Collapse: How Societies Choose to Fail or Succeed”, where he asks “the urgent question: How can our world best avoid committing ecological suicide?” Underlying the environmental sustainability arguments discussed thus far is the impact on people and society, Robert Putnam’s “Bowling Alone: The Collapse and Revival of American Community” questions social sustainability and presents arguments for movement back towards collective and relational activities.

A tool that the mass population can utilize to assess their current behavior towards sustainability is needed. However, this is difficult to accomplish, but a start to a cultural behavioral shift starts with education playing a key role. Once people understand their current status, this tool could provide them with information to induce the recognition that there are other ways of approaching sustainability. With such recognition, society can drive more fundamental solutions to sustainability, and eventually to a sustainable solution recognizing the “big picture”.

Through this project, the creation of a framework is utilized in hope that it can bring awareness amongst various individuals on their current approach to sustainability. It is understood that this framework is meant as a tool for understanding and educating individuals, and is not expected to create instantaneous results. Even though many people might have some idea of how they approach sustainability, they might not know how to describe it in words. This framework can be the tool that facilitates this process and provide a better understanding of what sustainability challenges exist and how one can be a better leader in their field or in their daily lives.
Once an individual can visually and rhetorically assess his or her current status, then he or she can compare it with those of others. Such comparisons could allow people to recognize that there are alternative approaches to sustainability challenges. With this goal in mind, the framework strives to bring awareness to alternative solutions as well as identify the positive aspects of an individual’s approach to sustainability challenges.

**Methodology**

*Approaching the Project*

Sustainability is an umbrella term that encompasses a variety of challenges. Challenges such as water distribution and quality, air pollution, and even waste products were all addressed in the initial brainstorming sessions of potential project ideas. However, a question arose on why these problems with sustainability exist in the first place. Regardless of whether it is dealing with water, air, or soil, there are underlying reasons as to why humans are not living within the planetary boundaries. We wanted to address the core of the issue, as the “big picture” of sustainability.

As the group explored this idea, it was apparent that there are values held by individuals that triggered them to act or behave in certain manners. This is where the group felt the most change and influence could occur—mainly by understanding the different approaches people have to addressing sustainability and how to educate, as well as bring awareness, the different tactics of solving sustainability challenges. With this idea in mind, the group sought the “best” sustainability approach and found various traits and values that individuals could identify.

*Research and Development*

During research, each member focused on finding literature that encompassed sustainability solutions. Within the research, the group found certain tensions and polarities in the approaches. Further research and exploration brought the group to the Competing Values Framework (CVF) for Leadership which will be later introduced and explained in the Literature Review section proceeding. Adapting this well-defined model to sustainability, the group developed a framework with four different approaches to sustainability. With the CVF framework as a guide,
various competing values within sustainability that lead individuals to make certain decisions were explored.

*Execution and Analysis*

Once the framework for approaches to sustainability was created, the group identified key traits and values that are critical to sustainability. Then, those traits and values were grouped together into quadrants based on their commonality. The quadrants were then named Bio-sphere, Techno-sphere, Regulation, and Prosperity. Each quadrant highlighted the positive attributes of different approaches to sustainability. For the implementation of the framework, a card game was created for use in workshops. The group was able to hold two separate workshops with the completed framework. The first group was within an academic setting of 6 graduate students (used as the initial pilot run) while the other was within the corporate setting of 17 individuals spanning different departments of the Dow Chemical Company. We provided pre- and post-survey questions that were then analyzed to assess whether the participants’ views changed after the workshop.

*Background Research*

A great deal of publications were investigated to comprehend the scope of sustainability in the big-picture, both academic and mainstream. From this research we found many of the positive traits that encompass approaches to sustainability. So much of this reading produced a general understanding of the space and the succinct words that captured positive approaches. Through this research, it quickly become apparent that there were tensions underlying progress towards environmental sustainability, and to best capture it, we would have to develop a framework. Over time the Competing Values Framework rose to the top of the list by which to accomplish our goals.

*Competing Values Framework*

The Competing Values Framework (CVF) was developed by the University of Michigan faculty members to identify and highlight the major indicators of effective leadership and organizational performance. The CVF came from research on criterion that can predict if an organization performs effectively. The CVF is found to be an incredibly useful framework in organizing and
understanding organizations and the individuals within them, including “theories of organizational effectiveness, leadership competencies, organizational culture, organizational design, stages of life cycle development, organizational quality, leadership roles, financial strategy, information processing and brain functioning.” As a result of the robust research behind the framework and its usefulness in widespread application, the framework had been identified one of the 40 most important frameworks in the history of business.

The CVF was developed within two dimensions, based on research on leadership and management skills, information processing, and organizational culture. The first dimension differentiates between flexibility and focused approaches to leadership management. Some organizations are effective because they are constantly adapting, changing, and moving forward with different management structures reflecting their approach to business. On the other hand, some organizations are effective in staying rigid and predictable in management structure and decisions, and this reliability reflect these organizations’ durability.

The second dimension flows from an internal orientation to an external orientation. An internal focus looks at unity, integration, and collaboration, while an external focus looks at competition and rivalry. An organization that is internally focused will encourage a harmonious atmosphere amongst employees, while an externally oriented organization will emphasize competition amongst employees to achieve robust results. The internal end of this axis reflects cohesion, while the external end values independence.

Utilizing these two dimensions leads to the four quadrants of the framework. Each quadrant reflects core values that represent competing or opposite values in leadership approaches. Below is the original Competing Values Framework, as developed by University of Michigan faculty members.7 A visual representation of this framework can be found in Figure 1.
Approaches to Sustainability Framework

The overarching goal in developing this framework was to focus on the positive traits that characterize each quadrant. From here, identifying tensions diagonally and on the horizontal and vertical axes (described more below) were acknowledged. The visual representation of the created framework can be found in Figure 2. A comprehensive explanation on the axis formation of this model can be found under the ‘Axis Formation’ section described later in the paper, but first a breakdown of the four different quadrants: Bio-sphere, Techno-sphere, Regulation, and Prosperity will be defined as follows.
**Bio-sphere**

This quadrant encapsulates humans operating organically within planetary boundaries and utilizing natural ecosystem services. This strategy provides the most certainty for perpetual human life on the planet, gives guidance on how and to what magnitude we can operate, and sustains health for all constituents and within all facets of the system.

This quadrant values natural systems and asserts that they must be used to support human life, albeit at a rate slower than what is technologically possible or one that limits certain types of prosperity for some groups. Planet earth was at its equilibrium before humans began permanently impacting its natural systems, now acknowledged through the new epoch—the Anthropocene. To approach true environmental sustainability, we must acknowledge the thresholds of the planet’s primary systems that we must not move beyond in order to avoid an equilibrium that may not be suitable for human life, or adaptable to by humans. We need to limit blind outputs into the environment that have a risk of catastrophically interrupting our natural systems. The planet will provide the solutions, as long as we flexibly operate within its natural systems and constraints.
Traits

There are certain traits that are necessary due to the human population being embedded in the planetary ecosystem:

- **Biodiverse**: The ecosystem relies on a variety of species of life in complex ways.
- **Conserving**: Limited resources must be used in ways that distribute their use over time.
- **Cyclic/Eco-systemic**: The natural systems that maintain planet equilibrium.
- **Living**: Reliance on animate rather than manmade structures.
- **Natural**: Occurring innately within nature.
- **Organic**: Living matter and processes.
- **Renewable**: Not depleted when used.
- **Resilient**: Not susceptible to crisis.

These traits are very much grouped around the idea that we are constrained, and that for an appropriate population level to be sustained on the planet, we must operate within the bounds of the system with process speeds aligned with natural process speeds.

