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THOUGHT LEADERSHIP for LiFE

LiFE
Lifestyle for Environment

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Lifestyle for Environment

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“What is needed today is Mindful and Deliberate Utilization, instead of Mindless and Destructive Consumption.”

Shri Narendra Modi
Prime Minister

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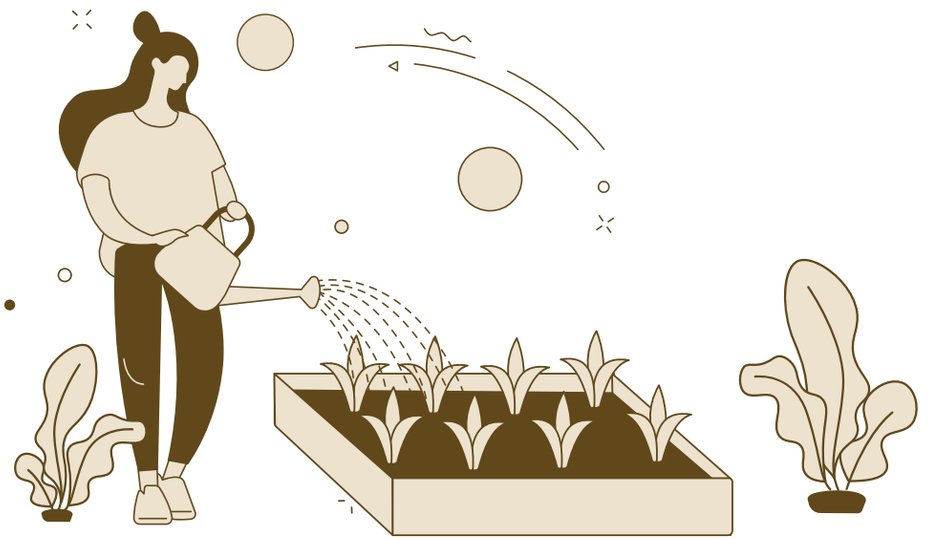
*All papers in this compendium are arranged alphabetically by the authors' last name.

Special Contributions to GCIP*



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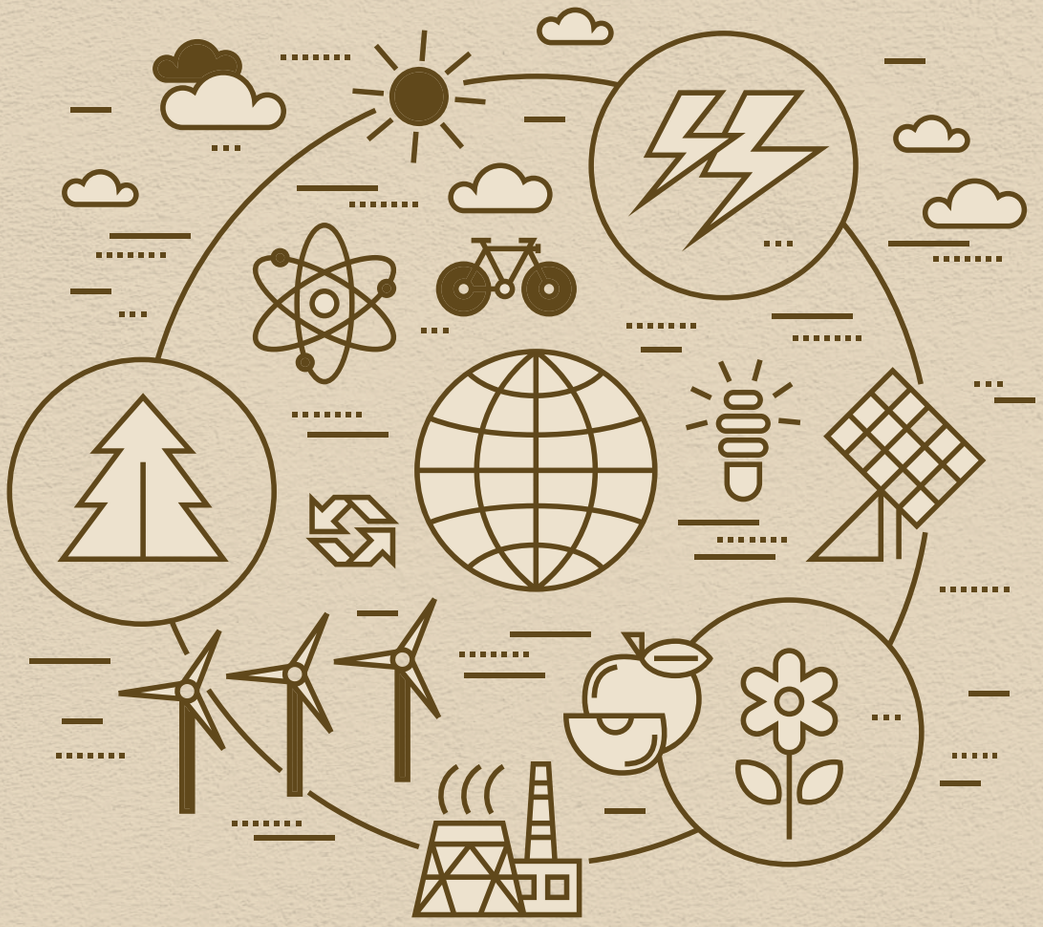


About
This Publication

Climate change is one of the most critical global challenges that requires collective action aimed toward its redressal. To support billions of livelihoods, promote growth and investment opportunities, raise the standard of living, and tackle the climate crisis, the world needs to adopt a new paradigm for development. Achieving this will not be possible without changes in our lifestyles to make us less dependent on energy-intensive resources, making it imperative to encourage greater sustainability in our consumption patterns. To this end, Lifestyle For Environment (LiFE) is conceived as a global movement for individual and collective action that seeks to adopt a pro-planet lifestyle. LiFE, or Lifestyle for Environment, was introduced by Prime Minister Narendra Modi at the World Leaders' Summit in Glasgow at the 2021 United Nations Framework Convention on Climate Change (UNFCCC COP26) when he gave a clarion call to rekindle a global pursuit to adopt sustainable lifestyle and practices. By recognising people as active participants in collective decision-making and emphasising the importance of behavioural change, LiFE envisions a shift in individual, community and household behaviour at a national and global level.

With the core philosophy that small actions by individuals (e.g. reusing shopping bags) can eventually add up and make a big dent in the climate crisis, this publication “Thought leadership for LiFE” has been crafted. This compendium is published as a part of the LiFE Global Call for Ideas and Papers, which was launched by Prime Minister Narendra Modi on June 5, 2022. The call was launched to invite ideas and suggestions from academics, universities and research institutions etc., to contribute scientific and measurable solutions towards the LiFE movement. Of these, select solutions will be scaled in India, bridging the gap between ideas and on-ground implementation by leveraging technology and traditional knowledge.

Countries have recognised the role of multilateralism in addressing climate change and promoting regional and international cooperation in order to strengthen action in the context of sustainable development. Several leaders and heads of nations shared their messages at the launch of Mission LiFE in Gujarat on October 20, 2022, and extended their support to the initiative. Their quotes from the launch event have been included in this publication, “Thought Leadership for LiFE”.

As a part of this compendium, noted award-winning authors and experts were invited by the Chief Executive Officer, NITI Aayog, Government of India, as Keynote Authors to share their expertise, insights, and experience on nudging behavioural change for sustainable lifestyles. The authors have contributed their reflections on how to solve the challenge faced by our planet using human-centric, collective efforts and robust action that further sustainable development. This compendium contributes to the global knowledge repository of ideas that have the potential to change behaviours, nudge action and unite the world towards affirmative climate action.

Submissions were also invited from experts and academics from across the world who are noted voices in the field of sustainability. They are recognised as Special Contributors in this compendium. These submissions were received from authors from five countries, including the USA, Japan, Australia, United Kingdom and France. Their research domain is across healthcare, energy, waste and technology.

We hope this compendium will serve as a call to collective action and provide impetus to solve the several climate challenges faced by humanity.

THOUGHT LEADERS SPEAK

(Addresses and messages on the occasion of Global Launch of Mission LiFE on 20 October, 2022)

Shri Narendra Modi
Prime Minister

United Nations Secretary General Antonio Guterres ji, Chief Minister of Gujarat Shri Bhupendrabhai Patel ji, External Affairs Minister of India Dr. S. Jaishankar ji, all other dignitaries from the country and abroad, ladies and gentlemen! A warm welcome to all of you on this glorious land. For Mr Antonio Guterres, India is like a second home. You have also traveled to India many times in your youth. You also have family ties with Goa. I feel that I am welcoming a member of my own family to Gujarat today. Mr. Antonio Guterres, thank you very much for coming here! Heartiest greetings to you! I am glad that since the launch of Mission LiFE, many countries are now associated with this resolution. I would like to thank the President of France Shri Macron, Prime Minister of the UK Liz Truss, President of Guyana Irfaan Ali, President of Argentina Alberto Fernandez, Prime Minister of Mauritius Pravind Jugnauth, President of Madagascar Andry Rajoelina, Prime Minister of Nepal Sher Bahadur Ji, Brother Solih from Maldives, the Prime Minister of Georgia Irakli Garibashvili and the Prime Minister of Estonia Kaja Kallas.

This event is being held in the vicinity of our national pride which is the Statue of Unity, a colossal statue of Sardar Vallabhbhai Patel. I believe that unity is the most important factor against climate change. The world's largest statue will inspire us to set high environmental goals and to fulfil them.

When the standards are high, the records are bound to be enormous. Organizing this event in Gujarat holds a lot of importance. And this is a perfectly suitable place too. Gujarat is one of the states in India which first started taking a lot of steps towards Renewable Energy and Environment Protection. Be it installing solar panels on canals or campaigning for water conservation to raise water levels in drought-prone areas, Gujarat has always been a leader or a trendsetter.

It is generally believed that climate change is a policy related matter. But as soon as we start looking at this issue from the point of view of a policy, inadvertently, our mind will start thinking that only the government is supposed to do something about it or the international organizations should take some action on it. It is true that the government and the international institutions play a major role in it and they are also trying to handle it. But we all can see that now the seriousness of this issue is no longer confined only to the discussion table but has reached every corner of the world and every household today.

People are beginning to feel the changes happening around them due to climate change. In the last few decades, we have seen how the impact has intensified and have also faced unforeseen calamities. Today our glaciers are melting and sea level is rising. Our rivers are drying up and the climate is becoming erratic. And these changes are making people think that the issue of climate change cannot be left at the policy marking level only. People themselves have started realizing that as an individual, a family and a community, they should take some responsibility for the planet earth and do something on a personal level. People want to know what steps they can take at individual level or together with family and community, so that the earth can be protected?

The answer to all these questions lies in Mission LiFE. Mission LiFE's mantra is 'Lifestyle for Environment'. Today I am presenting this vision of Mission LiFE to the world with the hope that every individual on this planet earth puts his or her effort. Mission LiFE connects the powers of the people for the protection of this earth and teaches them to utilize it in a better way. Mission LiFE makes the fight against climate change democratic in which everyone can contribute according to his or her capacity. Mission LiFE believes that even small efforts can have a huge impact. Mission LiFE inspires us to do all that can be done in our everyday life to protect the environment. Mission LiFE believes that the environment can be protected by changing our lifestyle. I want to give you two very interesting examples. You must have seen that some people set the temperature of the AC to 17 degree Celsius or 18 degree Celsius. But after lowering the temperature of the AC, these people sleep with blankets or quilts. Every 1 degree celsius of temperature lowered in AC can have a negative impact on the environment. But we can save the environment if we try. That is, if we change our lifestyle, it will be a big help to the environment. Let me give another example of our Lifestyle. Some people go to the gym in their car that has an average mileage of 5 kilometres per liter; and then sweat it out on the treadmill in the gym. Now if your aim is to sweat out, then why don't you simply do that by walking or cycling up to the gym? This way both the environment and our health would be benefitted.

This is how small efforts of an individual and the society can bring major results by changing the lifestyle. I want to share another example. In India, we had urged the countrymen to use more and more LED bulbs a few years back. The aim was to reduce the electricity bill of the people, reduce the cost of electricity and also protect the environment. The government started a scheme of LED bulbs and the private sector of the country also became a part of it. International experts who have come there today will be surprised to know that within a short time, people of India have installed more than 160 crore LED bulbs in their homes! Consequently, we could cut down more than 100 million tonnes of carbon dioxide emissions. And kindly note that this is happening every year. This is not just a one-time achievement! It is helping us every year. Due to the LEDs now, every year emissions have started decreasing a lot!

Gujarat is Mahatma Gandhi's birthplace. So he was one of those thinkers who completely understood the importance of conserving the environment and living life in harmony with nature. He had developed the concept of Trusteeship. Mission LiFE makes all the stakeholders trustees of the environment. Trustee is someone who does not allow the indiscriminate use of resources. A Trustee does not act as an exploiter but as a protector. Mission LiFE will strengthen the concept of P3. P3 means Pro Planet People. Today we are living in a world where we talk about groupism i.e. which country is in which group or against which country or group. But Mission LiFE connects the people of the earth as Pro Planet People, uniting them in their thoughts. It functions on the basic principle of 'Lifestyle of the planet, for the planet and by the planet'.

We can build a better future only by learning from the past. India has a rich tradition of worshipping nature for thousands of years. The importance of water, land, air and all the natural things has been accurately explained in our Vedas. For example, the Atharvaveda says: माता भूमिः पुत्रोऽहं पृथिव्याः। That is, the earth is our mother and we are her children. 'Reduce, Reuse and Recycle' and circular economy have been a part of our Indian lifestyle for thousands of years. And we all know that in many parts of the world, in many countries, such practices are still prevalent today, which inspire us to walk in harmony with nature. Mission LiFE will encompass every lifestyle related to the conservation of nature, which our ancestors adopted, and that can be made a part of our lifestyle today.

Today, the annual per capita carbon footprint in India is only about 1.5 tonnes, compared to the world average of 4 tonnes per year. Nevertheless, India is committed to tackling a global issue like climate change. It had started the Ujjwala scheme to get rid of the smoke of coal and wood. Keeping in mind the water security, we are running a massive campaign to build 75 'Amrit Sarovars' in every district of India today. Unprecedented emphasis is being laid on 'waste to wealth' here. Today, India has the fourth largest renewable energy capacity in the world. Today we are ranked number four in wind energy and number five in solar energy. India's renewable energy capacity has increased by about 290 per cent in the last 7-8 years. We have also met the target of achieving 40 per cent of the electric capacity from non-fossil-fuel sources 9 years ahead of the deadline. We have also achieved the target of 10 per cent ethanol blending in petrol, and that too 5 months before the deadline. Now India is working on the target of 20 per cent ethanol blending in petrol. India is also moving very fast towards eco-friendly energy sources for the Hydrogen Ecosystem, and Gujarat is turning into a hub for this green hydrogen. This will go a long way in helping India and many countries of the world achieve their goal of 'net zero'.

Today India is not only progressing but also providing solutions to live in harmony with nature and setting a good example. Today India has become the fifth largest economy in the world but at the same time our forest area is expanding and the number of wild animals is also increasing continuously. India now wants to extend its partnership with the world even more. Campaigns like 'One Sun, One World, One Grid' are strengthening our resolve towards such goals. By taking the lead in the formation of 'The Coalition for Disaster Resilient Infrastructure', India has made the world aware of its idea towards environmental protection. Mission LiFE is a next step in this direction.

Secretary General Antonio Guterres would agree with me that whenever India and the United Nations have worked together, new ways of making the world a better place have been found. India had proposed International Yoga Day, which was supported by the United Nations. Today because of the support of the United Nations, yoga has become an inspiration to crores of people around the world to lead a healthy life. One such example is the International Year of Millets. India wanted to familiarize the world with its traditional and eco-friendly, coarse cereals. The United Nations also supported this. We are going to celebrate the International Year of Millets next year, but the discussion related to it has already started all over the world. I am sure that with the support of the United Nations, Mission LiFE will be a huge success and it can be taken to every corner of the world, every country and every citizen. We have to remember this mantra – प्रकृति रक्षति रक्षिता । That is, those who protect nature are protected by nature. I believe that with this Mission LiFE, we will be able to build a better world. Once again I express my gratitude to all of you and I once again extend my heartfelt thanks to the UN for this support.

Thank you.

Scan this code to watch the speech

Reference - PM's Speech: https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1869518

Mr Antonio Guterres
UN Secretary-General

I am honoured to be with you at the Statue of Unity to launch the Lifestyles for the Environment initiative. In these perilous times for the planet, we need all hands on deck. I know that sometimes the enormous scale of a challenge might be reason enough to throw up one's hands in resignation. And there isn't a larger challenge in our world today than the climate crisis.
But this Lifestyles for the Environment initiative is designed to highlight an essential and hopeful truth: All of us, individuals and communities, can – and must – be part of the solution of protecting our planet and our collective future. After all, overconsumption is at the root of the triple planetary emergency of climate change, biodiversity loss and pollution. We are using the equivalent of 1.6 Earths to maintain our lifestyles. And that great excess is compounded by great inequality. The combined greenhouse gas emissions of the richest 1 per cent are more than twice the poorest 50 per cent.

So, we need to urgently transform our economic systems to make them friendly to the planet – and to make them equitable, so all can have equal opportunity to thrive in developed and developing countries. Each one of us will have to learn to live sustainably and reduce our environmental footprint.
By saving energy and reducing pollution and waste.
By using less plastic.
By taking advantage of clean cooking technologies.
By eating more sustainably and not throwing away food.
By using renewable energy.
By making our money count as consumers by supporting sustainable products.

And many other examples we have seen in the wonderful film at the start of this ceremony. And we also need to be speaking up and demanding that leaders support clean, green lifestyles and ambitious climate action. This is the mission of the Lifestyles for the Environment initiative that I hope can spread throughout the world.

I am immensely encouraged by the commitments that India has made to pursue environmentally sound policies. These efforts include a pledge to significantly increase investment and deployment of renewable energy. Championing the International Solar Alliance. And joining the High Ambition Coalition for Nature and People, which aims to protect and conserve 30 per cent of the world's ecosystems by 2030. I also congratulate India on its upcoming G20 presidency. The G20 accounts for 80 per cent of global greenhouse gas emissions. But it also represents 80 per cent of global GDP. So, the G20 combined has the resources, the know-how and the power to end our war against nature and set us on course to more sustainable living. Central to that goal is the urgent need to pivot from economies based on fossil fuel consumption to economies powered by renewable energy. A revolution in which developed countries must invest massively, financially and in technological support to allow emerging economies themselves to also be able to present more ambitious targets. The world counts G20 economies to lead the way in progressive ending the use of coal by 2030 in OECD countries and 2040 in non-OECD countries. Developed countries must follow through on their commitments to provide meaningful financial and technological support to countries like India through this transition. We need to unleash a renewables revolution – and I look forward to working with India in driving this agenda forward.