Values

The Bio-sphere quadrants lends to approaching sustainability in many of the following ways:

- **Living organically**
- **Limiting population level**
- **Leaving the planet alone**
- **Valuing biodiversity**
- **Operating within planetary boundaries**
- **Consuming within natural limits**
- **Growing within natural limits**
- **Conserving non-renewable resources**
- **Preventing pollution**
- **Considering ecosystems**
- **Processing materials naturally**
- **Using waste for food**
- **Coexisting with environment**
Challenges

Similar to all of the approaches to sustainability quadrants, despite the true value and strengths they each bring to solutions, if any one were to be over-emphasized, there would be massive costs to people and/or planet. Arguably, the most sustainable situation from the planet’s natural system perspective would be one without the presence of humans, or human “innovation” and manipulation. This clearly is not a winning solution. However, there will be population levels that the planet’s ecosystem can absorb, depending on individual’s magnitude of impact on it’s systems. One might argue that this would result in a meager and repressive life for the earth’s inhabitants, or certainly one that achieves slower progress. The challenge then would be to rethink how we organize ourselves to operate within the constraints of the planet and achieve prosperity. Focusing on relations, rather than transactions, is one such way.

The negative affects on the planet of human activity have been studied and written about by many scientists and authors. Rachel Carson first brought the issue to the public arena in her book ”Silent Spring” through her discussion regarding the impact on the great lakes. Through their analysis, the Stockholm Resilience Center is studying the planetary boundaries that we must not cross to avoid environmental changes that the human species is not equipped to adapt to. On the more outspoken end of the spectrum we have Bill McKibben, a leading environmentalist who attempting to build a social movement towards more sustainable living. There are truly too many individuals and organizations to list that are doing work in this space.

Integration into the model

In many ways, the Bio-sphere quadrant defines the scope and scale of human activity, if such activity is to be truly sustainable. It not only balances out the demands of the Prosperity quadrant, but is also provides a clear boundary that the Techno-sphere quadrant must not cross. For example, the physical material and product outputs must not mix with the Bio-sphere, in order to not degrade the environment and reduce the ability of it to support future generations; that could happen through excessive toxicity or physical impediment.

As the Bio-sphere defines the boundaries, it requires human population to not cross them. This could be accomplished by market forces contributed by the Prosperity quadrant, inert products in
circular product or material flows from the Techno-sphere quadrant, or caps from the Regulation quadrant. Unfortunately, effective policy and regulation is difficult to implement in the current political environment, and there is a deficit of truly long-term and ethical behavior in the business environment. This is all to say that organizing society to utilize the contributions of all four quadrants is mandatory, and this CVF is one way by which to make this connection and encourage such implementation.

**Techno-sphere**

Technology allows for the advancement of society in not only fun gizmos and gadgets, but also in human health, growth, and overall well-being. From LEDs to hybrid cars to alternative energy sources and vaccines, technology is continuing to progress society. Technology provides us with endless possibilities. As the population increases and more countries transition from third-world to first world, technology will provide a key part of the answer to these complex challenges of human health, energy distribution, and adaptation to severe environmental disasters.

Technology has drastically affected the way society communicates and functions, and it can be expected that further development of technology will become more elaborate and extensive. Though some can argue that technology has caused environmental problems, it is also the same advancement in technology that has helped humans develop and prosper. However, with technology came an increase in greenhouse gases, waste, and environmental disruption. But, technology addresses environmental sustainability challenges with various equipment, such as water treatment mechanisms, air scrubbers, ever more efficient light bulbs, and more recently, the rising trend in alternative energy sources like solar and wind. However, there are also risks and consequences associated with this development and unknowns.

**Traits**

There are many positive traits within the technology realm that have been explored for this framework. Approaching sustainability challenges through a technological lens some traits include:

- **Accessible**: In order for technology to be useful, it must be accessible to the masses in order for it to be implemented effectively.
Adaptive: Technology must constantly change in order to address current issues in society.

Convenient: Technology should make the user’s life easier without compromising quality of life that they standardize for themselves.

Distributive: Similarly to accessibility, technology should be distributed to various locations so that many can benefit from its use.

Effective: Technology needs to help address challenges without causing side-effects and negative trade-offs such as environmental damage or human health.

Feasible: Technology should be able to be implemented in a large scale making it practical in addressing large-scale challenges while also considering the natural environment.

Innovative: Technology should be able to create new ideas and mechanisms to help change people’s lives and habits as well as defend the natural environment from human damage.

Integrative: Allowing for coordination of technologies fosters convenient information sharing with fewer materials and can even be integrative with the surrounding environment.

Although not exclusive, this list provides the main ingredients for a technological approach to sustainability, with a focus on creating a tool to tackle the solution in a creative way that benefits users as well as the environment.

Values

Furthermore, a leader within the Techno-sphere may hold many of the following values in approaching sustainability challenges that focus not only on breakthrough ideas but how to critically think about current processes. Some values include:

- Providing alternative options
- Allowing for growth and progression
- Innovating new solutions
- Benefiting human life
- Using materials/resources effectively
- Creating cost-effective solutions/options
• Benefiting the natural environment
• Researching and Developing
• Integrating technologies
• Reducing, reusing, repurposing, recycling
• Adapting to the changing environment
• Finding long term solution for large scale challenges
• Finding short term solutions for immediate challenges

Challenges
Technology comes with trade-offs. There is always a learning curve in finding any kind of solution. As we learn more about how technology impacts the environment negatively, we can develop more alternatives for people to change habits and values, just as the invention of the car changed people's perception on mobility and behaviors.

There are unknowns that are associated with technologies that cause this approach to sustainability to fall short. Scaling provides a huge challenge for technology. For example, solar panels are a promising alternative energy source, however, it is found to be very impractical to scale in terms of cost and performance. Although it is possible to create a solar farm, there also provides energy storage challenges such as batteries.

Technology can provide innovation and alternatives but another challenge associated with technology is implementing it effectively into society. With a technology that benefits the environment and society has not adopted it, it does nothing to benefit the solution. Going back to the solar panel example, it is a technology that can benefit society, but it is not being adopted as widely as it can be even though there are governmental incentives and subsidies that assist in lowering cost. Technology is always developing yet some solutions need immediate solutions that sometimes technology cannot address.

Integration into the model
Techno-sphere as an approach to sustainability is one that the framework encompasses well. With enough research, development, and time, technology will find a way to lessen its negative
impact on the environment. However, the true solution comes when technology partners with the remaining quadrants to help compliment the solution. For instance, technology can help regulations reach the standards that are set, while also preserving (or making minimal impact on) the planet, in addition to adapting into society to help it progress and prosper.

*Regulation*

Regulations create concrete, discernible rules for companies, organizations, and individuals to apply and follow. The benefit of this is to demarcate clear lines on what is and is not acceptable, with little room for interpretation. The clarity of regulations is one of their strongest assets. Outside of regulations specifically, companies that operate with a top-down management approach that engages a few key management personnel to make company-wide decisions enables this same sort of clarity.

A regulatory approach to sustainability eliminates the classic collective action problem by managing numerous actors with different stakes and incentives in sustainability. Regulations set an outer bound on companies and individuals on which activities they can do and to what extent their actions are acceptable, allowing for predictability and uniformity. Regulations also establish levels and 'rights' to pollute and 'rights' to use resources.

A regulatory method generally fosters top-down management approaches to problems. This allows a set group of individuals (or an individual) to make efficient decisions in whichever level of governance they operate (local, state, federal, corporate, etc.). Regulations create infrastructure that can be adapted as technology and sustainability initiatives move forward with our growing comprehension of the problems and solutions to sustainable development.

Regulation can be more broadly understood to include multiple policy instruments, as opposed to singular instruments that have been used in the past. Similarly, regulatory approaches to sustainability can be redefined to include a broader range of regulator actors and participants to develop a more imaginative, pluralistic approach to regulations.11
The benefits of a regulatory approach allow for ease in interactions between various groups – for instance, in Italy, local and regional governments currently play the largest role in promoting Corporate Social Responsibility in a sustainability context, by fostering communications centered on shared values and trust between SMEs and local institutional and political actors.\textsuperscript{12}

\textit{Traits}

Below are eight traits that the Regulation quadrant encompasses:

- **Centralized**: The basic, underlying assumption in this quadrant is that a central group of individuals hold the most relevant knowledge to address a problem.
- **Coordinated**: Actors in a regulatory environment require coordination of efforts in order to be effective.
- **Incremental**: Most regulations change over time, though the steps are generally small and cautious.
- **Controllable**: Less actors are involved, so there is a greater ability to control these actors, and similarly, for these actors to have all of the control.
- **Reactive**: Regulations and management generally change as a result of an event occurring, not in anticipation of an event.
- **Equitable**: A regulatory approach can equitably divide resources and knowledge amongst individuals.
- **Predictable**: With a particularly structure in place, whether it be government or management, the outcomes of decisions of this group are generally predictable.
- **Resource-Sharing**: With few actors, a regulatory approach can tap into various different information holders to disseminate knowledge across artificial boundaries.

\textit{Values}

Based on the traits above, approaching solutions to sustainability in this quadrant should be about:

- Establishing who has the right to use resources
- Establishing who has the right to pollute
- Decision-making by top-down management
- Making decisions more efficiently
• Creating appropriate boundaries
• Accomplishing uniformity
• Capping emissions/pollution
• Centralizing leadership
• Coordinating many actors
• Negotiating and executing
• Disseminating resources and knowledge
• Providing clarity to existing standards
• Empowering third parties to act as surrogate regulators

Challenges
As regulations currently stand, they can be narrow and open to interpretation because governments and companies have a hard time anticipating every instance that might fall under a particular regulation. This quadrant assumes that central management and regulations have the strongest chance of success, while overlooking potential key actors. In this case, clarifying each actor involved in a particular problem or solution, while also keeping in mind the need for dynamic and flexible approaches in management, can mitigate the potential oversight in a regulatory, top-down approach.

Integration into the Model
This quadrant assumes that individuals at the top of a management chain have the most important and up-to-date information, and are therefore capable of creating the most effective rules and strategies to handling sustainability measures. However, this quadrant overlooks the innovative nature of individuals who are not constrained by rules and regulations in developing new technology.

Similarly, this quadrant assumes that those in control of regulations and standards have the best interests of the planet in mind. However, combining a regulatory approach with the science and long-term concerns of the Bio-sphere quadrant will effectively address longevity in regulatory measures, while not sacrificing the clarity and effectiveness of implementing rules and standards and management approaches to sustainability issues.
Finally, this quadrant is in tension with prosperity in the sense that regulations are often reactive and respond to environmental and sustainability concerns once they already become a problem. Including forward-thinking and growth measures into a regulatory approach will allowed governments to work towards incorporating posterity and the planet’s ability to sustain itself into its regulations. Overall, an approach that contains aspects of each quadrant balances out the clear-cut lines and somewhat harsh applications of regulations, and likewise incorporates a well-rounded approach to sustainability moving forward.

**Prosperity**

In order to make this planet more sustainable, the participation of not only a minority of population who are interested in saving this planet, but also of the mass public is needed. How can we achieve this goal? In order to answer this question, one must first look at what motivates people to act in a certain way make choices in their everyday lives.

We often choose to behave in a certain way because of the belief that doing so would confer us with certain benefits. One example of offering economic benefits to people in order to change their behavior in a more sustainable way is Starbucks offering discounts on its drinks to customers who bring their own tumblers. The inception of this program happened in 1985, and in 2011 customers brought their own tumblers into a Starbucks store in the U.S., Canada, the U.K., or Ireland 34.1 million times.¹³ In 2015, Starbucks hopes to serve 5% of its drinks to customers who bring their own tumblers.¹⁴

The benefit that we are deriving from our behavior does not necessarily have to be tangible, such as money. Rather, the benefit could be something as vague as happiness. Scientists, economists, and scholars have made various attempts to measure happiness, and if we assume that happiness is measurable at all, then countries such as Switzerland, Denmark, Norway, and Netherlands are some of the happiness countries in the world.¹⁵ Coincidentally, some these same countries are considered to be some of the most “sustainable” countries in the world.¹⁶ We think this phenomenon is due to the motivation for people to raise their quality of life, which results in behaviors that are more sustainable.
Whether it is wealth or quality of life, we wanted to create a quadrant in our model that reflects people’s choice of behavior based on various incentives. Different people are motivated by different benefits. One word that we think encompasses all of the different types of benefits is “prosperity.”

Some might think that the solution to sustainability entails sacrificing our prosperity for that of the environment. However, is prosperity really incompatible with sustainability? When we choose to live a prosperous life, are we doomed to give up a sustainable life? Would it be possible to use the motivation towards prosperity as a means to achieve sustainability? This “prosperity” quadrant is for those who believe so.

**Traits**

Below are 8 traits that the Prosperity quadrant encompasses:

- **Incentive**: The basic underlying assumption of this quadrant is that people are motivated to act in a certain way, because doing so confers certain benefits to them.
- **Free Market**: The incentive system is based on offering a benefit that is commensurate to the expectation of the actor. In other words, the actors are trading their behavior for benefits. A free market is necessary to allow such trades.
- **Profitable**: While the actors are trading their behavior for benefits, they would have more incentives to do so if the benefit they are getting yields a net gain compared to the loss of their actions, which is a loss that comes from opportunity costs.
- **Competitive**: People would compete to make the most of their behavior. In other words, they would want to trade in their behavior for the largest benefits.
- **Growth**: People should not have to sacrifice growth in order to become sustainable. In other words, growth and sustainability are not incompatible.
- **Individualized**: Different people want different benefits for their actions. Therefore, this quadrant encourages individual action rather than collective.
- **Measurable**: In order to construct an efficient trading system, the benefits would have to be measured in some way, and a value would have to be attached.
• Practical: People are not forced to act and are more likely to engage in sustainable behavior actively, which makes the solution more practical.

Values
Expanding on the traits above, approaching solution to sustainability in this quadrant should be about:
• Providing incentives
• Providing growth
• Providing economic profits
• Maintaining a free market
• Improving the quality of life
• Putting a value on nature
• Putting a value on pollution
• Encouraging individual actions
• Establishing tangible goals
• Trading emissions and pollution
• Being cost-effective
• Inducing corporate actions
• Decentralizing leadership

Challenges
This quadrant assumes that people are consciously thinking of their behavior and the returns they get because of such behavior. However, this might not always be the case. There might be behavior that people engage in instinctively without realizing the full implications of that behavior. In that case, educating people of the consequences of such actions might allow them to think about the issue and possibly lead them to assess and evaluate their behavior based on this new knowledge.

Also, altruistic behavior might be very difficult to explain with this quadrant. Donations and sacrifices that people make for others do not always come with benefits for the donors and those who sacrifice. In this case, the benefit might have to be evaluated based on the value it has on
society, rather than the individual. In other words, the value of the donation in the perspective of the acceptor plus the self-satisfaction of the donor might be greater than the value of money to the donor. This net-sum benefit to society might be the motivating factor for the donor. However, this analysis goes against the premise of this quadrant that focuses on individual actions rather than collective ones.

Another limitation to this quadrant is that perhaps instigating a proper motivation, in the end, might not be as effective as imposing a penalty. Going back to the Starbucks example mentioned at the beginning of this section, a better strategy by Starbucks would be charging 10 cents to customers who DO NOT bring their own cups. However, Starbucks would be afraid that this penalty system would give a negative impression to its customers and would result in people not buying from Starbucks anymore.

Integration into the model

As discussed above, a penalty system under the Regulation quadrant rather than an incentive system might be more “effective” at inducing immediate results, but whether it would be more “efficient” is a different matter. There are limitations to how much we can restrict an individual’s behavior. There are natural and constitutional rights of individuals that we simply cannot restrict. Therefore, providing the right incentives for unsustainable behavior that emanate from such basic rights might be a better approach to sustainability compared to the regulation quadrant.