In three weeks, world leaders will meet in Egypt for the next United Nations climate change conference – COP-27. COP 27 represents a key political opportunity to rebuild trust and accelerate action across all the pillars of the Paris Agreement.
Adaptation.
Mitigation.
Finance.
And loss and damage.

Full implementation of the financial commitments made in Paris.

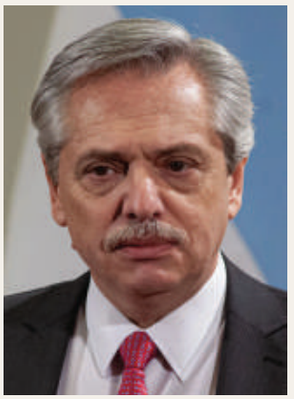
A quantum leap in support to adaptation in developing countries and measurable progress and serious progress in loss and damage are essential conditions to re-establish trust between developing and developed countries around the world. With its vulnerability to climate impacts, and its massive economy, India can play a critical bridging role. We have no time to lose. We are in imminent danger of failing to meet the goal of limiting global temperature rise to 1.5 degrees Celsius. Our global goal has to be net zero emissions by 2050. And to achieve this, we must collectively halve global emissions from 2010 levels by 2030. And as the LIFE initiative highlights, every citizen has a role to play – and that includes everyone, everywhere, using their voice to urge their leaders to take much needed ambitious climate action.

As the Prime minister of Mauritius has recalled, Mahatma Gandhi reminded us that: “The world has enough for everyone’s need, but not enough for everyone’s greed.” That perfectly captures the situation we face now. Unfortunately, for the time being, greed is prevailing over need. And we need to reverse this trend. The planet is able to support each and every one of us – but we must treat its resources with wisdom and respect. So today, let us pledge to alter our economies and our lifestyles so we are able to share Earth’s resources fairly and take only what we need. And let us count on India – as it assumes the G20 Presidency – to help usher in a new era of sustainability, fully in line with its history, its culture and its ambition.

Thank you.

Scan this code to watch the speech

Reference - UNSG's Speech:
https://www.un.org/sg/en/content/sg/statement/2022-10-20/secretary-generals-remarks-launch-of-lifestyles-for-the-environment-initiative%C2%A0delivered



Mr Alberto Fernandez
President, Argentina

"We must ensure that the world develops, that poverty reduces, that social equality is achieved and in order to accomplish that, we should aim at sustainable, innovative and above all environment-friendly production. Knowing that the leading democracy in the world, India, has undertaken the task of seeking a way out, I feel more at ease."

Scan this QR to watch the message

Mr Andry Rajoelina
President, Madagascar

"I am convinced that LiFE could become one of the turning points in our fight against the climate crisis."

Scan this QR to watch the message

Ms Elizabeth Truss
Former Prime Minister, United Kingdom

"As democracies, we must work together to secure energy independence and protect our economies. That's why we are turbo-charging our rush to renewables; we are investing with partners like India to help build vital climate infrastructure."

Scan this QR to watch the message

Mr Emmanuel Macron
President, France

"The time when our world is subject to increasing geo-political tensions, we have no choice but to choose cooperation over division, for one single reason: No one can address global challenges, and especially climate change, on their own. The LiFE initiative is part of this agenda for stronger cooperation."

Scan this QR to watch the message

Mr Ibrahim Mohamed Solih
President, Maldives

“Prime Minister Modi’s Mission LiFE couldn’t have come at a more crucial juncture. The ill effects of the climate crisis come at us with full force. [. . .] This ambitious initiative is a call for action.”

Scan this QR to watch the message

Mr Irakli Garibashvili
Prime Minister, Georgia

“Georgia welcomes and fully supports this global initiative timely introduced by his Excellency Narendra Modi. We promote an environmentally conscious lifestyle that focuses on the principle of mindful and deliberate utilisation.”

Scan this QR to watch the message

Mr Irfaan Ali
President, Guyana

“I wish to extend my best wishes to the Prime Minister of India, Narendra Modi, on the launching of the Mission LiFE logo and document, which seek to mobilise one billion Indians to become Pro Planet People by 2027, who will practice simple environment- and climate-friendly behaviours in their daily lives.”

Scan this QR to watch the message

Ms Kaja Kallas
Prime Minister, Estonia

“We can achieve even more if we combine the green transition with the digital one. We have digitised the energy network in Estonia and see the potential this has for energy savings as well as innovation. It is time for profound change in our lifestyles; we need to place sustainability front and centre.”

Scan this QR to watch the message

Mr Pravind Jugnauth
Prime Minister, Mauritius

“Lifestyle changes at the individual level and behavioral changes at the community level are needed to reduce the strain on the environment. I, therefore, strongly support the movement launched by Prime Minister Narendra Modi to build on good practices at the level of individuals, communities and institutions in order to accelerate the transition to the most sustainable future.”

Scan this QR to watch the message

Mr Sher Bahadur Deuba
Former Prime Minister, Nepal

“To build on the idea that positive changes, individual actions and behaviours are the key parts of the climate solutions that world urgently needs.”

Scan this QR to watch the message

Reference - Speeches: https://pib.gov.in/PressReleasePage.aspx?PRID=1869544

“LiFE can take the fight against climate change with billions of steps forward every day.”

Shri Narendra Modi
Prime Minister

KEYNOTE AUTHORS*

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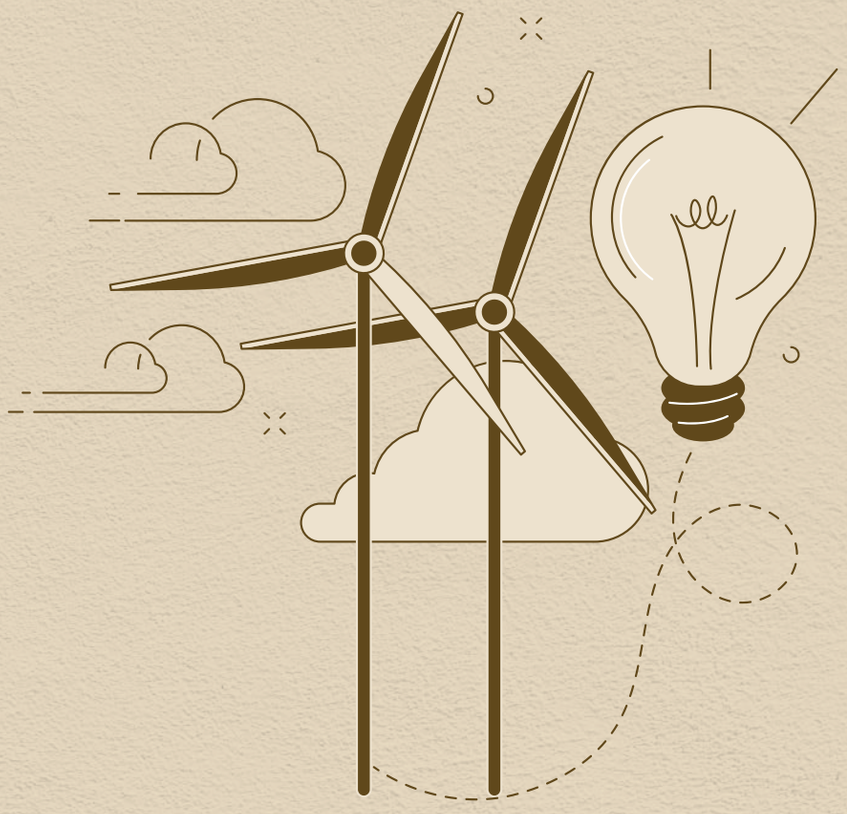

DECISIONS, DECISIONS: HELPING INDIVIDUALS FIND THE BEST WAY TO HAVE AN IMPACT ON THE CLIMATE CRISIS

*Robert Aunger**

*London School of Hygiene and Tropical Medicine

Climate change is often said to be one of the most pressing issues of our time. There are constant calls from scientific experts, NGOs and other advocates that the world needs to take immediate action to address this crisis (e.g., the Intergovernmental Panel on Climate Change [IPCC] reports). The consequences of inaction are already becoming apparent, including more frequent and intense extreme weather events, rising sea levels, and loss of biodiversity (Clark et al., 2016). The urgency of the climate crisis demands that people take bold and concerted action to mitigate its impacts (Fragnière, 2016). However, effective action at the necessary scale has been slow to arrive, either from individuals or responsible organisations at regional, national or international levels (Stern, 2009; Beck, 2016).

Despite growing evidence of the severe consequences of inaction, there have been several reasons why responsible parties at all levels have not done enough to address the climate crisis until now. Some businesses have been resistant to adopting more environmentally-friendly practices, often citing concerns about the cost and feasibility of such changes, especially in a competitive economic environment (Rickards et al., 2014). One of the primary reasons for inaction has been the lack of political will and leadership at the global level (Jetten et al., 2021; Parker et al., 2012). Many policymakers have been slow to respond to the crisis, in part due to concerns about the short-term economic impacts of shifting production efforts toward more climate-friendly activity (Slawinski et al., 2017; Ferns & Amaeshi, 2021). There has also been a lack of coordination and cooperation among nations, despite numerous global meetings, which has made it challenging to reach consensus on the best way forward (e.g., UN Climate Change Conference of the Parties [COP] meetings).

Another cause of inaction has been the reluctance of individuals to change their behaviour. Many people have been unwilling to make lifestyle changes, such as reducing their consumption of fossil fuels or adopting other more sustainable practices (Newell et al., 2022; Whitmarsh et al., 2011; Gifford et al., 2011). Many people are still not fully aware of the scale of the problem or the urgent need for action. This lack of awareness has been exacerbated by misinformation and propaganda campaigns by those with vested interests in maintaining the status quo (Hassan et al., 2023; Maxwell & Miller, 2016; Brulle, 2020). Additionally, it remains difficult for individuals to determine what their own best course of action would be to assist in this effort (Marshall, 2015; Schenck, 2008).

In another work (Aunger, submitted), I have proposed an individual-level decision-making model to help identify the most impactful kinds of actions a particular person can take, given their circumstances. The model can be seen in Figure 1. How it works can be determined by examining it from left to right. The box on the extreme left represents contextual factors that can impact the way in which decision-making proceeds. These factors lead to psychological processes that determine behaviour, which in turn can affect the climate at an aggregated scale through intermediary factors. The model can be customised for specific situations by adding information about particular factors and options.

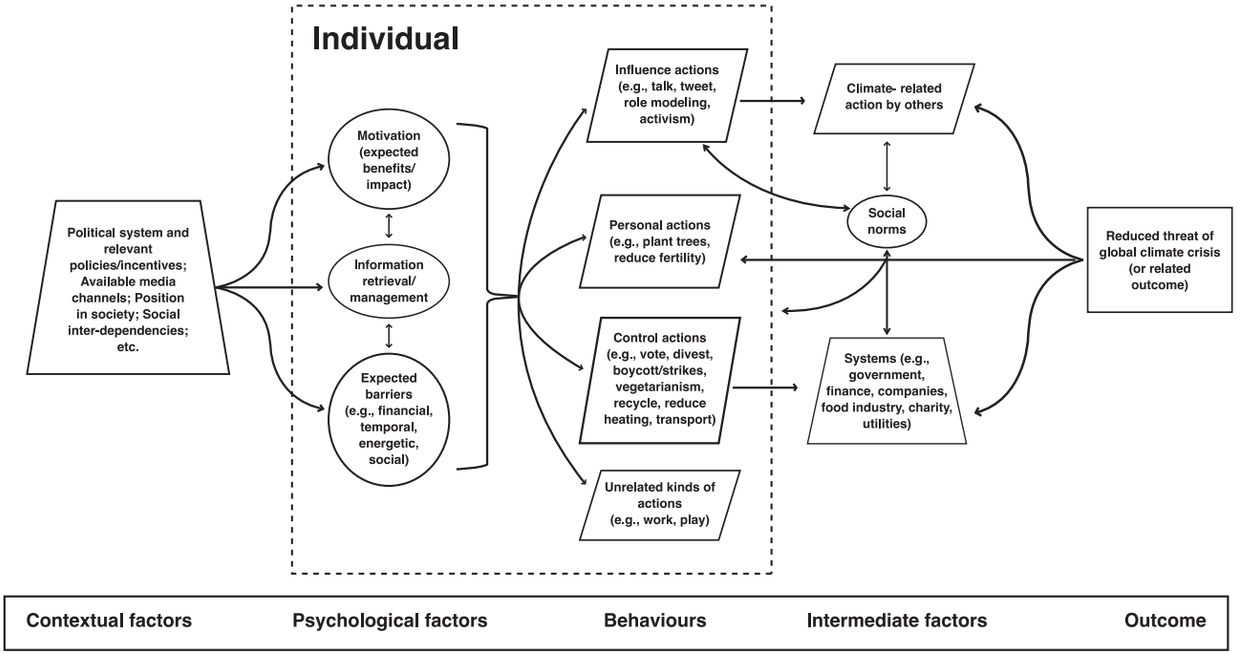

Figure 1: A climate crisis decision-making model

The model argues that individuals can follow four chains of logic through to a decision about a course of action with respect to climate. The first is by taking personal action that directly affects a climate-related process, such as planting trees or reducing their fertility. These actions do not depend on anyone else to have an impact on climate – the consequences are direct. The second route is to utilise one's personal power over a system, such as owning a company, which then has an impact on climate. For example, one might manage a company and ensure that it gets supplies for production of its outputs from environmentally responsible sources. The third pathway is through what is called 'influential' action, where the individuals persuade others in their social network to do something, which then affects a climate-related process. In such a case, an influencer could post about their own pro-environmental behaviour for others to use as a model of how to behave themselves. The fourth option is to choose something unrelated to the climate, such as exercising or watching a movie, which represents the opportunity cost of not taking action related to the climate.

A Worked Example

Obviously, the number and kinds of factors to consider when making a decision about eco-friendly action can be complex. Hopefully, a worked example can help illuminate the virtues of an individual-level decision-making approach which is specific about the options available.

Nipa is a 45-year-old woman living in Mumbai. She is an architect designing some private residences in Mumbai, a public housing project in one of New Delhi's slums, and an office building in Chennai. From keeping up with news items, she knows climate change is an urgent problem, but is unsure how best to make a contribution. She reads about Prime Minister Modi's climate initiative and the availability of an online guide to decision-making around climate. She looks up the website. From this reading, she works through the categories of action for her own circumstances.

Contextual factors

Of course, Nipa must first consider her context – her position in society. She recognises that she is relatively wealthy, well-educated and privileged. She is, therefore, more responsible for the present situation through her own past behaviour than many others, which causes her to think she should be quite serious about her role in mitigating further environmental degradation. She is not part of the government nor a technologist, although she does contribute to the built environment in which many others live their lives, which means she could help with long-term adaptation to a changed environment.

Personal actions

As an architect, Nipa can certainly include lots of plants and trees in her plans for the public housing project, and for any other commissions that come her way. She notes that this sense of 'natural' environments for buildings is a growing trend in her profession that she could lead on.

Control actions

Nipa first researches the kinds of actions that she could take as an individual. She notes that in India, the top three most environmentally costly behaviours are heating/cooling by electricity/gas, agricultural practices, and transportation choices. Nipa next searches for an online carbon footprint calculator and sees that her most significant contribution is due to flying to various building sites. Her second most significant contributor is the electricity to cool her house. As it is something she can do that provides a quick return and takes little time, she decides she can easily reduce her electricity use, and promises herself to look into eco-friendly energy suppliers.

It would be hard to cut down on flying, given how long train journeys take, even though that is really costly in carbon terms. But doing fewer visits to those building sites really should be looked at. She could probably also buy less food at supermarkets and more in local vegetable markets, where the food hasn't travelled so far. But that would require changes to her weekly shopping routines, and she isn't sure it makes that much of a difference, so her motivation for that change is low.

What about actions that would work through the institutions with which she is affiliated in some way? She makes a list of all the organisations she is a member of - from a golf club to a fiction reading group. It becomes immediately apparent that the most promising avenue is through her professional organisation, the Indian Institute of Architects. She thinks she could publish an article in their professional journal about the need for environmentally-friendly construction processes – perhaps focusing on not using concrete wherever possible, as concrete production is a major contributor to climate change. These are one-off activities that will not take much time, and she judges they could reach quite a lot of influential people. Her own standing as something of an intellectual in the IIA has been established by previous articles and by the innovative quality of her previous buildings (although she has not previously been involved in eco-friendly design). So she determines to write to the IIA about the possibility of an opinion piece around concrete. She also writes a post about this idea on her Twitter and Instagram accounts (an influence action) and gets some retweets and likes. This reinforces her thinking that she will make a concerted effort in this direction, as it is the best combination of her authority, social position, and expertise, and with respect to a quite significant contributor to CO_2. This seems to be her area of special advantage, around which she could become passionate.

Nipa could also put forward a motion or resolution that members always consider the climate impact of their designs. She can also vote for eco-friendly leadership in the IIA. These possibilities will be investigated, as she does not know enough about them currently.

She makes a note to also look into whether her bank is engaging in egregious anti-environmental investments.

Influence actions

Like most people, her face-to-face social network is composed of family, friends and neighbours. Reaching out to these kinds of people can be done in a high impact way, through personal visits or phone calls. She decides to Whatsapp her two kids, in Bangalore and Chennai, about the need to take climate change more seriously in their lives, at least beginning with doing a footprint calculation. She follows up by sending them a link to one of the online calculators. There are also those 'friends' and acquaintances who are fans or followers of her work on social media (where she maintains a professional appearance). She again thinks there are some easy options here.

Finally, Nipa thinks she could make sure anyone she votes for pledges attachment to an eco-friendly agenda. As such candidates and parties remain unpopular in her district, this would seem to be a waste of a vote, but she pledges to back the BJP at the national level, in support of the LiFE initiative.

Reflections on her decisions

Nipa then takes some time to reflect on what she has changed in her life. Nipa hopes these actions will be enough to make some difference, although she is not sure. She is a bit disappointed about her lack of action over flying. She also decides to get updates from some climate-related online groups (like climatewatchdata.org or climatenetwork.org) to make sure she keeps up to date on the latest thinking. New information might improve her decision-making and bring to light new ways of helping. She thinks she will revisit her decisions regularly and, meanwhile, will make sure she actually reads news from her climate watch groups. She feels better about herself but still wonders what more she could (easily) do. At least this is a beginning, she thinks.

In this way, by providing a focus that helps structure thought and by ensuring all options are considered (some of which might not be thought of otherwise and which might prove viable), the use of the decision-making model can facilitate new actions being taken.

Making a Difference

The use of this model suggests that it will almost always be the case that 'emphasising the social' will be favoured by the decision-making calculus. Most people, to have a larger impact, will have to become effective ***Climate Champions*** – that is, engage in activities that have an impact not only on their own behaviour but that of others. This means that everyone should become a social change agent themselves. This in turn, means there is a role for behavioural science to help everyday people become behavioural scientists so that they can have the biggest impact on others. How can we train the whole world to become behaviour change experts and to begin working with each other to create the social movements that will lead to achieving and surpassing social tipping points?

Behaviour change principles

There are a couple of other ways in which we can help. First, a list of principles can be devised to make sure that any effort undertaken by the well-meaning will not backfire or fizzle out with no effect but actually cause others to take notice and take action. Which channels and targets of action are relevant depends on the individual's situation. (Use the decision-making model to decide!) However, there are general principles that can be applied to any communications about the climate crisis.

1. *Whatever you do, make sure it is seen* - It is often very low-cost to ensure that others become aware of one's own actions (e.g., via posting on social media). This can add a social dynamic to what would otherwise be an isolated incident.

2. *Make sure that messages are about concrete, local consequences* – Do not focus on reducing the eventual global temperature increase by 0.5C, but on keeping local shops from flooding.

3. *Make sure that messages are about well-defined target behaviours* - Again, do not talk in generalities but work together with others in your community to get people to – for example – switch to eco-friendly electricity providers, or to participate in recycling efforts.

4. *Be a role model* - Any message from you is more effective if you are seen as relevant, credible and authoritative. So 'walk the walk' as well as 'talk the talk'. Be an agent of change that others look to.

5. *Adopt a positive frame* - People rapidly grow tired of 'gloom and doom'. They respond more positively to positively framed messaging. Much of the messaging thus far about climate change has been negatively framed, pointing out the horrors that await us all if nothing is done. This needs to change.

Some suggested messaging strategies

Using this general approach, I can even devise some strategies or concepts for messaging that should hit people hard.

First, some based on contextual factors

- *You cannot rely on the government* - The evidence just is not good that governments will step in and save us. It has got to be the people, acting on behalf of their own future.

- *Be the first domino* - If our actions are interdependent, with everyone watching everyone else and taking their cues as to the 'right choice' from others, then what you do as an individual matters. Based on the social norm dynamic, you can start the ball rolling as just one person: one person's sacrifice is the first step for norms to change. In effect, your action could be the one that sets off a copycat domino effect, automatically taking us all to the social tipping point that reverses crucial trends. Why not be The One?

- *Target the rich* - Targeting the rich could be the fastest, most efficient way to achieve climate goals. Unfortunately, the rich are very powerful and hence able to escape most social pressures (Constantino et al., 2022). As a consequence, they are often the least likely to change, either because they think they are the 'good guys,' already making a huge social contribution through their wealth-generating activities, or they believe they can buy their way out of their responsibilities (e.g., through carbon offsetting). The fairness argument could be used against them, however, and is difficult to counter.

Now for some motivational strategies

- *A child's question* - What kind of answer will you be able to give to your children and grandchildren when they ask, "What did you do during the '20's?" The 2020s will be the decade during which future climate trends will be set for generations, for good or ill. Will your answer be "Nothing I'm afraid, I took it to be someone else's problem"? Imagine the look on their faces of disappointment, disrespect, horror.

- *Green world* - The new world, should we all get into action, will not be a bad one to live in, actually – it will be healthier, fun, natural and sustainable. Surely it will be different from now, but not in a bad way.

- *It's not about money* - Many times it does not cost anything to have some impact, and when it does, society can afford it (the alternative cannot be contemplated). Being climate friendly is within the reach of everyone.

- *The future now* - Find ways to trigger the pang of loss from a new vantage point. For example, make a vivid picture of a future paradise lost due to inaction now.

- *Investing in the world's future* - Contrast the investment you are making in your children's education and maintenance with the investment you are making in the world they will inherit. Does one make sense without the other?

Here are some logical strategies

- *Pascal's (revised) wager* - Hey climate sceptics, if you're wrong, it is the end of civilisation as we know it. But if you go along with this, it will be a bit inconvenient for you, but you could help save the planet. Can you afford to be wrong? It only makes sense to act as if the crisis is real.

- *No risk* - It is not a risk to believe that climate change is the most important risk you are facing in your life. The risk that climate change is happening is very nearly certain. The risk that it will affect you or your family is very high. What other risks could be comparable? The risk of losing your job, or getting seriously ill, perhaps? (In fact, these risks are related to climate change!) You would have to contemplate something like playing on the railway tracks or parachuting out of an airplane to find examples of comparable risk. Are you going to risk these things? But take note: these things are voluntary, whereas the risk of climate change will visit you regardless of your choices. It is inevitable. What will you do to minimise the severity of that visit?

- *Often, it's what you don't do that matters* - Not taking that flight, and not eating that meat are pro-climate 'actions' (when it is a real choice). Reframing 'action' in this way can make people feel a lot better about themselves and inspire overt action in other domains.

- *Double-counting* - Many actions taken by individuals and organisations can count both as mitigation and adaptation: if you use fewer raw materials, you are both conserving them and getting accustomed to their scarcity. Actions to aid adaptation may also be less dependent on the actions of others and so more under our control. And if one of the problems is to stimulate people to act, then getting to count actions as both mitigation and adaptation can double the motivation.

Conclusion

The climate crisis is one of the most significant challenges of our time, and the need for action has never been more urgent. The causes of inaction are complex and multifaceted, but it is clear that individuals need to take immediate and concerted action to mitigate the impacts of climate change. However, it is quite possible to be overwhelmed both by the feeling of a need to do something oneself about the impending climate crisis and the feeling that one is powerless to do anything meaningful as an individual, given the global scale of the processes at work producing that crisis. This combination of feelings can induce psychological paralysis (Albrecht, 2011; Toivonen, 2022) that leads to inaction. I have argued that using a step-by-step approach which breaks down the task of deciding what is the best way to help can help break any logical log-jam around reasoning about climate. There are also some obvious principles from behavioural science, both around the kinds of logic to use and appropriate messaging strategies, that can be applied to any effort by organisations trying to promote such decisions in others. In these ways, hopefully the effectiveness of pro-environmental motivations among both individuals and institutions can be improved and lead to better climate outcomes for our shared global future.

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INVESTING IN INNOVATION TO ADDRESS CLIMATE RISKS AND FOOD SECURITY

Michael Kremer*, Arthur Baker** and Imara Salas*

*Director of Development Innovation Lab, University of Chicago.
**Development Innovation Lab at University of Chicago

1. Introduction

This paper discusses two sectors in which India is implementing innovative programmes to address challenges exacerbated by climate change, creating a model for the rest of the world - drinking water and agriculture.

Climate change increases the risk of waterborne disease, already a major cause of mortality and ill health in Low - and Middle - Income countries. The Jal Jeevan Mission aims to provide safe, adequate, and regular drinking water to rural households through individual household connections by 2024, with over 80 million household tap connections installed so far.

Against a background of stagnant agricultural productivity in many countries, climate change threatens food insecurity and livelihoods. To address the interlinked challenges of climate change, food insecurity, and low agricultural productivity, the world will need to invest more to encourage innovation and direct it toward human needs.

India is already a leader in this area. Focus areas for its G20 presidency include climate finance, inclusive growth, digital economy, and technology transformation. In 2018, the state of Odisha launched Ama Krushi, which delivers digital agricultural advice to more than three million farmers, and India's Department of Agriculture and Farmers' Welfare has now launched a partnership with the Development Innovation Lab at UChicago to explore opportunities for innovation related to agriculture and food security in the context of climate change.

This note discusses a number of promising innovations. Section 1 discusses water treatment and India's JJM program. Section 2 focuses on innovations in climate change, agriculture and food security, giving three examples: improved weather forecasting (2.1), soil health cards and leaf colour charts (2.2), and digital agricultural extension (2.3). Section 3 discusses how governments can create institutions to accelerate the pace of innovation and shape it to meet human needs. 3.1 discusses push funding instruments, including tiered, evidence-based social innovation funds. 3.2 discusses market shaping instruments, including Advance Market Commitments.

2. Water Treatment

Climate change could pose a threat to public health through its impact on waterborne disease. Both floods and drought can increase the risk of waterborne disease. Levy et al. (2016) conducted a meta-analysis, finding that heavy rainfall and drought were associated with an increased prevalence of diarrhoeal disease in 71 per cent and 76 per cent of studies, respectively. This section discusses innovations to improve the quality of drinking water and reduce waterborne disease.

Despite rapid reductions, the under-5 mortality rate in India is around 5 per cent, and more than 10 per cent in Uttar Pradesh (Indian Council of Medical Research et al., 2020). Waterborne diseases are a major cause of child mortality, a recent meta-analysis estimates that a quarter of child deaths in Low - and Middle - Income countries could be averted through water treatment, and middle-income countries could be averted through water treatment, and one in four deaths can be addressed by pipe water (Kremer et al, 2023). We conduct a back-of- the-envelope calculation, which suggests that providing universal access to safe drinking water in India would prevent 136,000 child deaths per year.

Climate change could increase the risk of waterborne disease. Droughts can reduce access to drinking water, causing people to substitute for sources more at risk of contamination, and floods can spread waterborne diseases such as cholera (Levy et al., 2016).

In 2019, the Government of India established the Jal Jeevan Mission (JJM), aiming to provide safe and adequate drinking water to rural households through individual household connections by 2024, with over 80 million household tap connections installed so far.

In addition to providing access to piped water, the government aims to ensure water is safe to drink, which poses several challenges. Even if water is treated centrally to remove pathogens, water can be re-contaminated in transit. Intermittent water supply can allow contaminants to seep into pipes.

One solution is passive chlorination devices, which can be placed in pipes nearer to the point of use, re-treating water. These devices can dose chlorine precisely, such that it has sufficient strength to make water safe to drink without having a detectable taste (Pickering, 2019).

3. Innovation for Agriculture, Climate Change, and Food Security

Governments can take many actions to address climate change, both making citizens more resilient and reducing emissions. Here we focus on the role of innovation, defined broadly to include anything that enables more value to be created with fewer resources.

This includes biological technologies, such as drought- and flood-resistant crops. It also includes other technological innovations such as improved weather forecasting and mobile-phone-based digital agricultural extension systems that can help farmers access timely, customised information about farming techniques that may be needed to adapt to changing rainfall, temperature, and pests.

Finally, it includes social innovators such as payments for ecosystem services, which can both benefit the environment and increase farmers' incomes (Jack et al. 2022), and innovative social protection policies, such as cash transfer programs which respond to weather events that cause crop failure. Another example of a successful social innovation is the graduation approach, which combines cash or asset transfers (often of livestock), with training and other support and has been shown to sustainably increase incomes (Bandiera et al., 2012).

This section describes three promising innovations, improved weather forecasting (3.1), soil health and leaf colour charts (3.2), and digital agricultural extension (3.3).There is evidence that each has substantial benefits, and each has already been deployed at scale. As such, they serve as examples of how investments in social innovations can yield large benefits. However, as we will discuss, in each of these areas, further research and innovation could have substantial benefits.

While each of these innovations is beneficial when delivered alone, an integrated package delivering all of them could have benefits greater than the sum of its parts, in part because, for example, improved weather forecasts could be more precisely customised to farmers' needs if delivered through digital agricultural extension. Moreover, a strong digital agricultural extension would allow improved weather forecasts to reach more people.

Two other examples of how digital agriculture could be combined with other innovations are discussed in section 3.1 (improved weather forecasting), and 3.2 (soil health).

3.1 Improved weather forecasting

Weather unpredictability exposes farmers to risk and compels them to adopt risk-mitigation strategies that can reduce expected income (Cole and Xiong, 2017). Accurate weather forecasts enable farmers to optimise their production decisions, both reducing risks and increasing expected income. In India, for example, smallholders that live in areas with better seasonal forecasts allocate their investments based on predicted rainfall and have higher profits on average. A half standard deviation increase in the monsoon forecast increases planting-stage investments by two-thirds (Rosenzweig and Udry, 2013).

More accurate and more localised forecasts are currently available in many Low - and Middle - Income countries. In many cases, it is useful to have more data against which to check and calibrate the models that can be from ground stations or potentially collected by satellite. Producing high-quality forecasts involves large fixed costs: forecast providers must access, process, analyse, and disseminate vast quantities of data generated by meteorological centres. This process is capital-intensive and requires complex computing systems and skilled staff. Once a forecast is released, the information can spread at near-zero marginal cost. This means that weather forecasts might be highly cost-effective if delivered at scale but difficult to support through user fees.

By international agreement, national governments are responsible for generating weather forecasts, since these production characteristics lead to undersupply by markets. However, weather centres in Low - and Middle - Income countries suffer from underfunding, failing infrastructure, and inadequate expertise (Rogers, 2019). Finally, stronger geographic variation in weather in tropical regions means that, for many farmers in developing countries, more granular weather forecasts are needed.

Taken together, these factors justify public investment in accurate weather forecasts. However, the value of weather forecasts also depends on farmers' ability to access and use them.

As discussed below, digital agriculture systems could enable weather forecasts to be delivered widely to farmers at very low marginal cost. They also allow granular forecasts specific to each region to be sent to the relevant farmers. This is particularly important in tropical regions, where geographic variation in weather is stronger.

3.2 Soil health cards

Nitrogen fertiliser is a major source of greenhouse gas emissions as well as local environmental damage caused by run-off. Fertiliser is an important tool for farmers, but there is widespread overuse of fertiliser, in part because the type and amount of fertiliser needed depends on local soil chemistry. As such, the correct use of fertiliser can both reduce emissions and increase yields (Blaise 2006). Several governments, including the government of India, have thus instituted programs to systematically test local soil quality to allow site-specific recommendations on nutrient management.

In India, recommendations are delivered through "Soil Health Cards" (SHCs), which give fertiliser recommendations based on farmer-conducted soil tests (Cole and Sharma 2017). If farmers follow these recommendations, they can improve yields, reduce expenditure on fertiliser, and create environmental benefits.

Integrating digital agriculture alongside SHCs could make the programs more effective by improving comprehension, trust, and, ultimately adherence to recommendations. Cole and Sharma (2017) found that many farmers struggled to comprehend SHCs. Introducing supplementary audio and video messages explaining the content of the SHC increased comprehension by 39 per cent and 40 per cent, respectively compared to farmers who only received the SHC. Farmers receiving video and audio messages were also 5-7 percentage points more likely to report fully trusting recommendations.

This illustrates how digital approaches can be integrated with physical services to create an integrated package of services, maximising benefits to farmers. Further examples of this could include digital support to help guide farmers as they purchase fertiliser and other inputs (Cole & Sharma 2017).

Leaf colour charts are another promising approach to optimising fertiliser use. Like soil health cards, they can help farmers to avoid fertiliser overuse, decreasing costs, increasing yields, and reducing environmental damage.

Preliminary findings suggest that digital leaf colour charts could be effective, substantially reducing the cost of delivery compared to physical charts. Islam and Beg (2019) find that leaf colour charts reduced use of urea fertiliser by 8 per cent without compromising yield. Tao et al. (2020) find that their accuracy in determining leaf colour levels is between 85-96 per cent, a range comparable to that of chlorophyll meters, a standard measurement tool for leaf colour levels.

3.3 Digital agricultural extension

Digital agricultural extension provides an opportunity to scale the transmission of customised and science-based information to farmers at a low marginal cost. Climate change means that farmers may no longer be able to rely on traditional practices and may need to adapt to new information on weather, rainfall, and temperature conditions. Most small-scale producers have little access to agronomic advice and market information outside traditional extension services. Yet, in many countries, the ratio of farmers to extension agents exceeds 1,000 to 1, severely limiting their reach (Davis et al., 2010).

The widespread adoption of mobile phones presents opportunities to provide millions of farmers with low-cost, customisable agricultural advice (Arouna et al., 2021; Tjernström et al., 2021). A meta-analysis found that providing agricultural information via digital technologies increases the odds of adopting recommended inputs by 22 per cent (Fabregas et al., 2019). This implies a 9:1 cost-benefit ratio.

However, market failures associated with information markets limit the ability of digital services to reach a socially efficient scale through purely commercial financing (Fabregas et al., 2019). Multiple organisations have introduced extension models based on selling subscriptions to individual smallholder farmers, with relatively unsuccessful outcomes.

Because the marginal costs of disseminating information are close to zero, the optimal scale of such systems is very large. However, in part, because farmers can pass on information to each other, it is often difficult for information providers to survive on a subscription model, and other timing-based models may lead providers to compromise the independence and objectivity of the advice they offer farmers. Digital agriculture advisory is unlikely to scale through market mechanisms alone without public support. As governments have provided public support for traditional in-person agricultural extension, there is a strong case for public support for high-quality digital agricultural extension.

Based on this evidence, in 2018 Odisha's Department of Agriculture and Farmer Empowerment (DAFE) partnered with Precision Development (PxD) to set up Ama Krushi, a platform to deliver timely, customised, and free digital advice to smallholder farmers via their mobile phones. Now delivered by Tatwa Technologies, Ama Krushi reaches more than 3 million farmers across Odisha. This program provides a model for other states in India and around the world for the delivery of agricultural advice.

The results from Fabregas et. al (2022) are for relatively simple systems using SMS messages. New technologies could enable even greater benefits, if paired with complementary social innovations. Digital agriculture enables A/B testing, which can refine the design of messages. Evidence suggests that small changes to the timing and wording of messages have substantial effects on the take-up of advice. A/B testing can also be used to evaluate new types of digital agriculture, combining messages with other technologies.

For example, smartphones with GPS systems could also deliver location-specific data, allowing advice to be more localised. They could also enable farmers to give feedback on crop performance. Combining this with machine learning tools could help improve the quality of advice and enable farmer participation in the R&D process.

Smartphones could also facilitate video tutorials to improve the adoption of new techniques and camera-based diagnosis, to better tailor advice to specific circumstances.

4. Institutions for Innovation

Under our current institutions, commercial incentives to invest in innovations to address these risks are inadequate, given the huge social need. However, new social institutions can be created to encourage innovation and shape it to meet human needs.

Of course, programs to invest in innovation will need to be designed efficiently to maximise returns and avoid wasting resources by throwing good money after bad, so it will be important to discipline any investment program. This requires changes to both upfront funding for innovation (known as "push funding") and to how innovations are rewarded ("pull funding").