The Prosperity quadrant might allow the Techno-sphere quadrant to reach more individuals. A technology might only be available in the lab and not be seen through to application because of many reasons, which includes scalability, price, etc. In other words, the public does not necessarily have the best technology available in the lab, but only the technology that is possible to succeed in the market. By providing a sufficient incentive through the Prosperity quadrant, technology that might not see the light of day otherwise could reach a larger audience.

When compared to the Bio-sphere quadrant, the Prosperity quadrant provides more tangible results that can be immediately recognized people. Natural systems have a much longer life cycle than humans, so the effects and limitations of nature might not be instantly recognizable.
However, the Prosperity quadrant also includes the concept of putting an object value on nature, which allows people to compare the value of nature to the consequences of their acts and make more efficient judgments.

**Axis formation**

As the traits that define positive approaches to sustainability coalesced in four groups, and then were associated with quadrants on a 2x2 matrix, the real and perhaps surprising tensions that exist between desirable attributes came into focus. Firstly looking at the horizontal axis, we can see that the magnitudes to which the approaches desire to modify the planet vary. At the extreme of Bio-sphere and Regulation we have an absolute assertion that the planet is not to be modified or in other words have very minimal human interference (beyond what it has been already, and therefore it requires regeneration). An example would be regulating areas of land or sea conservation. Conversely, the Techno-sphere and Prosperity quadrants see further modification of the planet to enable human’s to be sustainable. Wind turbines for electricity generation are one such example.

Secondly looking at the vertical axis, we can see the degree to which the approaches focus on the specific problem, or adapt to it. Combining the Regulation and Prosperity quadrants there is a focus on specific problems, and the solutions and required to be narrow in scope or creativity. The currently stipulated GDP growth targets (for example), with approaches to sustainability overlaid, represent such a combination. A systemic approach results from combining the Bio-sphere and Techno-sphere quadrants, as interactions and unintended consequences are considered.

To briefly touch on the tensions between the diagonal quadrants on these axes; the South West- North-East axis captures the magnitude of the approach. Techno-sphere is of breakthrough scale, whereas Regulation is incremental. In other words, the techno-sphere tries to come up with fast solutions to challenges and tries to “leap” to changes, whereas regulation takes a slower, but just as affective, approach with “baby” steps. Since regulation lies within governments, it is important that these processes take their time to be thought about thoroughly, however it is a much slower progression to solutions. The North-West–South-East axis, on the other hand,
captures the timeframe of the solution. Bio-sphere is long-term, whereas Prosperity is more immediate and short-term. This timeframe is thought of with the prospective of a human life compared to the Earth’s. The Earth has been present long before human kind and will continue to be around while prosperity is a very human trait that focuses on the “here and now” and is much more short term than the timeframe of the Earth.

To reiterate all of the above mentioned traits and combinations can be positive approaches to sustainability, but solutions that capture the strengths of all four, will be a more well-rounded approach that provides many strengths to tackling sustainable challenges. With all four approaches being considered, a more balanced approach may be sought.

**Goals**

The framework enables understanding the diverse approaches to environmental sustainability. In practical terms, it allows individuals/organizations to self-select into the quadrant that best aligns with their own values. In this regard, it allows observers to do the same, but more importantly, it identifies and communicates the strengths of the alternative approaches to sustainability. In addition, the framework can be a tool to enable real change towards sustainability by evolving various individuals, organizations, governments, academics, students, etc, in understanding of other approaches. The underlying assertion is that a balanced approach, drawing upon the strengths of each quadrant, is ideal way in achieving sustainability, and the framework can hopefully catalyze movement towards it.

**Deliverables**

In developing the Approaches to Sustainability Framework, the hope was to have as broad of a reach as possible in terms of application. To this end, two separate workshops were designed with the framework, which included a card game along with a survey.

**Card Game**

The card game was based off of the original CVF for Leadership card game, in which the participant’s self-select statements that they most identify with in relation to leadership methods to determine which quadrant they were to likely fall under. To modify this game to a game about
sustainability, 13 statements from the Values section of each quadrant discussed above were written on the cards. The group refined, eliminated any overlap, and clarified the meaning of certain words or phrases used in the statements over time. Once finalized, a 52-card deck, color-coded to each quadrant, was produced.

The card game was first utilized at a workshop of graduate students and peers. The goal was to hand out 5-6 cards per person at the beginning of the workshop, and have the participants walk around to each other, read other statements, and trade cards based on which statements the individual identified with. The objective was to get an overall reading of the group, ‘break the ice’ in the group, and identify any cards that might not make sense to participants, in order to refine the statements for the card game further. Once the group had time to trade cards, the participants were then asked to either (a) identify the color that was most represented in their hand, or (b) pick one card which statement really resonates with them personally. From here, based on the color of the card or cards, the group was sorted into the four quadrants of the framework.

At this point, the facilitator targeted the group in the Bio-sphere (top left) quadrant to begin the discussion by asking those in the quadrant to read their statements aloud and identify similarities or overall characteristics of their quadrant. It is important to note, that it does not really matter which quadrant is mentioned first, but for our purposes we chose Bio-sphere due to its placement on the framework. This was then contrasted by having the group in the Prosperity section (bottom right) read their statements and do the same exercise. The group as a whole then talked through tensions and what each approach has as advantages and disadvantages. The same was then done for the Techno-sphere (top right) and Regulation (bottom left) quadrants. This was the general format within our workshop setting, described below.

Workshop
The goal of the workshops was to apply the framework in a group of the intended audience (those with strategic influence in multi-national corporations that can impact their organization’s environmental impact), like what could be done with many other groups in the future, in the role of a consultancy. This is to say: attempt the goals of the framework listed above; crucial to
accomplishing these is to help individuals in a group evolve their understanding to leave the workshop with knowledge that will positively impact: their decisions, the environmental sustainability of their company, and an improved role of their company in society. A secondary, post-workshop activity is seeking feedback, on the workshop effectiveness and the framework robustness.

The workshop took place in two parts – the first was a graduate student, and the second at the Dow Chemical Company headquarters as mentioned earlier. The initial workshop included graduate students from law, public policy, psychology, sociology, and sustainable systems. The goal was to test run and receive feedback on the workshop program and framework, in addition to teaching about the framework. (See Appendix I, October 16, 2015 Workshop Agenda).

The second workshop took place at the Dow Chemical Company Headquarters in Midland, Michigan on October 30, 2015. For participant type, the company contact and coordinator, Anne Wallin, was asked for a cross functional group (balance across company) of individuals who each influence Dow’s business strategy (and hence the environmental sustainability of the company). In terms of number, a group of about 20 people is most helpful to get enough variation of ideas/perspectives, while keeping the group size manageable, and respecting the time of company employees. The list of attendees included various individuals with a sustainability-related position, and our focus was to apply our framework to a larger group in a corporate setting. (See Appendix II, October 30, 2015 Workshop Agenda) The project team convened beforehand to focus again on the goals for the workshop – emphasizing the framework, refining the model as needed, identifying tensions amongst the different quadrants, getting individuals to learn about their quadrant and the values of other quadrants before coming to the conclusion that combining all four quadrants is most beneficial.

For the second workshop, participants started out with an initial survey question for attendees. The group then played the card game before discussion of the separate quadrants, in the same format as the workshop with the graduate students.
After the card game and introduction to the four quadrants, each quadrant group discussed a problem statement for 15 minutes. The first problem statement was “How should energy be distributed?” After discussion and coming up with a plan, each group presented their plan. Each group explained their plan and identified strengths and weaknesses to the whole. Based on the feedback provided at the end of the workshop, this part of the workshop was not as clear to the participants in the sense that the groups were not aware they were supposed to be coming up with a ‘plan’ to present due to the lack of directions provided on the handouts with the problem statement written. In future workshops, the directions and objective will be present at the top of this sheet so the groups can reference it, in case the oral directions were unclear, not heard, or simply not remembered.

After this problem statement, the groups were broken up to include participants that selected into each quadrant, so each group was diverse. From here, a more Dow specific problem statement was presented – “What should Dow do to lower CO₂ concentrations in the atmosphere?” From here the same format was followed in presenting solutions and discussing strengths and weaknesses. The goal of these two problem statement sessions was to show that working just within your similarly minded colleagues limits the creativity of solutions, while working with individuals outside of your mindset challenges the group as a whole to come up with more well-rounded solutions to problems. At the end, a brochure of the framework for the participants was provided to pass on or to contact us with further questions or feedback. (See Appendix III, Workshop Brochure)

**Results & Feedback**

*Reaction to the Statements and Traits*

When the participants of the workshops were provided with the statements and traits of each quadrant without the name of those quadrants, they were able to associate those statements and traits with the quadrants. Although people did not name the quadrants the same as the framework (e.g. people named the Bio-sphere quadrant “Nature”), their perspectives on what each quadrant includes and how it contributes to a sustainability solution coincided with the framework.
Nonetheless, some people perceived certain statements and traits differently than what was intended. For example, one person in the corporate employee workshop mentioned that “decentralized leadership” should not fit in the Prosperity quadrant, but rather should fit in the quadrant that describes NGOs. Another comment was that “improving the quality of life,” sounds much like “to convenience human life” and thus an elaboration of those two statements would be necessary. This encouraged the group to re-examine the framework and defined terms and values differently based on the provided feedback.

Another interesting comment received from the corporate employee workshop is that the Bio-sphere quadrant is “What,” the Techno-sphere quadrant is “Who,” and the Prosperity quadrant is “How.” Although this was an interesting way of categorizing the statements and traits for the quadrants, such categorization would not coincide with the intentions to create the framework. The “What, Who, and How” categorization would enable the recognition of the key components of a sustainability solution, but it would not allow for analysis of different people’s approach to sustainability. In other words, the framework was created to influence people’s behavior by allowing them to realize that there are other approaches to sustainability, but the “What, Who, and How” categorization would only have an educational effect on people.

Workshop Results

One interesting difference observed between the graduate students workshop and the corporate employees workshop is that 0 out of 6 participants in the former chose the Prosperity quadrant, and 0 out of 17 participants chose the Regulation quadrant. (Figure 3 & 4).
During the graduate student workshop, each quadrant was chosen by 2 people. During the corporate employee workshop, the Bio-sphere quadrant was chosen by 5 people, and the Technosphere and Prosperity quadrants were chosen by 6 people each.

During the workshop, the student participants generally associated the Prosperity quadrant with economic profit and believed that a profit-making attitude is at least partially responsible for the current unsustainable lifestyle. They were doubtful as to whether a cause of the problem could also become a solution to the problem.
On the other hand, corporate employees agreed more with the idea of utilizing incentives to cajole people into doing certain things. Instead, they disagreed the notion of the Regulation quadrant being at the forefront of change. Most of the corporate employees had experience working with government agencies, and they were frustrated with the feeling that these agencies were lagging behind in innovation. While they conceded that this is how regulation should function and that regulation is also a key element of a solution to sustainability, they did not think that it was as efficient or capable of inducing a change of larger scale.

The discrepancy between the academic setting and the corporate setting brought about how other factors, such as age, experiences, culture, disciplines, demographics, and job functions, play a role in determining people’s approaches to sustainability (Figure 5). Although a particular trend was not observed in the different age groups, this kind of analysis would be meaningful in achieving one of the goals in creating this framework, which is providing tailored information to people who approach sustainability in a particular way. How this can be achieved is discussed further below.

Figure 5 Approaches to sustainability of each age group based on their participation in the workshops.
Feedback on the Workshop

While the graduate school workshop participants generally expressed that the workshop was an interesting learning experience, the corporate employee participants were critical about certain aspects of the workshop. For example, one participant expressed that they really did not like “exercises that create and emphasize stereotypes.” However, it is important to note that this is not the intent of the framework. Stereotypes are created when flexibility is ignored. The framework is not trying to emphasize that any one quadrant is superior compared to others. Simply it helps assess the current approach that people have towards solutions to sustainability and can be used to try and help them understand that there is not only one solution to sustainability. In fact, a hope for the framework is to encourage people to be more flexible in their approach to sustainability and educate those who may not have thought of other alternative ideas.

Admittedly, the fact that the workshop looks to analyze people’s approaches to sustainability based on the demographic information that was collected might give people the preconception that stereotyping is occurring, however, the framework is a tool that can be utilized to understand people’s behavior rather than a tool that tries to create an inflexible notion that certain parts of the population behave in a certain way. In order to avoid the notion of stereotyping in future workshops, it will be important to fully and clearly express the intent of the workshops prior to the participants executing it. This will be helpful to avoid any ambiguities as well as them understanding the intention of the workshop in the first place. Rather than the “free for all” approach that was initially performed.

There is significant market research available that analyzes the spending behavior of people in different demographics. For example, the Bureau of Labor Statistics has released data on the spending pattern of different age groups. This kind of information can be used by various commercial entities for tailoring their marketing campaign to specific age groups. Such studies and marketing practices are allowed by society perhaps because we think that it makes the economy more efficient. So why not try a similar thing with sustainability to make sustainable solutions more efficient?
The framework received diverse feedback from the Dow workshop. The major theme was clarity in the goals and instructions for breakout sessions. Some interesting feedback statements were: “Broaden the group to include more than just the “pro’s” of Dow that work on sustainability;” “Lots of my coworkers could benefit;” “Unfortunately, I really don’t like exercises that create and emphasize stereotypes, so that structure is quite off-putting;” and “Axes were not clear or described, I think that would be a good addition.” Most of this feedback alerted the team to the necessity of clarity in goals and framework – particularly the last statement. If it seems like the workshop is creating and emphasizing stereotypes, then it is not adequately portraying the framework, and is therefore an area for further refinement. The framework that was created for this project could serve a similar purpose in the sustainability field to that of target marketing. How this can be achieved is discussed below in the Next Steps section.

Overall, an average score of 6.7 / 10 was received for the workshop when participants were asked whether the corporate employee is likely to recommend this workshop to others. The scale was from 1 to 10; in which 1 signifies that the participants would not recommend the workshop to others and 10 signifies that they would. This score means that, despite some deficiencies discussed above and disagreement with the usefulness of the framework, people generally felt that the framework itself gave some new insight to their current behavior and how they relate to others’.

An alternative method of interpreting the rating feedback is to use the Net Promoter Score (NPS).\textsuperscript{18} From the ratings collected using the Feedback Form and question “Based on this approach to sustainability workshop, how likely are you to recommend the framework to a co-worker?” the scores were grouped by 0-6 - detractor; 7-8 - neutral; and 9-10 - promoter. (See Appendix IV, Workshop Feedback Form) From these groupings and the following formula we can calculate the NPS:

\[
NPS = \left( \frac{\#\, promoters}{\#\, participants} - \frac{\#\, detractors}{\#\, participants} \right) \times 100
\]
With 1 promoter and 7 detractors out of 16 returned feedback forms we calculate a NPS of -37.5. (See Appendix V, Workshop Feedback) The range of possible scores is -100 to 100 with a good score being 50 and the goal to be in the range of 50 to 80. Therefore, using this analysis of this specific audience, we show that there is significant improvement in the workshop required to make it a usable consulting tool.

*Participant Growth*

Given that a use of the framework in a workshop setting is to grow awareness of the benefits of a diverse approach to sustainability drawing upon the strengths of each quadrant, it is important to attempt to quantify such change. To do this we can look at the participant responses to the pre-workshop question (“What happened in your life recently that you think is a positive progress towards sustainability?”), the self-selected quadrant during the card game, and the post-workshop question (“Please write a newspaper headline regarding sustainability that you hope to see in 2050.”).

In an effort to undertake quantitative and therefore comparative analysis of participants at these three stages of each workshop, the answers and self-selection were coded by the magnitude (1 - low or none to 5 - high) to which they represent each of the approach quadrants. (See Appendix V1, Workshop Data) For example, the response, “Renewable energy boom”, to the pre-workshop question shows high Techno-sphere magnitude while low in the other three quadrants.