This section discusses two such institutions, open, tiered, evidence-based social innovation funds (4.1) and Advance Market Commitments (4.2). The former is an example of "push funding" - it gives direct payments to invest in innovation. The latter is an example of "pull funding" - it makes payments conditional on success, aiming to reward successful innovations.

4.1 Open, tiered, evidence-based, social innovation funds

Tiered, evidence-based innovation funds can be used to develop promising innovations. Examples include France's Fund for Innovation in Development and Development Innovation Ventures at USAID[1].

These institutions have a few key characteristics. To cast a wide net and identify the best innovations, social innovation funds are open to different sectors and types of applicants, from researchers, to NGOs, to firms, to governments. They also fund innovations intended to scale commercially or through the public sector.

[1]Which I co-founded and for which I currently serve as Scientific Director.

However, to discipline funding decisions, social innovation funds employ a tiered funding approach, providing small amounts of funding for pilots of promising ideas, but requiring rigorous testing of impact and cost-effectiveness before awarding larger-scale funding.

DIV recently had its ten-year anniversary, and we analysed the impact of its portfolio in the first few years. A conservative estimate suggests that the program yielded social benefits of at least $17 for each $1 invested (Kremer et al., 2021).

4.2 Market shaping

One set of institutions to encourage innovation are market-shaping mechanisms such as Advance Market Commitments (AMCs). Under an AMC, governments commit to pay for a future technology or innovation if it is developed to meet pre-specified technical criteria, and garner market demand. In this way, it can incentivise R&D by many actors and only pay out if it is successful.

AMCs are appropriate in cases where we are able to specify a new technology which is needed and where there is a market failure which means that the social returns to developing the technology are higher than the commercial returns. This approach was used to incentivise the development and production of vaccines against the strains of Pneumococcus common in Low - and Middle - Income countries.

Since the approach was put in place, three pneumococcal vaccines targeting those strains have been developed, have reached hundreds of millions of people, and have saved an estimated 700 thousand lives.
Advance Market Commitments could be used to incentivise R&D to help address the challenges of climate change and food insecurity.

For example, we could conduct an AMC for animal feed that reduced carbon emissions or plants with longer roots that locked up more carbon or drought and flood-resistant seed varieties. As well as incentivising R&D, an AMC would create incentives for rapid adoption, since the developer would be paid based on sales.

Another example of an area where market shaping might be needed is improved seed varieties. These have the potential to substantially increase yields whilst also making crops more resilient to droughts and floods. However, the use of improved seeds is highly uneven across and within regions. Only 35 per cent of the cultivated area in SSA is planted with improved varieties, and adoption is as low as 13 per cent in some African countries (Walker and Alwang, 2015).

This is partly due to R&D gaps. The majority of agricultural R&D takes place in developed countries, as smallholder farmers in heterogeneous poor countries do not present an attractive market for commercial R&D (Suri and Udry, 2022). As a result, crops designed to resist pathogens in developed countries are patented over five times as much as varieties resistant to disease elsewhere. Since the effectiveness of inputs is highly influenced by local agronomic conditions, new technologies are often unsuited to low - and middle - income countries (Moscona and Sastry, 2022; Laajaj et al., 2020).

Market and government failures further constrain the adoption of improved crops. It would be socially efficient to produce improved crops which can be replanted each year. However, commercial incentives to do this may be limited since the creator would only capture a small amount of the value of the innovation. Firms might prefer to produce hybrid seeds which cannot be replanted or lose productivity with each replanting, thereby needing to be repurchased from the company despite this limiting the social value of the innovation, particularly in contexts where there might be significant. Information constraints can limit demand for improved seeds, partly due to inappropriate extension services or concerns around seed quality (Fisher et al. 2015; Simtowe et al., 2019). Policy failures also disrupt the market for inputs. For instance, it can take up to 15 years for seeds to go through the testing and registration process required in parts of Africa (Langyintuo et al., 2010).

Improved crops can have significant effects on productivity and income. High-yielding seed varieties developed and adopted during the Green Revolution increased yields by 44 per cent between 1965 and 2010. As a result, the production of cereals tripled during this period, with only a 30 per cent increase in cultivated land area (Pingali, 2012). Recent trials have found that farmers using locally-adapted seeds in Kenya's mid-altitude zone - an area with traditionally low adoption levels - saw yields increase by 21 to 47 per cent (Bird et al., 2022). In Malawi, the adoption of improved soybean and agronomic practices was associated with a 61 per cent yield gain and 53 per cent higher income (Tufa et al., 2019).

The adoption of resistant varieties can also help farmers be more resilient to shocks. In India, where 30 per cent of the cultivated rice area is prone to crop damage from flooding, tolerant rice can achieve yields 45 per cent higher than traditional varieties during prolonged floods (Dar et al., 2013). In Malawi, the adoption of drought-tolerant maize has been associated with a 44 per cent increase in yields (Katengeza and Holden, 2021). Higher incomes resulting from the introduction of resistant crops may also improve calorie consumption and dietary quality. Using panel data from a farm household survey in four Indian states, Qaim and Kouser (2013) found that the widespread introduction of insect-resistant cotton reduced food insecurity by 15 to 20 per cent among producers.

5. Conclusion

Investments in innovation can have very large social returns and could help us address the challenges of climate change and food security. Encouraging these innovations will require new social institutions, since the commercial returns to investments are often much lower than the social value. The Development Innovation Lab at the University of Chicago, which I lead, has a Memorandum of Understanding with India's Department of Agriculture and Farmers' Welfare to identify, test and scale potential innovations. Based on the Government of India's track record of innovation, including in digital agriculture, this is a highly promising opportunity.

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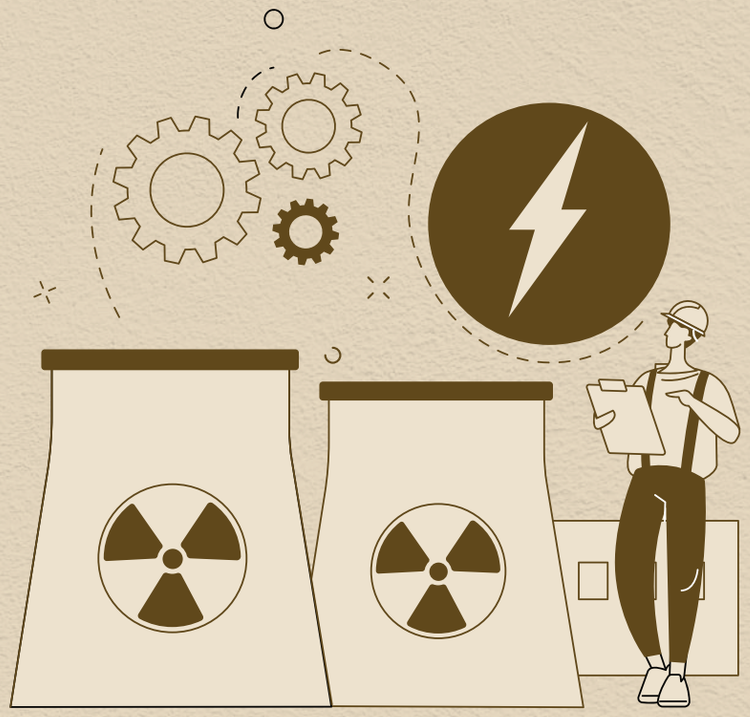

LEVERAGING IDENTITY IN BEHAVIOURAL INTERVENTIONS TO PROMOTE SUSTAINABLE LIFESTYLES IN INDIA: PROMISES, PITFALLS AND RECOMMENDATIONS

Ganga Shreedhar,*
Prartnaraj Kadungoth Sreeraj,*
Samyukta Pradip Kumar and Kate Laffan**

* London School of Economics and Political Science

Abstract

India's LiFE Programme calls for solutions and behavioural insights that can help promote climate action. In line with this goal, in this paper, we consider the potential for identity-based strategies to encourage pro-environmental action. We first outline the relevance of various forms of identity – namely self, social and place-based – for engaging in pro-environmental behaviour and summarise the existing evidence of identity-PEB associations. We go on to present a narrative review of the literature on behavioural interventions which look to leverage these various forms of identity to promote sustainable action. This literature is most developed in terms of providing evidence of the potential of interventions that make salient broad pro-environmental identity, identities attached to specific pro-environmental behaviours like 'water-saver' identity, as well as interventions leveraging on self, social and place identity. We conclude by discussing the gaps and limitations of the current evidence and calling for more research in the Indian context, which can shed further light on the potential for identity-based strategies to encourage climate action.

From the water we consume to the way we travel, to the food we eat, the everyday choices we make have important implications for our shared environment. Sustainable lifestyle change is understood to be central to efforts to mitigate the worst effects of climate change and address many of the other environmental challenges the earth is currently facing.

Behavioural science, which draws on psychology and economics and other social sciences, examines the psychological and situational drivers of human behaviour and identifies interventions which can shape how people act. Behavioural insights are increasingly widely recognised as being of central importance to sustainable lifestyle transitions. India's LiFE Programme seeks to spearhead such transitions and calls for the sharing of innovative solutions and behavioural insights that can help promote climate action.

People's identities, their sense of who they are, can shape what they do (Akerlof & Kranton, 2000; Hogg & Smith, 2007; Tajfel & Turner, 2004). Identities can affect pro-environmental behaviours (PEB) (Udall et al., 2021). Individual or self-identities are based on how people see themselves, including the values, thoughts, feelings and actions that they may prioritise. Self-identity can influence behaviour when people perceive themselves as the kind of person who would adopt a given action. For example, someone with an "environmentalist" self-identity may act pro-environmentally because they see themselves as the typical kind of person that behaves in ways that cares for the environment or minimises polluting actions since they personally value protecting the environment. People may also derive identity from the specific actions they take - for example, they may self-identify as a "recycler", because they see that as the kind of behaviour that is in line with their sense of self.

Apart from self-identities, people also hold social or group identities based on their affiliations with specific social groups. Groups can take the form of voluntary associations such as environmental organisations, and also socially assigned or self-identified social categories such as ethnolinguistic, gender or racial groups. Such groups often share normative expectations of how members should act, which may or may not coincide with how members actually act. An individual's strength of affiliation with a particular social group, and how strongly they buy into such normative expectations, or even how strongly they see such expectations being reflected in the behaviour of their members, influences how likely it is that they will act in line with the group's expectations. For instance, if one strongly self-identifies as a "woman" or "man", this may lead people to adopt actions that they perceive that society expects from their gender (Akerlof and Kranton, 2000).

Finally, people can hold identities based on the place(s) where that person comes from and/or is resident. These place identities operate at small scales, e.g., the neighbourhood level, as well as much larger ones, such as the region or country level. They capture people's sense of attachment to these places and can also be imbibed with behavioural norms (Devine-Wright & Clayton, 2010; Proshansky et al., 1983). For example, people may refer to themselves as city-dwellers, or as members of certain neighbourhoods, or in relation to certain natural landscapes like seas.

Identities can exert a trans-situational impact on people's behaviours since they often reflect internalised norms and values. In other words, when an identity is strongly internalised or integral to a person's sense of self, the values and norms attached to that identity is more likely to influence how they act across contexts. For example, it is more likely that an individual will behave pro-environmentally across different situations and domains – energy, waste, and water conservation – if they hold a strong pro-environmental identity (Whitmarsh & O'Neill, 2010).

Importantly, though, people can hold multiple self- and social identities simultaneously. For example, an individual can identify as a woman, and at the same time an environmentalist. The identity-effects on behaviour can thus depend on which identity – or combination of identities – is most relevant and salient in each behavioural context (Hogg & Smith, 2007; Udall et al., 2020). This can depend on situational factors, such as whether other members of the relevant social group are present. But they can also depend on individual-level factors, such as the strength of a person's identity and related attitudes and values in each domain.

While individual identities are understood to predict and influence behaviour, behavioural science research highlights systematic patterns of misalignment between identities and behaviours. For example, a person may see themselves as an environmentalist and yet engage in carbon-intensive activities like flying on a regular basis. In other words, value-action gaps can emerge (Kollmuss & Agyeman, 2002). Such misalignment can cause cognitive dissonance, a sense of discomfort or mental conflict, which can emerge when one's closely held beliefs do not line up with actions (Festinger, 1957), especially when someone is reminded about such value-action gaps.

Behavioural interventions leveraging people's identities can help make salient people's identities with a view to inducing them to overcome value-action gaps. Indeed, several studies have sought to "activate" relevant identities, by explicitly referring to them in persuasive messaging, labels, and other informational interventions. Activating identities ought to, in theory, result in behaviour change which is in line with what is prescribed and expected by that identity group. This is a nascent field but one which we think warrants attention.

In this paper, we examine the opportunity to leverage identities to encourage pro-environmental behaviour and sustainable lifestyle change in India and more broadly. Past work shows that both self and social or group identity is associated with PEB (Udal et al., 2020; 2021). For example, a recent systematic qualitative review revealed 99 different types of identities studied in a PEB context, mostly based on correlational studies (Udall et al., 2020). A subsequent meta-analysis showed that identity measures were associated with PEB. We build on this work and conduct a narrative review of the existing literature that has linked various types of identities to the key behavioural domains of change identified by Mission LiFE, namely: Water, Transport, Food, Electricity, Waste Management, Sustainability, Recycle and Reuse. Our review covers environmentalist identity but also other social and place identities such as people's gender, age, and nationality, amongst others.

In addition to synthesising the ways in which past work has sought to leverage social identities, we reflect critically on what we do not yet know and the promises and pitfalls of using identity-based interventions in an Indian context. For example, issues include the Western focus of much of the existing evidence as well as the dearth of causal evidence in relation to social, place and other identities, especially how the intersection of multiple identities impacts pro-environmental behaviour. Finally, we discuss the potential for social identities relating to region, religion, caste and other ethnolinguistic and cultural differences, which are of particular importance in India, to be a source of division and tension. We conclude with a call to action for more work which investigates how Indian people's sense of who they are can lead to sustainable action at the individual, household, community and national levels.

Identity and Pro-environmental Behaviour: Exploring the Evidence

Summary of search strategy

To inform this paper, we rely on previous reviews and also independently conduct a narrative review of the existing literature linking identity to pro-environmental behaviour across the consumption domains of interest - Water, Transport, Food, Electricity, Waste Management, Sustainability, Recycle and Reuse. Google Scholar searches, and a snowball approach (including examining references list of relevant papers) are used to identify the relevant peer-reviewed literature. The domains of water and electricity are covered using keywords like 'identity', 'experimental interventions', 'pro-environmental behaviour', 'water', and 'electricity'. Papers on waste management, recycling and reuse are also found with the above-mentioned keywords. Then, to narrow the search to identity-based interventions, the following keywords are used: 'identity-based experimental interventions', 'pro-environment', 'water' and 'electricity'. The domains of food and transport are covered with the following keywords: 'identity-based intervention', 'food consumption', 'sustainable consumption', 'experiment', 'green identity', 'social identity', 'reduction of meat', 'sustainable behaviour', and 'social identity-based intervention'.

We first summarise two relevant review papers which examine the empirical evidence of the association between identity and PEB. We then identify 17 further studies[1] which are deemed to fit the criteria for inclusion in our narrative review (related identity to pro-environmental action related to one or more of the domains of interest to the LiFE programme). Of these, 14 present causal evidence using randomised controlled trials (RCTs) on the impact of leveraging identity in behavioural interventions. This includes 7 field RCTs and 7 online or survey-based RCTs. Three studies present correlational evidence between types of identities and behavioural domains. The studies are based on samples living in Europe (7), North America (5) and Asia (5).

Key findings from previous reviews

Udall et al. (2020) conducted a systematic review of 99 studies on how identity is associated with PEB. They are largely concerned with reviewing psychological identity theories such as identity and social identity theory, and place identity theory. They conceptualise PEB-relevant identities on three levels of identity: individually focused or self-identity – how people label, describe, and recognise themselves; group-focused identity – how people label, describe, and recognise themselves as part of a group; and place-focused identity – how people label, describe, and recognise themselves as part of a place. A wide variety of identities are considered: from the more general to specific self- and social identities (e.g., environmentalists, green consumers, and nationality to being recyclers, pedestrians, or public transport users, respectively). They refer to their overall approach, the universal identity theory approach.

In a follow-up paper involving a meta-analysis of 104 papers, Udall and colleagues (2021) categorised identity into two levels, namely individual or self-identity (which we call self-identity) and group or social identity. They found that the overall association between identity and PEB outcomes, such as intentions and self-reported behaviour, was medium-sized (according to the Pearson's correlation coefficient calculated). They also found that self-identity is more closely associated with overall PEB than are group identities, but that self-identity better explained individual PEBs (e.g., taking out recycling), and group identities better explained group PEBs (those that require being part of a group, like attending a meeting). Additionally, they found that overall identity was associated most strongly with group PEBs in the field rather than in the lab, and in student - rather than non-student - samples. Importantly, only 11 per cent of identity-PEB studies offered causal evidence using experimental designs, precluding any strong claims about causal impact of identity on PEB.

In the following sub-sections, we build on Udall and colleagues' (2020) universal identity framework and discuss cases where individual, social and place identity has been leveraged in behavioural interventions (See Figure 1 for an outline of identities we consider). In terms of the type of identity studied, environmental identity was the most popular – a total of 15 studies examined it. A significantly smaller share of studies looked at social identities (4), place (3) and other identities (3). In terms of the type of domain studied, natural resource use behaviours (especially water and energy; n=10) were most common, followed by food consumption and green buying behaviour (6), and transport (1).

[1] Detailed table of literature reviewed - LiFE project can be accessed at this link: https://docs.google.com/spreadsheets/d/1o44nrRkmFBkmt3JvImst_FIBTdPZMxWUGd6mQty0ORQ/edit?usp=sharing.