This data was processed for the participants of each workshop separately. Looking firstly at the graduate student workshop – the responses to the first question and second question, the difference between the responses for each person, and the relationship between the first question and self-selected quadrant were evaluated. To evaluate the questions, the number of quadrants coded 3 or above was counted for each participant. 3 or above suggests a positive representation of the quadrant, and it would be desirable for all 4 quadrants to be represented in this way; a result of 4 (quadrants) is desirable to show a balanced approach to sustainability, drawing upon the strengths of all 4 quadrants. For the first question the average number of quadrants represented in this way was 2.0, with an average standard deviation of magnitude for each participant of 1.381. Again, a smaller deviation of magnitude would indicate more balance in the
participants approach. For the second question the average number of quadrants represented in this way was 2.6, with an average standard deviation of magnitude for each participant of 1.183. Comparing the average number of quadrants represented between the two questions there is an increase of 0.6 suggesting an increase of balance, and comparing the average standard deviation of magnitude for each participant there is a decrease of 0.198, again suggesting more balance. Looking specifically at the change in number of quadrants represented from the first to second questions, two participants increased by 2, one decreased by 1, to give an average increase of 0.4 quadrants. Though not statistically significant due to the small sample size, there is at least an indication that the graduate student participants experienced a growth of mindset towards a more balanced approach to sustainability. When looking at how well the response to the first question predicted the quadrant that a participant would self-select into during the card game, only one participant (20%) matched, suggesting that it was not a good predictor.

Secondly looking at the corporate employee workshop - the responses were evaluated in the same way. For the first question the average number of quadrants represented in this way was 1.647, fewer than the graduate students, with an average standard deviation of magnitude for each participant of 1.368. For the second question the average number of quadrants represented in this way was 2.0, with an average standard deviation of magnitude for each participant of 1.265. Comparing the average number of quadrants represented between the two questions there is an increase of 0.353 suggesting an increase of balance, and comparing the average standard deviation of magnitude for each participant there is a decrease of 0.102, again suggesting more balance. The direction of change was the same for both workshops. Looking specifically at the change in number of quadrants represented from the first to second questions, five participants increased this number and two decreased this number, to give an average increase of 0.31 quadrants, again in the same direction. There is at least an indication that the corporate employee participants experienced a growth of mindset towards a more balanced approach to sustainability. When looking at how well the response to the first question predicted the quadrant that a participant would self-select into during the card game, only 18% matched, further suggesting that it was not a good predictor.

In an attempt to use slightly more rigorous analysis, the two data sets were combined (to give a
sample size of 22) to test whether the there is a difference in means of the number of quadrants represented at the beginning and end of the workshop. With a difference in means of 0.416 and a standard error of 1.48 we fail to reject that the means are the same at any relevant significance level. This clearly indicates the need to increase the sample size.

Conclusions
At the core of our conclusions is our fulfilling the overarching goal of developing a high potential framework for driving the global population to living sustainably in the future. In our workshops, highlighted in depth above, we received encouraging results of applying our framework in a workshop setting. Finally, we greatly broadened our own understandings of sustainability and how progress can be made moving forward. This framework is still very much a work in progress, with continued applications and feedback informing our revisions and own learning around the efficacy of an interdisciplinary, multi-faceted approach to sustainability in the future.

Next Steps
The framework could function as a bilateral communication tool. In other words, not only could it collect information from people, but it could also provide useful information to the people who use the framework. In order to do so, more data from more people needs to be collected. One of the ways of doing this is creating an app or a website version of the workshop. This method would allow people to use the framework without physically being at a common location.

After these revisions are performed, the framework could be used as an educational tool for organizations. Not only could the workshop and the framework help an individual organization better understand and assess its approach to sustainability. The collection of data from the general population would provide a strong basis for how an organization should strategize their approach to sustainability to more effectively influence their target audiences, but this framework has a lot of refinement before it gets to that point.

There is much room for workshop testing on multiple 20-person groups to collect a statistically significant sample size and attempt to evaluate the efficacy of the workshop. Such testing could
be randomly controlled to assign half of the participants to a workshop that receives no exposure to the framework learning tools. Further analysis could be undertaken on actions that participants of both the treatment and control group take in successive periods following the workshop, with the intent to measure their actions and extent to which they represent a balanced approach to sustainability.

Furthermore, with a much larger sample size, it would be possible to investigate links between the other participant demographics that we collected. The field of study and business department would likely expose individuals to particular schools of thought that could be teased out in a more comprehensive study. Likewise, there may be patterns relating to gender or hometown data that was collected (but not included in appendix for anonymity of participants) that could be predictors for the average participant fitting this category.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:00 PM</td>
<td>Setup</td>
<td>Revisit session goals! (people learn their quadrant, the value of other quadrants, the benefit of combining all 4)</td>
</tr>
<tr>
<td>5:15 PM</td>
<td>Participants and Food Arrive</td>
<td>benchmark ideology</td>
</tr>
<tr>
<td>5:30 PM</td>
<td>Participants answer 1 initial paper survey question</td>
<td>Number each person in a quadrant to have a mixed team later</td>
</tr>
<tr>
<td>5:30 PM</td>
<td>Card Game (number off people in quadrants for later)</td>
<td>Number each person in a quadrant to have a mixed team later</td>
</tr>
<tr>
<td>6:05 PM</td>
<td>Project goals and objectives for workshop</td>
<td>Number each person in a quadrant to have a mixed team later</td>
</tr>
<tr>
<td>6:15 PM</td>
<td>Problem Statement 1 - in quadrants (group work, report out, comment)</td>
<td>Number each person in a quadrant to have a mixed team later</td>
</tr>
<tr>
<td>6:35 PM</td>
<td>Problem Statement 1 redux - in mixed (group work, report out, comment) AND/OR: Problem Statement 2 - in mixed (group work, report out, comment)</td>
<td>Number each person in a quadrant to have a mixed team later</td>
</tr>
<tr>
<td>7:15 PM</td>
<td>Takeaways, 1 final paper survey question</td>
<td>Number each person in a quadrant to have a mixed team later</td>
</tr>
<tr>
<td>7:30 PM</td>
<td>END</td>
<td>Number each person in a quadrant to have a mixed team later</td>
</tr>
</tbody>
</table>

2 min Prac WS Survey feedback on workshop
5 min CVF Survey feedback on framework at same time
## Appendix II: October 30, 2015 Workshop Agenda

### All
12:45 PM  
Arrive and Setup  
Revisit session goals! (people learn their quadrant, the value of other quadrants, and the benefit of combining all four)  
(15 min)

### Christina/Insung
1:00 PM  
Participants Arrive  
Participants answer 1 initial paper survey question (benchmark ideology)  
(10 min)

### All - Nadine lead
1:10 PM  
START: intro Dow Fellows and team formation (make us legitimate)  
(5 min)

### Mark
1:15 PM  
Card Game (letter off people in quadrants for later)  
(30 min)

### Nadine
1:45 PM  
Project goals and objectives  
(10 min)

### Christina
1:55 PM  
Problem Statement 1 - in quadrants (group work, report out, comment)  
(20 min)

[Optional]
2:15 PM  
Problem Statement 1 redux - in mixed (group work, report out, comment)  
(20 min)

### Insung
2:35 PM  
Problem Statement 2 - in mixed (group work, report out, comment)  
(20 min)

### Mark
2:55 PM  
Takeaways, 1 final paper survey question (ideology change?)  
(15 min)

### All
3:10 PM  
END / Feedback form
Appendix III: Workshop Brochure

THE FOUR QUADRANTS

Bioregion: Humans operating organically within planetary boundaries and utilizing natural ecosystem services. This strategy provides the most certainty for perpetual human life on this planet, gives guidance on how and to what magnitude we can operate, and sustains health for all constituents and within all facets of the system.