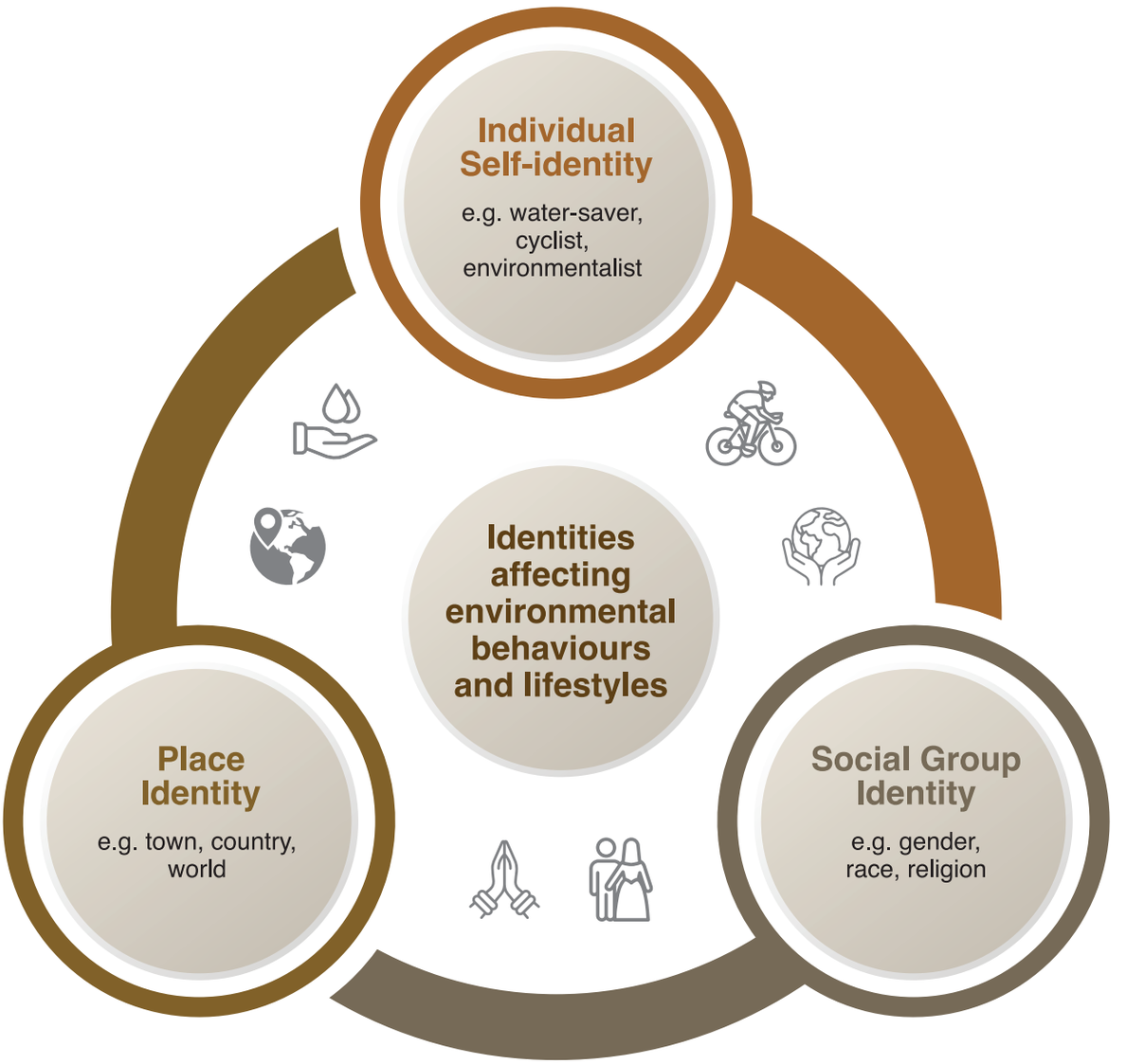

Figure 1: People hold multiple identities that impact pro-environmental behaviour and lifestyles.

Environmental identity

An environmental identity typically refers to the extent to which people indicate that environmentalism, or acting in an environmentally friendly way, is central to who they are (Gatersleben et al., 2014; Whitmarsh and O'Neill, 2010). Several studies have shown that having an environmental identity is positively associated with PEB. For example, Whitmarsh and O'Neill (2010) found that UK residents with a more general 'green' identity more frequently enacted pro-environmental actions across diverse domains. Environmental identity can exert a positive influence on environmental action across diverse contexts (e.g., home and work) and behavioural domains (e.g. water, energy, transport). In terms of more specific PEB self-identities, water-saver identity has been shown to be associated with lower water use amongst UK students living in apartment-style residence halls (n = 303) (Mallett and Melchiori, 2016).

There is emerging evidence that pro-environmental identities, both overarching and more specific, can be effectively leveraged in behavioural interventions. For example, in an online identity labelling intervention study conducted with a sample of 3015 urban Chinese consumers, animal welfare identity labelling ("For animal welfare conscious consumers") and green labelling ("For environmentally-conscious consumers") encouraged self-reported sustainable food choices (Ortega et al., 2022). Relatedly, in a field-based RCT study conducted in the USA by Schwartz et al., (2020) (n=611) environmental green identity labelling of products ("This product is for green shoppers") was shown to impact pro-environmental behaviour and choice. This paper also indicated that the treatment was heterogeneous across groups - individuals with higher incomes and education levels were more likely to choose pro-environmental options when presented with green identity-labelled products (Schwartz et al., 2020). Finally, identity labelling can be used to enhance the perceptions of the value of pro-environmental consumer goods. In a study by Lin & Nayga (2022) (n=3015 US survey respondents), consumers' self-reported willingness to pay for sustainable food options was higher when these products were presented with a combination of green identity labels and environmental impact labels ("This product is for green shoppers" paired with images of USDA organic coffee, fair trade, and carbon trust labels) than with environmental food labels (Images of USDA organic coffee, fair trade, and carbon trust labels) alone.

Social group identity

Apart from personal identity of an environmentalist, it is also possible that there is group identification with a (social) group of environmentalists (Dono et al., 2010) or a movement (Dunlap and McCright, 2008) if an individual considers themselves to belong to a group which engages in PEB. As with environmental self-identities, researchers are increasingly looking to leverage social identities to encourage pro-environmental action (Hu et al., 2020; Lede et al., 2019; Mallett & Melchiori 2016; Costa Pinto et al., 2014). This approach has typically involved linking pro-environmental action to the identity of the target population. For example, Lede et al., (2019) linked water saving behaviour to group identity, specifically ingroup student identity or city/regional identity (the latter are both place identities and discussed below). In doing so, they encourage self-reported and actual reductions in water-saving behaviours such as shower-time (n=4604) in a water-scare region of the UK. Similarly, Mallett & Melchiori (2016) successfully linked water-saver identity to student identity, to encourage reduced water use, but found that it was successful at changing behaviour only for those who successfully internalised a water-saver self-identity. This suggests that identities that are attached to specific behaviour may be more effective than more general ones. Interestingly, Costa Pinto et al., (2014) compared the efficacy of leveraging self- and social identities in 215 German participants, and found that emphasising self-identity (e.g., participants were asked to think about what makes them different from their family and friends) was more effective at encouraging pro-environmental behaviours among women, whereas social identity (e.g. participants were asked to think about what they had in common with family and friends) was more effective for men. This suggests that the effect of making salient individual versus social identity may depend on the social group people belong to.

Indeed, people often belong to multiple social groups and occupy different societal roles, which in turn can interact to influence PEB. For example, Stets and Biga (2003) discuss how social environmental studies have shown that women tend to express higher levels of concern for the environment than men (although the findings are somewhat mixed). One explanation with the most consistent support is that women are typically expected to care more about the health and safety of families and communities, and this caring orientation in turn affects PEB (Akerlof and Kranton, 2000; Stets and Biga, 2003). Importantly, what it means to hold a particular social identity is not fixed, and there can be considerable variations within a group and over time. For example, in western settings, conventional notions of masculinity are associated with meat-eating behaviours and beliefs like "real men eat meat". De Backer et al. (2020) find that new masculinity ideologies critically question such beliefs, and the more men identify with new masculinity, the less they eat meat. Similarly, there have been recent efforts to re-interpreting religious texts to shape economic decision making (Benjamin, Choi, & Fishcher, 2016) and environmental attitudes through activating religious beliefs and identity priming based on financial and environmental values. Shreedhar et al. (in prep) find that activating eco-Islamic values can increase pro-climate attitudes in Kuwait, compared to just providing information on these same policies.

Place identity

Place identity refers to people's bonds with places and physical environments, and how these bonds are an important component of a person's sense of self (Devine-Wright and Clayton, 2010). Place identity has been shown to be positively associated with willingness to undertake conservation behaviours. For example, in examining the predictors of uptake in a curbside recycling programme in the UK, Nigbur et al., (2010) found that neighbourhood identification interacted with perceptions of injunctive social norms (what the persons thought others thought of engaging in the programme) and fed into people's own personal norms around the behaviour and self-reported willingness to engage in it (n=531). Rare Pride

campaigns, that link pride of place with the conservation of local wildlife and biodiversity, have been widely used to improve conservation outcomes, for example, the efforts to protect the St Lucia parrot in the Caribbean (Jenks et al., 2010).

Some limited research also indicates that activating place identities such as community, neighbourhood and local city identity and communicating the practices and behaviours of people from these places can promote pro-environmental behaviour. As previously discussed, in Lede et al. (2019), appealing to city- and county-level identities alongside non-monetary incentives such as magnets and banners given to participants had a place identity label ("Norwich Saves Water") helped increase water saving behaviours and intentions. Other work has also examined how place identity may moderate the effectiveness of other behavioural interventions. For example, Laffan (in prep) found that people reported a higher willingness to pay for green energy sources that were advertised as being generated in their region or country, compared to abroad and that this was particularly the case for those reporting high levels of place attachment. Taken together, these studies suggest that place identity can both predict and be leveraged as intervention to encourage PEB.

Table: Summary of studies

Identity category	Target domain and behaviour	Promises and pitfalls
Individual or self-identity	• General: Pro-environmental identity, green identity, animal lover, health • Specific: Recycler, energy saver, water saver, cyclist, vegetarian/vegan	Promises: Strong positive associations with self-reported intentions and behaviours, and in some cases causal behavioural impacts *(e.g., on pro-environmental choices)* Pitfall: The majority of studies were conducted in a WEIRD context. *(e.g. Whitmarsh and O'Neill, 2010)*
Social or group identity	• Voluntary: Organisational, movement-based, hobby or activity-based, student identity, university identity, collective identity • Assigned or self-identified: Gender, race, religion	Promises: Linking pro-environmental behaviour to ingroup social identity can significantly lead to pro-environmental behaviour. Pitfall: The above phenomenon happens mostly among males when the pro-environmental self-identity (water saver self-identity) is internalised and when the ingroup student identity is leveraged rather than dissociative outgroup identity. *(e.g. Hu et al., 2020; Mallett & Melchiori, 2016; Lede et al., 2019; Costa Pinto et al., 2014)*
Place identity	• Local: Neighbourhood, city, community, country • Global: World citizen, human	Promise: Leveraging place identity can result in pro-environmental behaviours. Pitfall: The above phenomenon can only be leveraged when used in conjunction with pro-environmental identities and specific descriptive and injunctive norms are communicated. *(e.g. Nigbur et al., 2010; Lede et al., 2019;Matthies et al., 2011),*

Notes: The reviewed research articles were discovered through a technique that involved searching for specific keywords related to pro-environmental behaviour in consumption areas including Water, Transport, Food, Electricity, Waste Management, Sustainability, Recycle, and Reuse. To identify appropriate peer-reviewed literature, both Google Scholar searches and a snowball approach were utilised. Studies that focused on interventions targeting identity were given priority.

Promises, pitfalls, and recommendations

Overall, the review of the literature in this article suggests that people's identities can exert important influences on PEB. People's identities may be broadly categorised as self, social and place identities. The first focuses on how people see themselves as individuals (based on personal values and norms). The latter two capture how people see themselves as members of a social group or associated with a physical place. These identities affect PEB, in so far as they place certain expectations on valued and expected appropriate types of behaviour. While strongly internalised identities can predict behaviour across contexts, identities can also influence behaviour when made salient in behavioural interventions (e.g., via identity labels), or by naturally occurring cues in the environment (e.g., by priming).

The main findings from the literature are as follows. In terms of self-identity, environmental identities (e.g., "environmentalist" or "green" identity) are positively associated with several types of sustainable lifestyle behaviours. Specific behavioural identities, e.g., "water-saver" or "recycler" are also predictive of related actions in these domains. Additionally, labelling-type interventions can leverage pro-environmental identity to encourage sustainable lifestyles and specific pro-environmental behaviours. Social identities can also be drawn upon to encourage sustainable lifestyles. One way in which this can be done is by making salient the links between a given social group identity and patterns of positive pro-environmental behaviour within that group. The limited evidence that exists in this space suggests that this strategy may be more effective than the alternative one of highlighting the negative behaviours of outgroups. Finally, place identity also plays a role in predicting and encouraging pro-environmental action. Evidence suggests it has a moderating effect on both the pro-environmental norms within a place and on the impact of pro-environmental interventions that leverage place.

While these findings are promising, there are several limitations that apply to the state of the current evidence on, and opportunities to, leverage identity to promote sustainable lifestyles in an Indian context. There are also several pitfalls, which behavioural scientists must try to avoid, when leveraging identity in behavioural interventions.

First, much of the evidence comes from Western Industrialised Educated Rich and Democratic (WEIRD) contexts that are distinct from India in several ways, including in terms of populations and physical settings (Lede et al., 2019; Mallett & Melchiori, 2016; Costa Pinto et al., 2014 Gatersleben et al., 2014; Whitmarsh & O'Neill, 2010). This bias is a major barrier to understanding the effects of identity on PEB in India, as the behavioural practices prescribed by personal and group identities are culturally and situationally contingent. It is therefore unclear how these findings generalise to the Indian context, or indeed, the diverse sub-groups within India. For example, the purchase of consumer goods, food and water lifestyle practices vary widely across different states, castes, regions, and ethnolinguistic groups. Even within a particular group, there is significant variation in how individuals in these groups interpret and practice norms. Research needs to first be undertaken to understand what environmentalism, and environmental identities, mean across various populations in the Indian context. This can include both understanding of how people understand what it means to act pro-environmentally, but also perceived attributes of a prototypical environmentalist.

There can be unique forms of behaviours and economies in India which the current research does not speak to but may be useful to leverage – for example, instead of "recycler" identity, which is very much rooted in WEIRD recycling infrastructure and practices, localised and culturally relevant forms of waste disposal behaviours, such as re-selling to waste and scrap dealers or "kabadiwallahs" may be more appropriate. Conversely, it is also important to study what are anti-environmental behaviours, and the attributes of someone who is opposed to acting pro-environmentally in the Indian context. This can be undertaken via both qualitative and well as quantitative research methods.

Second, it is largely unclear from the existing literature how messaging framed around other self-identities, like health and financial identities, might work relative to and or in conjunction with environmental and social identity interventions. Indeed, given the manifold identities studied in the literature – and which exist in reality – it can be challenging to know which of these singular or plural identities matter in each context. On the one hand, leveraging multiple congruent identities and values may be more effective: for example, emerging evidence shows that using health and environmental benefits, or financial benefits framing can increase support for eco-friendly food choices and food saving intentions (Prelez et al., 2023; Shreedhar & Galizzi, 2021). On the other, there can be a potential conflict of values and attitudes within a person. If conflicting identities are triggered at the same time – for example, environmental and work identities – it is unclear whether and under what conditions the pro-environmental identity will 'win out'.

Furthermore, making some identities salient may backfire even if there is a perceptible link between the identity and a pro-environmental behaviour. For example, Sachdeva (2017) studied how sacred values – moral principles reflecting values or beliefs from a strongly internalised identity – can backfire: when respondents undertook sacred Hindu rituals such as acts

of prayer in the Ganga river (which is often worshipped as a symbol of purity), they perceived that water pollution risk was lower than when sacred values were activated. Similarly, several studies have found that the intersection of religious, racial and political identification in a given context matters; in the USA for example, White evangelical Protestants are the most sceptical major religious group regarding climate change (Veldman et al., 2021). Future work should be very careful in activating social identities due to potential unintended negative effects which may undermine the very goals of the intervention itself. Some issues and policies, such as water pricing or regulating diets for examine, can be highly visceral and politically charged. Activating identity may not even have the desired effects (Shreedhar et al 2023) on personally costly behaviours. Future work should look to carefully explore this in an Indian context and more broadly.

Third, a substantial amount of the existing literature relies on self-reported attitudes and intentions. The existing evidence suggests that identities and self-reported behaviours may be more strongly associated than actual PEBs, especially in the context of social identity and group-based behaviours (i.e., when behaviours are taken up as a part of a group) (Udall et al., 2021). However, whether individual or group identities predict actual behaviour – rather than self-reported actions, attitudes or intentions – depends on the context, including whether it can be made salient, the presence of other people in that context and whether those people belong to that person's in- or out-group, and whether there are any other structural barriers to performing the target PEB. Future work should focus on prioritising the measurement of revealed behaviours, especially in field settings. It should also collect and triangulate both self-reported and revealed data, from both survey and administrative sources. This can be done through several methods including self-assessment questions and incentivised tasks in surveys and diaries, direct observation, and administrative data (e.g., product choice, energy and water use from bills).

Fourth, when leveraging social identities, behavioural scientists and policymakers must carefully consider implications for social cohesion, discrimination, and polarisation. Social identities are essentially about group membership. Identity salience can lead to forms of disunity and prejudice (i.e., a distaste for outgroup practices), discrimination (i.e., favouring members of the ingroup over the outgroup) (Akerlof & Kranton, 2000), polarisation (i.e., divergent views about appropriate types of behaviour between groups, which can deepen over time) (Cole et al., 2023) and in some cases even dehumanisation (i.e., perceiving members of the outgroup as less than human and unworthy of humane treatment) (Albarello & Rubini, 2012). Strengthening divisive group identities for pro-environmental purposes may come at a social cost both in the short-run and long-run, at both the individual and societal levels. To mitigate these risks, it may be useful to use very specific identities that are focused on high-impact actions (e.g., "water saver", "energy saver"), more "neutral" settings (e.g. local neighbourhoods), rather than overarching social groups that can be polarising (e.g. based on religion, caste or region). That said, if there is a high perceived congruence between the behaviour and group itself, this strategy may be insufficient. In these cases, it is best to avoid identity messaging, focus on collectively shared benefits and adverse impacts (e.g., from climate change) and build social relations that emphasise non-divisive commonalities and collectives to address this (e.g. "we" are in this together).

Finally, there is an active debate about whether individual-focused interventions (of which identity-based ones are a subset) might distract from the systemic changes required to bring about sustainable transitions (Chater & Loewenstein, 2022). While in some cases, identity effects may be comparable to interventions that change the physical set-up (e.g. in Mallett & Melchiori, 2016), in many cases, it is likely that the biggest barriers to motivation and behaviour change do not come from individual motivation or willpower. It can instead come from "brown sludge" via the lack of feasible alternatives (e.g., I may want to take the bus to work but it is too crowded and there is no alternative public transport like a metro) and lack of infrastructure (e.g., even if I get an electric car, the electricity grid is powered by fossil fuels) (Shreedhar, Moran and Mills, in prep). There is also a growing debate about carbon-lock in, i.e., infrastructures, technologies, institutions, and behavioural norms which together act to constrain the rate and magnitude of carbon emissions reductions. The inertia of carbon emissions, and difficulty in rapidly changing behaviours cannot be altered by informational nudges alone. It is our contention that identity-based interventions, which largely rely on informational or priming approaches, have the potential to rapidly encourage sustainable lifestyle change only if the systems around people concurrently make that change feasible, affordable and desirable.