Technosphere: The advancements of science and technology have brought us the world we are so accustomed to now. Technology allows for the advancement in human health, growth, and overall well-being and provides us with endless possibilities.

Regulation: A regulatory approach to sustainability eliminates the classic collective action problem by managing numerous actors with different stakes and incentives in sustainability. Regulations set an outer bound on companies and individuals on which activities they can do and to what extent their actions are acceptable, allowing for predictability and uniformity.

Prosperity: In order to make this planet more sustainable, we need participation of not only a minority of population who are interested in saving this planet, but also of the mass public. One of the important ways of motivating the mass public to act is by giving them incentives so that they feel that by being more sustainable, they’re also being more prosperous.

FOR FURTHER INFORMATION PLEASE CONTACT:

- CHRISTINA BONANNI
  cebon@umich.edu
- NADINE HALABI
  nhalabi@umich.edu
- INSUNG HWANG
  insung@umich.edu
- MARK KROENING
  kroening@umich.edu
APPROACHES TO SUSTAINABILITY FRAMEWORK

OUR MODEL

WHO WE ARE
We are graduate students at the University of Michigan spanning multiple disciplines, from engineering, law, public policy and business. Through the DOW Master’s program, we have created an approach to sustainability framework that focuses on educating individuals on their strengths as a sustainability leader as well as providing insight on other approaches.

WHY A FRAMEWORK?
When approaching a potential project for the DOW Master’s Fellowship, our group wanted to approach sustainability from the “big picture.” Using the Competitive Values Framework (CVF) as our guide. The CVF was developed by University of Michigan faculty members to understand qualities and tendencies of organizations and their leaders. The framework has proven to be robust, being identified as one of the 40 most important frameworks in the History of Business. We tried to see what competing values in sustainability lead individuals to make certain decisions. We believe that all these aspects are legitimate approaches to solving sustainability challenges in the business world or on an individual basis.

OUR FOCUS
Our focus was to find the tensions associated amongst different values and traits within sustainability in hopes to better understand how the different approaches, although different, can complement one another. We then chose to group these traits/values in, what we believe to be the four major approaches to solving sustainability challenges.

TRAITS OF THE QUADRANTS
Traits/Values highlighted within each quadrant include:

- **Biosphere:** Cyclic/Ecosystemic, Biodiverse, Renewable, Conserving, Natural, Living, Organic, Resilient
- **Technosphere:** Integrative, Innovative, Effective, Practical, Adaptive, Distributable, Convenient, Accessible
- **Regulation:** Centralized, Coordinated, Incremental, Controllable, Reactive, Equitable, Predictable, Resource-Sharing
- **Prosperity:** Growth, Measurable, Through free market, Profitable, Individualized, Practical, Incentivizing, Competitive

This model is based on the assumption that no quadrant is superior to another.
Appendix IV: Workshop Feedback Form

Based on this approach to sustainability workshop, how likely are you to recommend the framework to a co-worker?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not a chance</td>
<td>In a heartbeat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is one change that could be made to improve this workshop?

What is one suggestion that would improve the framework?
# Appendix V: Workshop Feedback

<table>
<thead>
<tr>
<th>Rating</th>
<th>What is one change that could be made to improve this workshop?</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Unfortunately, I really don’t like exercises that create and emphasize stereotypes, so that structure is quite off-putting.</td>
</tr>
<tr>
<td>7</td>
<td>A little clearer directions with the activities. For people not involved with sustainability, a little more fundamental information to ground our thinking would be helpful.</td>
</tr>
<tr>
<td>6</td>
<td>Could use a little more prework - better understanding of what you were trying to accomplish.</td>
</tr>
<tr>
<td>7</td>
<td>Not sure I fully understood what you were trying to do.</td>
</tr>
<tr>
<td>8</td>
<td>An agenda that we spend a few minutes discussing upfront would be good.</td>
</tr>
<tr>
<td>7</td>
<td>Axes were not clear or described. I think that would be a good addition.</td>
</tr>
<tr>
<td>6</td>
<td>When you separate the quadrants, you may want to note down the different statements on a board to remind everyone what each quadrant is about.</td>
</tr>
<tr>
<td>6</td>
<td>Provide clearer directions.</td>
</tr>
<tr>
<td>7</td>
<td>Color card content more clearly aligned to the separate categories by how they are written - and no repeats.</td>
</tr>
<tr>
<td>8</td>
<td>Define the purpose of this workshop better at the beginning of the workshop. Have an agenda distributed to participants at the beginning of the workshop.</td>
</tr>
<tr>
<td>10</td>
<td>Lots of my coworkers could benefit.</td>
</tr>
<tr>
<td>6</td>
<td>The participants in our session are probably too similar in viewpoint, so the amount of discussion was probably not as diverse as you might want.</td>
</tr>
<tr>
<td>8</td>
<td>Better description of instructions for group exercises (don’t think all groups heard objectives).</td>
</tr>
<tr>
<td>6</td>
<td>Clearer instructions for breakouts.</td>
</tr>
<tr>
<td>6</td>
<td>Work on making instructions a bit clearer (write them on the handouts).</td>
</tr>
<tr>
<td>5</td>
<td>Clearer instructions and objectives in exercises.</td>
</tr>
<tr>
<td>6.7</td>
<td>Broaden the group to include more than just the “pro’s” of Dow that work on sustainability.</td>
</tr>
</tbody>
</table>

- **0-6**: detractor; 7-8: neutral; 9-10: promoter

\[
\text{NPS} = \left(\frac{\text{promoters/participants} - \text{detractors/participants}}{\text{participants}}\right) \times 100
\]

- **16**: Detractor
- **1**: Promoter
- **-37.5**: Goal is to be in 50-80 range!
<table>
<thead>
<tr>
<th>What is one suggestion that would improve the framework?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearer objective (what are you hoping to achieve from the workshop)</td>
</tr>
<tr>
<td>More dramatic wording to differentiate more easily. Seemed like a lot of overlap.</td>
</tr>
<tr>
<td>There was some confusion I notices in participants - maybe the suggestion about agenda would enable a clear idea of the overall flow of events - minor comment as overall, this went really well.</td>
</tr>
<tr>
<td>Look hard at characteristics for each quadrant - I didn't find them necessarily consistent.</td>
</tr>
<tr>
<td>Overall, this worked well.</td>
</tr>
<tr>
<td>Statements for yellow and blue were more clearly aligned to a different stakeholder group than green and red. Would work on statements for red.</td>
</tr>
<tr>
<td>More clarity in instruction - giving for crowd control and so participants can adjust their mindsets/thinking as they assemble in different groups.</td>
</tr>
<tr>
<td>Still don't quite understand the concept/word of the &quot;framework.&quot;</td>
</tr>
<tr>
<td>I'm not sure that the color definition statements were as uniform in viewpoint as perhaps you might want. There was some overlap in the statements which may have blurred the boundaries between the groups.</td>
</tr>
<tr>
<td>Thought it was great.</td>
</tr>
<tr>
<td>Perhaps useful to come to the workshop understanding the backgrounds of participants (more level setting).</td>
</tr>
<tr>
<td>Good framework.</td>
</tr>
<tr>
<td>If dividing into groups, work through each group's positions and then move to intergroup challenges.</td>
</tr>
<tr>
<td>Better define objective at start of event.</td>
</tr>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

Average: 2.000, 1.381

<table>
<thead>
<tr>
<th>No.</th>
<th>Quadrant</th>
<th>Y</th>
<th>G</th>
<th>R</th>
<th>B</th>
<th>Match pre?</th>
<th>Question</th>
<th>Y</th>
<th>G</th>
<th>R</th>
<th>B</th>
<th>#&gt;2</th>
<th>Stdev</th>
<th>#&gt;2 diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biosphere (Yellow)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Scientists find solution to reverse climate catastrophe.</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1.915</td>
<td>-1</td>
</tr>
<tr>
<td>2</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Global water shortage eradicated!</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>0.500</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>The world is safe, we are not crossing 4C.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>0.000</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Regulation (Red)</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>Solution to reduce emissions in the atmosphere found!</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1.500</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Biosphere (Yellow)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Earth's atmosphere is re-balancing.</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2.000</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Regulation (Red)</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average: 2.200, 0.400

Difference: 0.600, -0.198
<table>
<thead>
<tr>
<th>No.</th>
<th>Department</th>
<th>Field of work / study</th>
<th>Age</th>
<th>What happened in your life recently that you think is a positive progress towards sustainability?</th>
<th>Y</th>
<th>G</th>
<th>R</th>
<th>B</th>
<th>#&gt;2</th>
<th>StdErr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Core R&amp;D</td>
<td>PhD Chemistry</td>
<td>36</td>
<td>Installing energy efficient lighting at home</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2.000</td>
</tr>
<tr>
<td>2</td>
<td>R&amp;D</td>
<td>PhD Physical Organic Chemistry</td>
<td>49</td>
<td>I pointed out the high energy cost for live streaming videos to someone who should have known more about this toxic than I do</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>3</td>
<td>EH&amp;S/Sustainability, Polyurethanes and Chlor-alkali</td>
<td>B(S) Chemical Engineering / M(S) Macromolecular Science and Engineering</td>
<td>53</td>
<td>Development of business M/Ph plan</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1.414</td>
</tr>
<tr>
<td>4</td>
<td>Toxicology</td>
<td>PhD Toxicology</td>
<td>34</td>
<td>Getting a toxicology position at Dow</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1.893</td>
</tr>
<tr>
<td>5</td>
<td>Sustainability</td>
<td>ScD Chemical Engineering</td>
<td>57</td>
<td>Rode my bike (mostly commuting) for more miles in a year than ever before (It’s been doing this for 8 years)</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1.708</td>
</tr>
<tr>
<td>6</td>
<td>Public Affairs</td>
<td>BA English</td>
<td>54</td>
<td>Volunteered for troubled youth program</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0.957</td>
</tr>
<tr>
<td>7</td>
<td>Toxicology and Environmental Research and Consulting (TERC)</td>
<td>PhD Environmental Sciences</td>
<td>22</td>
<td>Work for TERC</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>0.500</td>
</tr>
<tr>
<td>8</td>
<td>EH&amp;S/Sustainability</td>
<td>B(S) Electrical Engineering - M(S) Toxicology</td>
<td>50</td>
<td>I was asked to lead a regulatory platform that gives me a chance to demonstrate my commitment and impact to our function, business, Dow, health and the environment</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1.633</td>
</tr>
<tr>
<td>9</td>
<td>EH&amp;S/Sustainability, Product Regulatory Services</td>
<td>B(S) Chemical Engineering / BA German / MPhil Engineering for Sustainable Development</td>
<td>35</td>
<td>Working on a PhD dissertation on organization development and corporate sustainability goals</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0.816</td>
</tr>
<tr>
<td>10</td>
<td>EH&amp;S/Sustainability</td>
<td>PhD Chemistry</td>
<td>Grey hair</td>
<td>Our team exceeded a goal target by &gt;2x</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1.500</td>
</tr>
<tr>
<td>11</td>
<td>Maintenance</td>
<td>B(S) Mechanical Engineering</td>
<td>29</td>
<td>Our new house - far more energy efficient than our last house</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.500</td>
</tr>
<tr>
<td>12</td>
<td>Public Policy/Government Affairs</td>
<td>BS Biochemistry and Microbiology / MS Toxicology / PhD Environmental and Bioremediation</td>
<td>37</td>
<td>Practicing mindfulness</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1.414</td>
</tr>
<tr>
<td>13</td>
<td>EH&amp;S/Sustainability</td>
<td>BS Microbiology</td>
<td>54</td>
<td>The increased engagement across the value chain to work collectively to improve sustainability of consumer products</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1.500</td>
</tr>
<tr>
<td>14</td>
<td>Health Services</td>
<td>BS Nutritional Services</td>
<td>45</td>
<td>We started our own garden at home</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2.000</td>
</tr>
<tr>
<td>15</td>
<td>EH&amp;S/Product Stewardship</td>
<td>PhD Chemical Engineering</td>
<td>37</td>
<td>Support of a company with science-based CO2 goals</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>0.500</td>
</tr>
<tr>
<td>16</td>
<td>EH&amp;S/Sustainability, Environmental Remediation and Restoration</td>
<td>BS Biology and Chemistry / MS</td>
<td>46</td>
<td>My kids have embraced the concept of reduce, reuse - our son is an avid builder of things and reuses</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1.414</td>
</tr>
<tr>
<td>17</td>
<td>Energy Business</td>
<td>PhD Physical Chemistry</td>
<td>54</td>
<td>Renovating a home in AZ, while doing this we are improving the insulation and air sealing well above code</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1.500</td>
</tr>
</tbody>
</table>

Average: 1.647, 1.368
<table>
<thead>
<tr>
<th>No.</th>
<th>Quadrant</th>
<th>Y</th>
<th>G</th>
<th>R</th>
<th>B</th>
<th>Match pr?</th>
<th>Please write a newspaper headline regarding sustainability that you hope to see in 2050.</th>
<th>Y</th>
<th>G</th>
<th>R</th>
<th>B</th>
<th>#&gt;2</th>
<th>StdDev</th>
<th>#&gt;2 diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prosperity (Blue)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>Life expectancy reaches record levels</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>2.000</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Prosperity (Blue)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>Sustainability is no longer a needed word in our vocabulary</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>(What newspapers? must be digital version) Primary sustainability issues solved - Scientists, NGO's and Regulators seeking next challenges</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1.500</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Dow registers sustainable chemistry using risk assessment based solely on non-animal predictive toxicology assay battery</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>1.000</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Prosperity (Blue)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>Electricity and Power are now 95% decarbonized, enabling society to meet 2 degree Celsius target!</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1.893</td>
<td>-1</td>
</tr>
<tr>
<td>6</td>
<td>Biosphere (Yellow)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>World’s last fossil fuel power plant converts to solar energy</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1.893</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>We invented the new technology to produce materials more sustainably - low energy cost, environmentally friendly, good performance</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1.633</td>
<td>-1</td>
</tr>
<tr>
<td>8</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>India in 2050 versus 35 years ago is a great example of the benefits of the numerous sustainability initiatives launched in the early part of the 21st century</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Biosphere (Yellow)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>(We won’t be reading newspapers in 2050) All 9 Billion of us made it</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1.414</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Prosperity (Blue)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>20 years of improvement and counting: UNEPA continues to show gains</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1.414</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>Biosphere (Yellow)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>We are safe - you[!] children and their children can safely live on earth!</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.000</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>Prosperity (Blue)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>Climate change slowing down, poverty ending</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.000</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>Biosphere (Yellow)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Chemistry is key to a sustainable world</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2.000</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>Prosperity (Blue)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>Dow enhances people’s lives in Midland with new gardens and parks</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1.500</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Biosphere (Yellow)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Societies come together across the globe to celebrate 35th anniversary on the launch of the UN Sustainable Development Goals: Nations remember transformational global goals that enabled transition to sustainable society; Dow CEO Dikembe Ramathondran recounts <em>Dow is proud of its legacy leading this transition, which was first conceived in 2015 with our leading 2025 Blueprint goal</em></td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1.000</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Deaths of children under 5 from dysentery zero!</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1.000</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Technology (Green)</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>N/A</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>0.18</td>
<td></td>
<td>2.000</td>
<td>1.265</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference</td>
<td>0</td>
<td>3.553</td>
<td>0.102</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
References


2 Id. page 60.


7 Cameron, Kim S., Robert E. Quinn, Jeff Degraff, & Anjan V. Thakor, Competing Values Leadership: Creating Value in Organizations, September 26, 2007, Edward Elgar Publishing.


15 Environmental Performance Index, “Country Rankings.” http://epi.yale.edu/epi/country-rankings


18 Harvard Business Review, “The One Number You Need to Grow.”