Conclusion

The findings from this narrative review suggest that people's sense of who they are based on the values they hold and the groups and places they belong to can both help predict whether they act pro-environmentally and be leveraged to encourage them to do so. Many questions remain around the opportunities to better understand and promote sustainable lifestyles using identity in India and more broadly. We invite you to join us in our efforts to answer them.

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“LiFE borrows from the past, operates in the present and focuses on the future.”

Shri Narendra Modi
Prime Minister

CLIMATE-FRIENDLY DEFAULT RULES

Cass Sunstein and Lucia Reisch***

*Robert Walmsley University Professor, Harvard University and Harvard Law School

**El-Erian Institute for Behavioural Economics and Policy, Cambridge Judge Business School

Beyond Mandates and Incentives

Increasingly, both citizens and policymakers are placing high hopes on demand-side policies, both behavioural and conventional, to help mitigate climate change (Creutzig et al., 2018, 2020). Greenhouse gas emissions are driven, in large part, by individual behaviour, produced by some mixture of perceived benefits, perceived costs, and perceived social norms (Ross et al., 2016). Changes in such behaviour, produced by new norms and different kinds of choice architecture, could produce substantial emissions reductions. To be sure, those changes are most unlikely to do everything that must be done. But if a tonne of carbon emissions is valued at an appropriate level—say, around $35, as the United States now believes or around €30, as Germany is now discussing—then even seemingly modest steps could easily produce monetised benefits in the hundreds of millions, or even billions, of dollars (or euros). And if any nation is adopting some kind of "Clean Power Plan," designed to reduce greenhouse gas emissions, a serious question remains: How will such a plan achieve its goals? At least part of the answer lies in uses of behavioural science, including behavioural economics—our main topic here.

For orientation, suppose that in a relevant community, there are two sources of energy, denominated "green" and "grey." Suppose that, consistent with its name, "green" is better than "grey" on climate change grounds. Those who use green energy emit lower levels of greenhouse gases and of conventional pollutants. Suppose that those who use grey energy save money. Which will consumers choose?

The obvious response is that the answer will depend on the magnitude of the relevant differences. Suppose that green energy is far better than grey in terms of climate change and that grey energy costs only very slightly less. If so, consumers will be more likely to choose green energy than if it is only slightly better on environmental grounds and if it costs far more. Individual preferences certainly matter. Across a reasonable range of imaginable differences in magnitudes, we would expect to see a great deal of heterogeneity across people, nations, and cultures. Some people do not much care about greenhouse gas emissions, and the monetary figures will drive their choices. For other people, reducing such emissions is important, and such people may be willing to pay a great deal to make the environmentally preferred choice. On standard assumptions, people's decisions will depend on the relationship between economic incentives and underlying preferences.

The standard assumptions are not exactly wrong, but as behavioural economists have shown, they disregard important variables that do not involve strictly economic incentives (Shafir, 2013). Some kind of choice architecture lies behind people's decisions, and that architecture may have a large effect on what people choose (Thaler & Sunstein, 2008). One question involves prevailing social norms (Allcott, 2011; Allcott & Rogers, 2014). What choices are other people making, and why? If choosers know that most other choosers are selecting green energy, there will be an increase in the likelihood that they will themselves choose green energy (Allcott, 2011: 1082). If, by contrast, environmentalists lament the fact that few people are choosing green energy, the result might well be to aggravate the very problem that environmentalists are seeking to solve, by drawing attention to, and thus reinforcing, a social norm that they hope to change (Cialdini, Demaine, Sagarin, Barrett, Rhoads, & Winter, 2006). And if there is a widespread belief that reasonable and good people select climate-friendly products, that norm will exert pressure in favour of green energy (Cialdini et al., 2006: 12). Social norms may well lead behaviour in a green or grey direction even in the face of significant economic incentives.[1]

Another question involves *expressive considerations.* Some consumers select green energy not because of a careful calculation that the environmental benefits justify the private costs, but because of a desire to express certain values (Posner, 2004) or to act in accordance with their idealised self-perception (Reisch, 2003). Many of those who purchase climate-friendly vehicles seem to be responding largely to expressive considerations. They want to "make a statement." They may want to do so because of the conception of their identity[2] or because they want their statement to be seen in public (Griskevicius, Tybur, & Van den Bergh, 2010). Expressive considerations can of course point in different directions in accordance with prevailing norms. In some communities, purchase of green energy (and green products in general) is strongly favoured on expressive grounds; in other communities, it is not favoured or is even disfavoured.[3]

[1]It is possible, of course, that an emphasis on social norms will trigger adverse reactions and potentially resistance, perhaps especially among younger people. See the discussion of "deviant subcommunities" in Kagan and Skolnick (1993).

[2]For relevant discussion, but not focused on environmental protection in particular, see Akerlof and Kranton (2010).

[3]On the diversity of social meanings, and their changes over time, see Lessig (1995).

While expressive considerations may involve people's self-understandings, they may also involve *signalling* (Griskevicius et al., 2010; Sexton & Sexton, 2011). Consumers may wish to signal their preferences to others and that desire may influence their choices, as in cases of *conspicuous conservation* (Sexton & Sexton, 2011). Socially visible products, such as electric sports cars, are naturally more useful for status display than switching to green electricity, installing a high-efficiency heat pump in the basement, or opting for car sharing. "Buying green" is often done for status reasons, while "behaving green" is usually less visible and status-laden (Starr, 2009). As we shall see, expressive considerations may also interact with law and policy. In particular, the law may affect the nature and even the sign of the signal.

People may also make a rapid, automatic judgment in favour of or against green energy, and that automatic judgment may motivate their behaviour whatever the nature of a careful calculation of its own consequences (Kahnemann, 2011). Denominating a product as a climate-friendly choice may be sufficient to create a kind of brand that sparks a "warm glow" for brand aficionados (Hartmann & Apaolaza Ibáñe, 2006). That form of green branding and the associated emotional benefits may well have a large effect on intuitive judgments. In fact, the power of green branding is such that it has been found to lead to a significant increase in the purchase of candy bars with green labels, especially among health-conscious purchases, even when those candy bars are not healthier in any way (Schuldt, 2013). Of course, social norms are likely to play a large part in producing such judgments.

Our principal topic here is the role of *climate-friendly default rules.* Defaults are settings that apply, or outcomes that stick when individuals do not take active steps to change them (Brown & Krishna, 2004; Johnson & Goldstein, 2013). Default rules establish what happens if people do nothing at all. In the example with which we began, people are asked to make an active choice between green and grey energy. But it is easy to imagine a different approach, one in which choice architects set a default rule in one direction or another while allowing people to depart from it. In short, social outcomes might be automatically green.

Apart from creating a default rule, choice architects may or may not seek to influence people's choices. In fact, there is a continuum of possible approaches, whose poles are active choosing (with neutral presentation) and firm mandates (with no ability to opt out), and whose multiple intermediate points include the following:

1. Active choosing accompanied by self-conscious framing or related influences (meant to encourage either climate-friendly or grey choices)
2. A climate-friendly default with costly opt-out
3. A climate-friendly default with costless opt-out
4. A grey default with costless opt-out
5. A grey default with costly opt-out

Our goal is to explore the uses of climate-friendly default rules. A great deal remains to be learnt; on the empirical side, new studies continue to be highly informative. For instance, we have recently found that in Germany, green defaults, i.e., automatically enrolling customers in cleaner energy sources, tend to stick, especially but not only among those who are concerned about the problem of climate change (Kaiser, Bernauer, Sunstein, & Reisch, 2019). On the basis of existing evidence, it is reasonable to think that climate-friendly defaults may well have major effects on environmental outcomes—in some contexts comparable to the effects of mandates and bans, and potentially far larger than the effects of information, education, moral exhortation, and even significant economic incentives (Chetty & Friedman, 2014; Nisa, Bélanger, Schumpe, & Faller, 2019). If the goal is to reduce greenhouse gas emissions and to save money in the process, default rules are an important tool in the regulatory repertoire, and they may be able to achieve a great deal more than other tools, including those that would cost taxpayers a great deal of money.

Especially in a period in which the standard tools—mandates, bans, and economic incentives—sometimes face serious economic and political obstacles, and because it is unclear that consumer information is effective in changing household action towards more sustainable choices (e.g., Nisa et al., 2019), climate-friendly default rules deserve careful attention. Such default rules might play a supplementary role in any nation's effort to reduce greenhouse gas emissions, or indeed by any such effort by private institutions or even households. It is true, of course, that public officials must have the legal authority to promote (or require) climate-friendly default rules and such officials may lack that authority. Without engaging the legal issues, which vary across states and nations, we urge that private providers should give serious consideration to climate-friendly defaults and that officials should do so as well to the extent that they are authorised to do so.

One of the primary advantages of climate-friendly defaults is that they can have beneficial effects while maintaining freedom of choice and hence respect for heterogeneity. Suppose, for example, a relevant population contains a number of people who are facing serious economic difficulty. If so, and if green energy is more expensive than the alternative, it may well be important to allow consumers to opt-out (at least if energy subsidies are unavailable). But a series of complexities arise by default rules are typically selected because they benefit choosers, not third parties; in the environmental context, externalities are frequently involved. This point suggests that the choice of default rules should turn on an assessment not only of consumer welfare but also of a set of other costs and benefits. If, for example, a green default would have modest costs for consumers, but produce significant social benefits from emissions reduction, it would (by hypothesis) be justified on cost-benefit grounds (Sunstein, 2018).

It follows that our own criteria are welfarist: We suggest that default rules should be evaluated by asking about their consequences, that social welfare is what matters, and that cost-benefit analysis is a useful (because administrable) method for testing whether one or another approach would increase social welfare. We acknowledge that this approach can be contested and also that it leaves gaps; we also acknowledge the existence of questions about public acceptability (Reisch & Sunstein, 2016; Sunstein & Reisch, 2019).

The largest point is that default rules with environmental consequences are pervasive, and they might be green, grey, or somewhere between. When existing defaults are relatively grey, it is not because nature so decreed, but because of emphatic human choices, and these might be otherwise. If public and private institutions seek to make progress on the climate change problem, they might well be able to do so by becoming far more self-conscious about the selection of the appropriate defaults. One of our principal points is that default rules of multiple kinds are already in place, alongside other forms of choice architecture, and they have large effects on outcomes, both economic and environmental, even if they have not been subject to careful scrutiny.[4]

The remainder of this chapter is organised as follows. In the following, we first offer a few examples of climate-friendly defaults, designed to establish their generality, their potential, and their impact. The next part explores why default rules matter, with an emphasis on the power of suggestion, the role of inertia, and loss aversion. We then examine non-sticky defaults and show that in some cases, people will reject climate-friendly defaults. The paper then explores whether choice architects should select a climate-friendly default, first on the admittedly artificial assumption that consumers' interests are the only issue at stake, and second by introducing externalities. Building on the foregoing discussion, we conclude with a general framework, welfarist in character, for choice architects to consider in selecting among the various options.

Climate-friendly Defaults: Examples

Daily life is increasingly accompanied by the equivalent of climate-friendly defaults. Consider motion detectors that turn out the lights when people do not appear to be in the relevant room. In this way, motion detectors create the equivalent of an "off" default. Or consider appliance and computer settings that turn the relevant equipment off when it is not in use. If the default setting on office thermometers is turned down in winter, and up in summer, we should expect significant economic and environmental savings, at least if the default setting is not so uncomfortable that people will take steps to change it (Brown, Johnstone, Haščič, Vong, & Barascrud, 2013). Both policy and technology are making climate-friendly defaults of this kind readily available.[5]

Green energy

We began with a choice between utility suppliers. It is far too simple, of course, to suggest that the available possibilities fall in two dichotomous categories of "green" and "grey." There are multiple options, and the environmental and economic consequences of diverse sources of energy require careful investigation; disputes are easy to find (see, e.g., Boyle, 2012; Everett, Boyle, Peake, & Ramage, 2012). For present purposes, it is sufficient to stipulate that from the standpoint of reducing greenhouse gas emissions as well as final disposal risks of nuclear waste, some renewable sources are far preferable to others, and consumers might want to consider that point when choosing energy, especially if they can save (or do not lose) money at the same time.

[4]Note that choice architecture may result from deliberate design or instead from invisible-hand mechanisms; there may be no architect (Ullmann-Margalit, 1978).

[5]For the available palette of default policies, see Johnson et al. (2012) as well as Jachimowicz, Duncan, Weber, and Johnson (2019).

Many jurisdictions do offer some kind of choice. In some nations (including the United States and Germany), people are generally defaulted into a particular source, with the option to opt-out. Typically, the default is relatively grey (perhaps because some of the green options continue to be expensive, or perhaps because most national energy authorities have promoted and subsidised grey energy for decades). To use green energy, people have to seek out relevant information and choose it affirmatively.[6] The deterrent effects of that requirement are large, even in circumstances in which people would give serious consideration to climate-friendlier options if presented with the choice unaccompanied by a default. What would be the effects of switching to a green default?

The question has been examined through randomised controlled trials, natural, and laboratory experiments (e.g., Ebeling & Lotz, 2015; Hedlin & Sunstein, 2015; Kaiser et al., 2020; Pichert & Katsikopoulos, 2008). While lab experiments should be taken with many grains of salt, because they may not predict actual behaviour (Loewenstein, Sunstein, & Goldman, 2015), overall, the results of these studies testify to the extraordinary power of green defaults.[7]

It is important to note that existing energy defaults may persist even if they do not reflect the preferences of the consumers (Ghesla, 2917; Kaenzig, Heinzle, & Wüstenhagen, 2013), which attests to the power of defaults. But do citizens approve of them? We asked for citizens' views on green energy defaults in 17 countries worldwide (Sunstein & Reisch, 2019). Our questions were admittedly stylised; we did not probe how citizens would react if green energy costs significantly more. Nonetheless, the responses do suggest a high degree of receptivity to automatic enrollment—irrespective of whether these defaults are encouraged or required by the government.

Energy efficiency

Many consumers use products that are significantly less energy-efficient than available alternatives (Frederiks, Stenner, & Hobman, 2015). For purposes of reducing greenhouse gas emissions, a central question is whether and when they will switch to products that are more efficient and less expensive (at least in the long run). And in some cases, people do have energy-efficient products, and it is possible that they will switch to less energy-efficient products that are less expensive (at least in the short run). Independent of the expense of the switch itself, does the default matter?

A series of experiments attempted to answer this question (Dinner, Johnson, Goldstein, & Liu, 2011). People were asked to choose between two kinds of light bulbs. One is the efficient but costly Compact Fluorescent Light Bulb (CFLB); the other is the inefficient but inexpensive Incandescent Light Bulb (ILB). The choice between the two greatly matters. If every home in the United States changed merely one ILB to a CFLB, the result would be to save over $600 million in annual energy costs, to eliminate greenhouse gas emissions equal to those of more than 800,000 cars, and to save energy that would light over three million homes annually.

In the relevant studies, subjects were told that they were undergoing a significant amount of remodelling of their home and that the contractor had outfitted the light fixtures with either the ILB or the CFLB. Subjects were asked whether they wanted to switch, at no cost, to the alternative. They were also given a great deal of information about the costs and benefits of the two options. For example, the CFLB would cost $11 in electricity per 10,000 hours, whereas the ILB would cost $49 per 10,000 hours. The CFLB would cost $3 per bulb whereas the ICB would cost $0.50 per bulb (Dinner et al., 2011).

The central finding is that the default greatly mattered. When energy-inefficient ICBs were the default, they were chosen nearly 44 per cent of the time. When the CFLB was the default, the ICB was chosen only 20.2 per cent of the time (Dinner et al., 2011). The disparity is especially noteworthy in view of the fact that, in the relevant experiments, people were not in the standard real-world situation of having to overcome inertia and make a change. They were asked, more simply, whether they would do so, and in the sense, they were forced to choose. If they had the option of postponing the decision and simply sticking with the status quo, the disparity would undoubtedly be larger.

[6]For one example, see http://www.massenergy.org/renewable-energy/FAQ (last visited 20 November 2019).
[7]For a critical evaluation of (the effectiveness of) "green nudges" in a broad sense see Andor and Fels (2018) and Schubert (2017).

Smart grids

Smart grid technology is of considerable interest in many nations. Such technology has the potential to provide a better balance of the supply and demand of electricity and to make the grid more flexible, efficient, and reliable. In particular, smart meters have increasingly been seen, by the public and private sectors alike, to be useful tools to develop smart energy use patterns through the provision of immediate feedback (Fox-Penner, 2014). However, consumers have been reluctant to accept this new technology, partly due to privacy concerns, and partly due to perceived risks of reduced comfort.

If the goal is to get close to the target, what might be done? An experimental study based on a nationwide panel in Denmark shows that the implied default greatly affects consumer behaviour. More specifically, the acceptance rate to install a smart meter is significantly higher if offered as an "opt-out" frame ("No, I would not like to have a smart meter with remote control installed in my home") than as an opt-in frame (Ölander & Thøgersen, 2014). The study confirms that the framing of the question, and the implied default, have a substantial impact on the share of a population that accepts Smart Grid installation; with this finding in mind, the authors urge "that campaigners, therefore, should choose a framing only after careful consideration" (Ölander & Thøgersen, 2014: 151).

Why default rules matter

Why do climate-friendly defaults have such a large effect on outcomes (see, e.g., Gale, Iwry, & Walters, 2009; Dinner et al., 2011)? There appear to be at least three principal contributing factors; each of them has distinctive characteristics in the context of greenhouse gas emissions (e.g., Brown, Farrell, & Weisbenner, 2011; Jachimowicz et al., 2019; Johnson & Goldstein, 2013).

Suggestion and endorsement

The first factor involves an implicit suggestion or endorsement on the part of those who have devised the default rule (McKenzie, Liersch, & Finkelstein, 2006; Madrian & Shea, 2001).[8] Suppose that choice architects, whether private or public, have explicitly chosen a climate-friendly default. If so, choosers may believe that they have been given an implicit recommendation (perhaps from a private institution, perhaps from public officials), and that they should not reject it unless they have reliable private information that would justify a change. If the default choice is green energy, it is tempting to think that experts, or sensible people, believe that this is the right course of action. Those who are deciding whether to opt out might trust the choice architects well enough to follow their lead.

Many people appear to think that the default was chosen by someone sensible and for a good reason. Especially if they lack experience or expertise and/or if the product is highly complex and rarely purchased, they might simply defer to what has been chosen for them.[9] The point suggests that default rules are less likely to have an effect when people consider themselves to be experienced or experts, and indeed, there are findings to this effect among environmental economists, who reject selected defaults (Löfgren, Martinsson, Hennlock & Sterner, 2012).

Outside of the climate change context, there is strong evidence that a lack of information on the part of choosers, including a lack of information about alternatives, helps to account for the power of defaults. In one study (involving savings behaviour), over half of those who stuck with the default specifically mentioned an absence of private information as one of their reasons for doing so (Brown et al., 2011). An implication of this explanation is that if choosers do not trust the choice architect, in general or in a particular instance, they will be far more likely to opt-out. And indeed, there is evidence for this proposition as well (Tannenbaum & Ditto, 2012). If choice architects select a climate-friendly default for reasons that are perceived as self-serving, elitist, preachy, or foolish, we would expect to see an increase in the rate of opt-out. Climate-friendly defaults are more likely to stick if choosers trust those who have selected them, or at least perceive no reason to distrust them.

[8]Of course, it is not true that all defaults are chosen because they produce the best outcomes for people.

[9]People might also have experienced for themselves the positive outcomes of controversial regulatory decisions that they might not have endorsed ex ante. Examples include smoking bans for bars and restaurants that have been imposed in the US and in Europe in the 2000s—in the face of industry opposition. Yet polls today show a high ex post agreement with these bans.

Inertia

The second explanation involves inertia and procrastination (sometimes described as “effort” or an “effort tax”; see Johnson & Goldstein, 2013). To change the default rule to either green or grey, people must make an active choice to reject that rule. They must focus on the relevant question, which is whether and/or how they should trade off environmental, economic, and perhaps other goods. Especially but not only if the question is difficult or technical, and if the tradeoff is complex or morally charged, it may be tempting to defer the decision or not to make it at all. In view of the power of inertia and the tendency to procrastinate, people may simply continue with the status quo and avoid choosing (Iyenga, Huberman, & Jiang, 2004).

In many cases involving climate change, the decision whether to select green energy involves some thinking, some risk, and a potentially complex (and morally charged) assessment of economic and environmental considerations. The choice of an electricity provider is not exactly intuitive; it may well be cognitively demanding. The default rule might stick simply because people do not want to engage in that thinking, take that risk, or make that tradeoff. Studies of brain activity find that when decisions are complex and difficult, people are more likely to stick with the default (Fleming, Thomas, & Dolan, 2010). Even if people in some sense want to investigate the issue and possibly make a change, they might decide that they will do so tomorrow – and tomorrow never comes.

Consider in this regard the finding that a default thermostat setting has a significant effect on OECD employees (Brown et al., 2013). A 1C degree decrease in the default caused a significant reduction in the average chosen setting, apparently because most employees did not much care about the new default and hence did not take the time to change it. Small as it was, the cost of that effort did not justify the bother. This interpretation is supported by the remarkable finding that when the default setting was reduced by 2C degrees, the reduction in the average chosen setting was actually smaller, apparently because sufficient numbers of employees thought that it was too cold and returned the setting to the one that they preferred (Brown et al., 2013).

In this case, the reason for the effect was probably inertia, not a suggestion. The 1C degree decrease was a bit colder than the preferences of OECD employees, but not enough to justify a change. But with a 2C degree decrease, the underlying preference manifested itself in the restoration of the original status quo. The general lesson, to which we will return, is that in the face of strong preferences, the default is less likely to stick, which gives choice architects greater room to manoeuvre when they make small changes rather than large ones.

Reference point and loss aversion

A third and especially interesting explanation stresses the fact that the default rule establishes the *reference point* for people’s decisions. Recall in this regard the behavioural finding of loss aversion. People dislike losses far more than they like corresponding gains (McGraw, Larsen, Kahneman, & Schkade, 2010) and whether a loss or a gain is involved does not come from nature or from the sky. The default rule determines what counts as a loss and what counts as a gain.

To appreciate the power of loss aversion and its relationship to default rules, consider an illuminating study of teacher incentives (Fryer, Levitt, List, & Sadoff, 2012). Many people have been interested in encouraging teachers to do better to improve their students’ achievements. The results of providing economic incentives are decidedly mixed; many of these efforts have failed (Fryer et al., 2012). But the relevant study enlists loss aversion by resetting the default. The authors gave teachers money in advance and told them that if students did not show real improvements, the teachers would have to give the money back. The result was a significant increase in math scores—indeed, an increase equivalent to a substantial improvement in teacher quality. The underlying idea here is that losses from the status quo are especially unwelcome, and people will work hard to avoid those losses.

Return in this light to default rules and the question of energy efficiency. Suppose that as compared to the grey (energy-inefficient) choice, the green option costs $200 more upfront but saves $210 over a period of five years. If the grey option is the default, people are likely to focus on the immediate loss of $200, and they will be highly reluctant to incur that loss. Perhaps the $210 savings will overcome their reluctance, but the immediate $200 loss will likely loom large. If, by contrast, the green option is the default, people are more likely to focus on the eventual loss of $210, and they will be highly

reluctant to incur that loss. In the environmental context, loss aversion may have an especially significant effect, certainly in the case of climate-friendly defaults: People may well feel a pang of conscience, or anticipatory regret if they are contemplating rejection of a green default (Hedlin & Sunstein, 2015).

In this respect, the default may well interact with, and help to establish or reinforce, prevailing social norms. Recall that some people make climate-friendly choices because they want to "make a statement." If opting out produces environmental as well as economic harm, it may entail a statement that consumers do not want to make, and this is so even if they would not have opted in.

When default rules do not stick

In some cases, people are willing to switch the default at the expense of the climate-friendly outcome. Recall that in the face of a 2C degree decrease in the default setting, many OECD employees took action to turn up the temperature (Brown et al., 2013). Note as well that when experienced people—environmental economists attending a conference—were presented with a default number for carbon dioxide offsets for flying, they were unaffected by that number (Löfgren et al., 2012). And in the study of energy-efficient light bulbs, the default rule was sticky, but not remarkably so. Even when it was the default, the energy-inefficient light bulb was rejected by about 56 per cent of choosers.[10] We could easily imagine populations that would likely reject the energy-efficient choice in equal or higher numbers, especially if the less efficient option cost a great deal less, and if in that population, environmental considerations did not loom large.

When default rules do not stick, the usual reason is usually straightforward: People have clear preferences that run counter to them. If preferences are clear, people are less likely to be influenced by the endorsement in the default rule. Inertia may well be overcome. Loss aversion will be far less relevant, in part, because the clear preference helps define the reference point from which losses are measured.

Suppose that consumers are defaulted into a climate-friendly energy source that costs 50 per cent more than the alternative. Unless social norms or inertia are particularly strong, some consumers will reject that default. For supportive evidence, consider both the evidence presented above and a study in the United Kingdom, which found that most people opted out of a savings plan with an unusually high (and therefore unattractive) default contribution rate (12 per cent of before-tax income). Only about 25 per cent of the employees remained at that rate after a year, whereas about 60 per cent of the employees shifted to a lower default contribution rate. Notably, people with lower incomes were more likely to stay at the unusually high contribution rate (Beshears, Choi, Laibson, & Madrian, 2012). Similar findings have been made elsewhere, with growing evidence that those who are less educated, and less sophisticated, are more likely to stick with the default (Brown et al., 2011).

The clear implication is that extreme or highly unwelcome defaults are less likely to stick. It follows that climate-friendly defaults that are perceived as foolish, wrong, harmful, expensive, or the imposition of some high-minded environmentalist elite may well be rejected by many consumers. A more puzzling and somewhat troubling implication, based on the lower incomes of those who stayed with the default in the savings study described above, is that default rules may be stickier for low-income workers than for their higher-earning counterparts. One reason may be that low-income workers have a great deal to worry about (Banerjee & Duflo, 2012; Shah, Mullainathan, & Shafir, 2012), and so are less likely to take the trouble to think through and to alter the default rule. An "effort tax" may seem especially high for, and have an especially large adverse effect on, people who are already facing a large number of decisions and costs.

This point suggests that a costly climate-friendly default may have a regressive impact, both because poor people have less money and because they may well be especially likely to stick with it. And indeed, there is general evidence that when people are highly informed and experienced, and hence know what they want, they are far less likely to be affected by the default rule (Löfgren et al., 2012). One reason is that the effort tax is worth incurring. Another reason is that highly involved and competent "market mavens" actually enjoy searching extensively and making their choice independently of defaults. Since "the consumer" does not exist in the abstract, there have been calls for a more group-specific policy design that takes the relative level of consumer competence into consideration, and in particular, that distinguishes among confident, vulnerable, and responsible consumers (Micklitz et al., 2013). Such distinctions may have a bearing on the selection of personalised default rules, taken up below.

[10]Recall, however, that the study was a laboratory experiment, not a randomised trial. If people actually had to take steps to change the default—rather than merely answering questions about whether they would do so—the switch rate would likely have been smaller.

Should private or public institutions choose climate-friendly defaults?

We now turn to the normative question. Which default rule should choice architects select? Are climate-friendly defaults a good idea? As we had suggested, our criteria are insistently and unabashedly welfarist. The question is whether one or another approach would improve people's lives, which requires a focus on the actual consequences. We acknowledge the existence of questions about public acceptability (Reisch & Sunstein, 2016; Sunstein & Reisch, 2019); we also note that welfarist considerations can be understood in diverse ways (Adler, 2012; Sunstein, 2018). Our hope is that in this context, considerable progress can be made without requiring the resolution of the most difficult normative questions.

Consumers (without externalities)

For purposes of simplification, begin with the case in which the only concern is the welfare of the chooser and there are no (or only modest) externalities. Under this admittedly unrealistic assumption, the preferred approach *is to select the default rule that reflects what most people would choose if they were adequately informed* (Smith, Goldstein, & Johnston, 2009). If we know that a particular default rule would place people in the situation that informed people would select, we have good reason to select that default rule (with the understanding that those who differ from the majority may opt out).

In the easiest cases, the answer is entirely clear once we specify the likely effects of the options in question. If climate-friendly energy both costs less and reduces environmental harm, it is safe to say that most informed people would choose it. It should certainly be the default. Under the specified circumstances, those who want consumers to make different choices will not find it easy to explain their views. Indeed, some options should be ruled out of bounds because they are obviously in no one's interest.

Now suppose that the tradeoff is not so self-evident, but that we have reason to believe that 80 per cent of people, given a great deal of information, would choose green energy. This might be the case if either (1) climate-friendly energy is far better on environmental grounds but only very slightly more expensive or (2) the relevant population is known to have strong environmental commitments. In either case, there is a strong reason to favour automatic enrollment in climate-friendly energy. But if grey energy would cost significantly less, and if it would be only slightly worse on environmental grounds, a grey energy default would seem best.

To be sure, it might well be necessary to do a great deal of empirical work in order to identify the approach that informed people would choose. (As we shall see, this is a point in favour of active choosing.) The idea of "informed" choice might also raise hard conceptual questions. For reasons that behavioural economists have emphasised (Sunstein, 2012), people may err even if they have a great deal of information. They may, for example, display unrealistic optimism or discount the long-term (Sunstein, 2012); the latter point bears especially on choices in the areas of energy and environmental protection. If informed choosers show systematic biases, it may not make a great deal of sense to base default rules on what appear to be informed choices. On the other hand, any effort to build correction of such biases into the very idea of the informed chooser creates a risk, which is that the enterprise will involve identification of what the choice architect believes to be the right choice on the merits—in which case the chooser, as an agent, tends to drop out of the analytic picture. The best solution is probably to rely on what informed choosers actually do, while also allowing correction if their choices can clearly be shown to be against their interest, perhaps because of some kind of behavioural bias.

On this count, actual evidence—about what informed choosers do—is extremely important. It would be useful to assemble information about the level of an opt-out under various alternatives (Thaler & Sunstein, 2008). Perhaps experiments or pilot programmes would provide such information.[11] If only two per cent of people opt out if climate-friendly energy is the default, and 50 per cent opt-out if grey energy is the default, we have reason to believe that climate-friendly energy is better.

[11]The Behavioral Insights Team in the United Kingdom is actively engaged in such projects, including in the domain of energy. See BIT (2011). available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/60536/behaviour-change-and-energy-use.pdf (last visited 21 November 2019).

Of course, it is possible that the majority rule is too crude. Suppose that there are two default rules, green and grey. Suppose that 55 per cent of informed people would be relatively indifferent between green and grey, but would slightly prefer green. Suppose too that because of their unusual situation (perhaps they are poor), 45 per cent of people would strongly prefer grey. It is probably best to select grey because almost half of the population would like it very much, and the (narrow) majority only cares a little bit. This example shows that it is important to ask not only about which approach would be preferred by informed people, but also about the intensity of their preferences.

Consumers and third Parties

In the climate change context, externalities are pervasive; they are the principal motivation for a climate-friendly default rule. Choosers may also face a collective action problem. Asked individually, they might rationally select grey energy, but they might prefer climate-friendly energy if everyone else were doing so as well (a possibility that argues for a firm mandate rather than a mere default rule). If choice architects are deciding among defaults in the presence of externalities and collective action problems, they must investigate the full set of costs and benefits, not only the welfare of choosers (see, e.g., Johnson & Goldstein, 2013). If a default rule turned out to stick, what would be the costs and what would be the benefits?

Even if most choosers would select grey because it is less expensive, green might be the better default if it would avoid significant costs. Suppose that we focus specifically on greenhouse gas emissions. We could easily imagine cases in which the avoidance of greenhouse gases would produce significant gains so that a green default would be simple to justify even if it turned out to be more expensive for users. Ideally, choice architects would monetise all of the relevant costs associated with relevant energy users and set a default rule accordingly.[12] Of course, it is true that the assessment could create serious empirical challenges both in monetising the relevant benefits and in projecting the level of opt-out.

As we have suggested, distributional issues may be relevant and important as well (Adler & Treich, 2015). Suppose, for example, that the cost-benefit analysis argues in favour of a climate-friendly default, but that the selection of that default imposes net costs on consumers, including poor people. Suppose too that poor people are unlikely to opt-out, perhaps because they are busy and occupied with other matters, perhaps because they are not confident that opting out makes the best sense or because they fear—unnecessarily—that they will lose supply. If poor people would in fact be net losers, but would not opt out, the argument for a climate-friendly default may remain plausible, but it is weakened. If it is chosen, it may be important to explore the possible financial subsidies for those who pay for it or to make the possibility of opt-out both salient and clear, at least if the latter can be achieved without endangering the goals that led to the default rule in the first instance.

Conclusion

With respect to climate change, consumer choices are greatly affected by a wide range of influences, including choice architecture in the form of social norms and applicable default rules. In fact, the climate change problem is created, in large part, by choice architecture that promotes extraordinarily high levels of greenhouse gas emissions. Mandates, bans, and incentives have legitimate roles, but climate-friendly defaults should be an important part of the mix. They are easiest to justify when they will simultaneously save money and reduce greenhouse gas emissions; consider motion detectors, automatic “off” defaults, and (in important cases) green energy.

In some cases, of course, climate-friendly defaults will be costly to consumers. For example, green energy may turn out to be more expensive. Smart grids and smart meters have potentially large benefits, but they may also impose costs as a result of traceability and reduced data privacy. No one should favour a situation in which choice architects select defaults that cost consumers a great deal (perhaps in terms of money, perhaps in terms of privacy) and deliver only modest environmental benefits. Some of the hardest cases arise when the climate-friendly default would cost consumers a nontrivial amount but also appear to produce significant environmental benefits.

In such cases, choice architects have two reasonable options. The first is to call for active choosing (and to inform consumers in the process). The second is to assess costs and benefits and to select the default rule on the basis of the assessment. The choice between the reasonable options depends on whether choice architects have justified confidence in their assessment of costs and benefits. If they do, and if the assessment demonstrates that the climate-friendly default is unambiguously superior, they should choose it.

[12] As we have noted, externalities might justify a mandate rather than a default rule.

Much of the time, the best approach is automatically green. Climate-friendly default rules, attentive to the full set of costs and benefits, are likely to emerge as a significant contributor to efforts to reduce greenhouse gas emissions—complementary to and on imaginable assumptions better than education, economic incentives, and mandates or bans.

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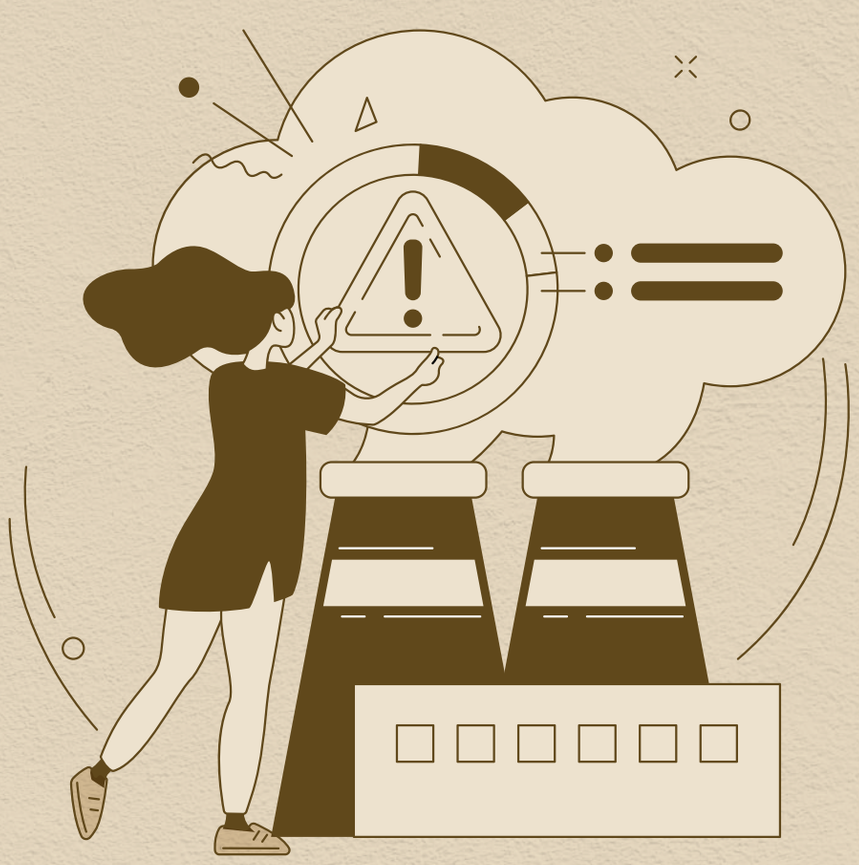

CLAP: A COORDINATING, LEARNING AND AGGREGATING PLATFORM FOR COLLECTIVE CITIZEN ACTION FOR ENVIRONMENTAL POLICY CHANGES IN INDIA

Elena Zinchenko and Anant Sudarshan***

*Booth School of Business, University of Chicago
**Department of Economics, University of Warwick

Introduction

In the battle against climate change, India is at a unique nexus: it is the third largest emitter of carbon dioxide by volume, according to the UNEP Emissions Gap Report (2020), on par with the largest developed countries. However, like other countries in the developing world, it is poised to experience a disproportionate share of the profound environmental, economic, and human costs associated with climate change (Taconet & Guivarch, 2020). The global action against climate change, therefore, requires strong leadership both from the Indian government and Indian people - as citizens of the world's most populous democratic country, they have a tremendous decision power to affect climate change policy.

Climate change poses unique challenges for developing countries. Poverty alleviation is an urgent policy priority that can make it more likely for governments or corporations to lock themselves into legacy high carbon pathways of growth. Alternative growth trajectories that involve the use of greener sources of energy, greater efficiency or lower consumption involve substantial uncertainty and risk of increased economic and human costs. These trade-offs are more likely to be considered in favour of protecting the environment when governments and citizens engage in an ongoing conversation around climate change policy - when citizens can voice their support in an actionable and expedient way, the state can take bolder steps in regulating the environmental impact of the industry.

Carbon emissions associated with economic growth are a function of household preferences as well as the manufacturing and energy systems that produce the goods and services that they demand. Research has found that splitting climate obligations by people rather than countries helps identify over 1.3 billion of high emitting individuals whose collective actions significantly contribute to climate change (Chakravarty et al., 2009). This provides a basis for the new LiFE initiative of the Indian government that reframes the climate change problem as needing a change in people's behaviour (or their consumption patterns). As stated by the UN's Emission Gap Report, *"governments have a major role in setting the conditions under which lifestyle changes can occur, through shaping policy, regulations, and infrastructure investments. At the same time, it is necessary for citizens to be active participants in changing their lifestyles through taking steps to reduce personal emissions."*

Changing consumption behaviours of entities, not individuals

Although household preferences matter for the carbon emissions of a country, equity is a central issue in determining whether governments should think about lifestyles and preferences as being an important element of transitioning to lower carbon growth. The emissions of the richest 1 per cent of the global population account for more than twice the combined share of the poorest 50 per cent. Therefore, policymakers in developed countries may get the greatest impact on reducing personal emissions by encouraging systemic lifestyle changes, such as reducing a long-haul flight (a 1.9 tCO_2e reduction per capita), switching to a vegetarian diet (reduction of 0.5 tCO_2e per capita per year), increasing housing stock energy efficiency, or using renewable sources of energy by households. These changes are unlikely to gain the most emission impact for a population in a developing country where personal air travel is not common, the winters are mild, and where vegetarian diet is culturally prevalent, such as in India.

Moreover, recent research suggests that individual behaviour changes are difficult to induce when not supported by a clear price signal. Enabling people to align their behaviors with their stated preferences through subtle interventions (e.g., "nudges") has received widespread attention among both researchers and policymakers (Thaler & Sunstein, 2008), including "behavioural intervention" units that were temporarily established in some governments. However, there is mounting evidence that nudge interventions have inconsistent effects with significant variability across intervention techniques and target domains (see Mertens et al., 2021 analysing over 200 studies reporting over 440 effect sizes of choice architecture) and suffer from a strong publication bias (Mertens et al., 2021). The types of intervention techniques also matter and have variable efficacy, with interventions that target decision structure (how choices are presented) consistently outperforming interventions that focus on providing additional decision information (decision assistance). Importantly for this initiative, behavioural nudges targeting environmental impact show no effect size after controlling for publication bias (Maier et al., 2022).

In addition to the problematic evidence on how nudges enable changes in behaviour, there is another important consideration of people's actions when applied to the environmental domain. Climate scientists have argued that there is a "crowding out" effect of exerting effort on individual actions like plastic recycling that deplete an individual's willingness to participate in

coordinated actions on corporate actors that are the main sources of pollution (Mann, 2021) . This means that focusing on individual behavioural changes may even be counterproductive to more substantive policy that requires collective action. Simply put, when governments seek to change individual behaviours that may have only a tiny impact on carbon emissions, they risk increasing public reluctance to engage with collective policy actions that will bear the greatest environmental impact. Behavioural tips on how to use less electricity, for instance, frequently use examples such as unplugging chargers or appliances when not in use, a step that has a vanishingly small impact on energy use but can require a significant amount of cognitive effort to accomplish. If this effort were to lead to fatigue when governments seek support for more substantive steps - such as imposing renewable purchase obligations on utilities or imposing a tax on diesel vehicles - then we might have been better off without promoting the individual behavioural nudges and directing the cognitive effort and coordinated actions towards a public goal.

For this reason, we argue that the Indian government, like other developing countries, will gain the greatest impact of collective citizens action on climate change by coordinating people's actions to affect corporate practices and local policy implementations rather than attempting to change individual consumption behaviours. Although millions of Low - and Middle - Income Indian households may have limited room to cut their own consumption, their preferences as citizens, employees, or consumers could significantly influence municipal, government, and corporate environmental policies and choices. This channel may thus be the most powerful way to link individual preferences to eventual carbon mitigation. However, currently there are few information channels for people to learn about possible local government or corporate initiatives, and even fewer channels for them to manifest their preferences for enabling these changes.

Eliciting Preferences: The Relationship of Individuals with Policy

In focusing on private companies and local governments, a key constraint to implementing policy or climate-friendly actions is the interaction of these decisions with the preferences of individuals. There is a range of consumption actions by private and public companies, as well as local government entities (municipalities) that could yield substantial emission reductions. For example, given that air transportation costs are a significant source of global emission, companies can either choose to have remote work or fly people from the corners of the world for meetings[1]. A delivery company might choose to use electric vehicles or e-bikes, or alternatively traditional fossil fuel vehicles[2]. A construction company might adopt green construction practices and factories might choose to invest in energy efficiency. These corporate policy changes are much more likely to occur with coordinated local citizen and employee support. This is because people's preferences may be in conflict, such as demand for inexpensive goods and corporate green policies that impose higher production costs. Employee preferences matter because employer decisions may benefit both employees and the environment (e.g., remote work policies) or impose some costs on employees (e.g., only reimbursing public transport). In general, many green actions may not be profit maximising even if they are welfare increasing, especially when externalities of environmentally degrading actions are not priced. Therefore, other stakeholders (such as shareholders), may push back on implementing such policies and hence soliciting their views is also important in the collective decision-making.

Likewise, in the case of the government, some climate policy decisions may impose some costs or constraints on voters. Without a clear and timely way to gauge the public support or opposition to specific policy measures, they may end up being perceived as very high, and this can lead to highly risk averse decision-making by politicians. However, individuals also care about protecting themselves against the costs of climate change and, therefore, place some political weight on climate-friendly policies. These preferences are not as visible as costs. People have important levers of influence being employees and voters but they lack timely and sensitive mechanisms for manifesting their preferences and for exerting influence on corporate and state actors. Eliciting and aggregating people's preferences on local environmental policies is key to determining which policies are likely to be relevant and feasible - a prerequisite for their successful implementation.

[1]Domestic and international shipping and aviation currently account for around 5 per cent of global CO_2 emissions and are projected to increase significantly (they are projected to consume 60 per cent - 220 per cent of allowable CO_2 emissions by 2050).
[2]Of course, as Indian consumers adopt consumption levels comparable to the developed world, there is significant scope for individual-level emission reduction. India currently has the world's fifth largest car sales - as this grows with rising incomes and rapid urbanisation, there are strong implications for global oil demand and a switch to electric cars.

A Coordinating, Learning and Aggregating Platform (CLAP)

Given the considerations above, we introduce a novel way to elicit and channel people's preferences for a variety of local environmental policy changes: A Coordinating, Learning and Aggregating Platform (CLAP). CLAP would connect actionable information for citizens with their coordinated feedback to policymakers and thus influence environmental policies. This allows policymakers and employers a mechanism to gauge public support for various initiatives and policy changes at a finer timescale than election cycles allow. It also provides citizens a social, public-facing platform to learn about the space of potential policy options relevant for their regions, upvote ideas they like, and downvote ideas they do not endorse.

Figure 1 provides a schematic representation of CLAP. It is envisaged that both public and more restricted versions of the same platform may coexist. For instance, a company might choose to host a module of CLAP where participants are restricted to its employees or shareholders. The government might use CLAP with a much wider range of users with membership linked to Aadhaar numbers. CLAP provides a transparent view at all points of both policy measures under consideration and user views towards them. It also provides a dashboard to track this information similar to those that have been set up to monitor government policy in other areas (such as drinking water and electricity access).

CLAP also contains an optional social media component allowing for outreach on social media channels. Social media accounts may not be suitable for feedback, however, because of identity verification considerations so the CLAP is envisaged as a distinct platform. CLAP will need to be developed and hosted on a secure platform, an effort that could fruitfully be led by the NITI Aayog. Corporate users may need to pay a fee to set up CLAP modules for their own purposes, and a source of revenue that might cover all or some of operating and development costs. The use of CLAP by corporate entities is ultimately voluntary. However, it provides a transparent way for firms to represent green credentials and a way to report on major climate initiatives directly to the government and the public at large.

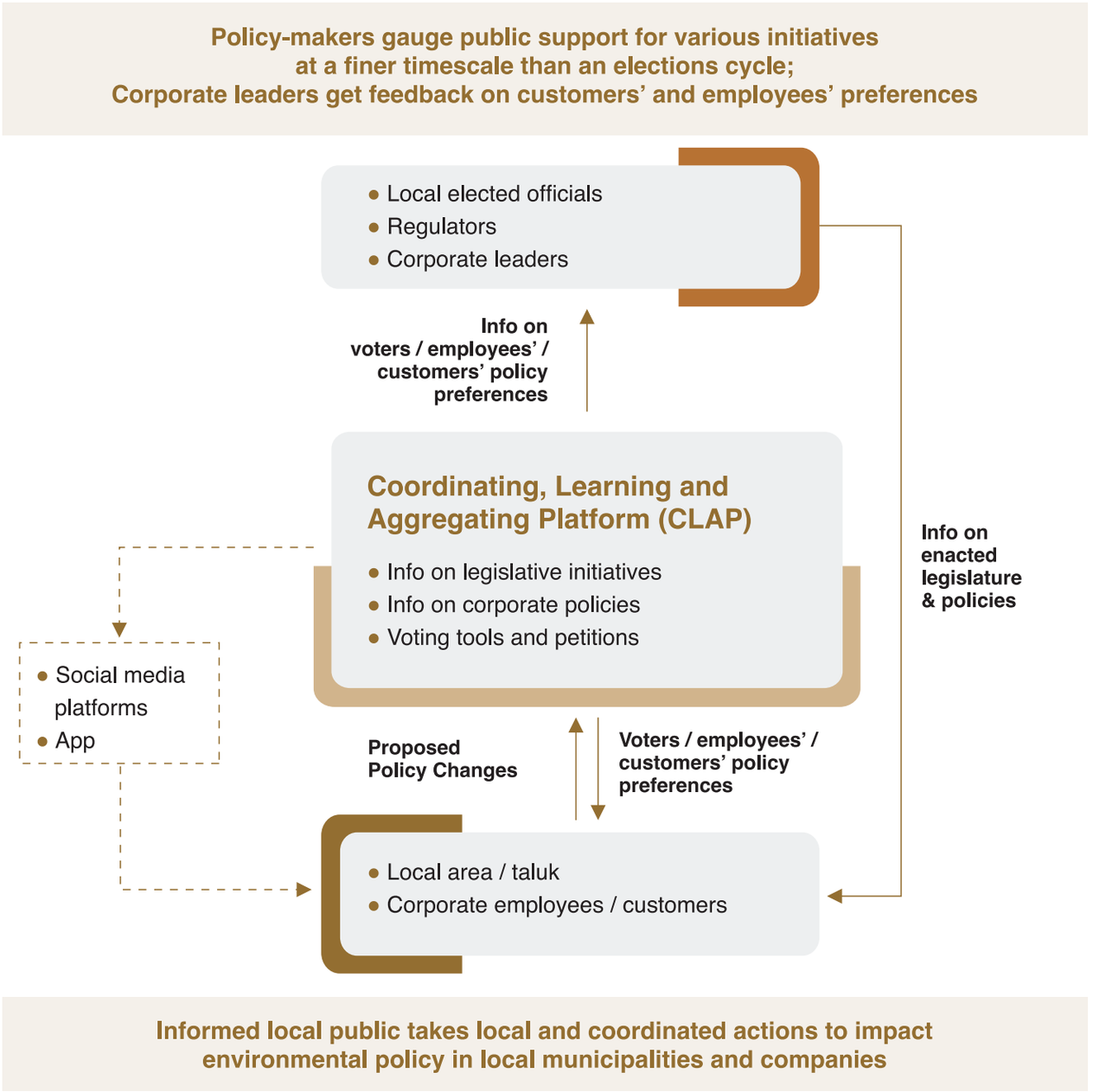

Figure 1: A schematic representation of CLAP

Key Features of CLAP:

1. Generates necessary information and feedback loops for informed citizen action and policy coordination
2. Presents relevant data on local corporate and governmental initiatives that could affect the environment to local citizens in a given geographic area
3. Uses social media to connect with local groups and increase social signalling and transparency on citizen action
4. Creates easy steps for people to communicate their views on the initiatives to the policymakers: signatures on petitions, etc.
5. Informs policymakers with fine-grained feedback on the considered initiatives that are more timely than infrequent election cycles
6. Communicates to citizens the outcomes of those initiatives: passed or not in the local governing bodies; adopted by a corporate agent or not, etc.

Piloting and Evaluation

We propose that CLAP be evaluated using a combination of two different approaches. First, a quantitative impact evaluation using a pilot deployment of CLAP within the private (corporate) sector. Second, a mixed-methods process evaluation from a constituency-level deployment in partnership with Members of Parliament. In the remainder of this section, we discuss each of these elements in turn.

Quantitative impact evaluation

The impact evaluation will involve about 50 firms that may be selected from members of the Confederation of Indian Industry. The implementation of the design we describe should ideally be supervised by a technical committee with representatives of the government, industry, and the research team.

As a starting point, all 50 firms will be asked to identify a set of potential climate initiatives that they might consider implementing. Such ideas may target different sources of emissions influenced by company policy. Firms may introduce initiatives designed to change operations or inputs to reduce the carbon intensity of output. They may also introduce incentives designed to change behaviours of their employees in ways that increase climate awareness or reduce emissions.

As an example of changing operations, a company might invest in new energy efficient technologies. As an example of changing employee behaviours, a company might provide discounts and incentives for the use of public transport by employees.

After an initial list of policy options is finalised, the pilot will select 25 firms who will be required to set up a local CLAP module for their company and enrol all employees. Each local CLAP module will contain a description of all climate-related actions shortlisted by the company and the projected impact, with accounts for all employees as well as the research team. The remaining 25 firms will form a control group listing non-environmental policies.

Data will be collected on several outcome variables at the level of both employees and the firm. At the employee level, the research team will carry out a quarterly online survey measuring employee participation in initiatives listed on CLAP, their attitudes to climate change, knowledge about their company's environmental performance, knowledge of climate initiatives, preferences over different actions their employer might take, and information on some of their own behaviours that might change with shifts in information accessibility and attitudes.

At the firm level, the research team will track a suite of basic environmental and climate related indicators (self-reported by the company) as well as information on employee response and which climate initiatives were implemented (if any). The firm survey will also capture information from senior company leadership on budgets assigned to climate related initiatives.

The RCT will run over a period of one year, allowing the research team to observe whether the number and type of climate initiatives implemented by firms with a CLAP environment differ from those in firms that do not engage with CLAP. In addition, the RCT will allow us to test whether company initiatives and employee attitudes move in similar directions – do employees who are engaged with CLAP change their attitudes and preferences and if so, do they affect company policy and the likelihood of taking ambitious and effective climate action?

Qualitative process evaluation

The process evaluation will focus not on corporate use of CLAP but rather on CLAP as a tool available to elected representatives of the people. In this portion of the evaluation, a CLAP module will be created for at least 50 Members of the Parliament in India (unless they choose to opt out of this opportunity). Residents in their constituency will be eligible to join. In addition, the MPs would be requested to disseminate information on the platform through their own channels to encourage enrolment.

The constituency level CLAP will be seeded with information on climate initiatives relevant to the constituency that could be implemented by local governance bodies (such as municipalities) as well as other stakeholders including MP offices. In addition, for each constituency a set of 4-5 climate champions would be identified who will help seed discussions on CLAP, populate the platform with new information as it becomes available, and enrol individual voters or local organisations. The primary role of these volunteers would be to help catalyse discussions and engagement on CLAP.

Three types of information will be collected. First, online data on voter engagement with CLAP (number of enrolments, posts, upvotes to ideas, addition of new ideas, etc.). Second, qualitative feedback from MPs and local governance bodies on whether the voter preferences expressed through CLAP were useful in changing their own governance actions. Third, online qualitative and quantitative feedback from constituency residents enrolled in CLAP, including data on their environmental attitudes, preferences, and behaviours.

This process evaluation will help reveal more detailed information on whether CLAP might assist governance and improve policy, as well as data on whether engagement with a platform like CLAP is sufficient to change public attitudes and behaviours towards environment-friendly policies.

As citizens of the most populous democratic country in the world, Indian people have substantial influence over climate-friendly policies but lack effective local channels to enact their collective will. The CLAP platform allows to deliver local, actionable information both from corporate and municipal actors to the employees, customers, and voters, harnessing individual citizen actions in service of the broad environmental policy changes.

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“There is an individual and collective duty on all of us to do whatever we can do for a better planet.”

Shri Narendra Modi
Prime Minister

SPECIAL CONTRIBUTIONS TO GCIP*

*All papers in this compendium are arranged alphabetically by the authors' last name.

TESTING THE POWER OF RESISTED TEMPTATION TO HELP PEOPLE QUIT SMOKING

Ian Ayres, Deepti Bandaru and Debjani Banerjee*

*Yale University

Abstract

Turning down temptations might make it easier for people to stay committed in the longer term to a personal goal. Resisting temptation might “self-signal” information about an individual's own resolve. Individuals who are subject to what we call “reactive incentives” have superficial incentives to accept a temptation and deviate from some pre-existing goal. But the process of resisting the temptation may cause these individuals to be less likely to subsequently deviate from that goal.

The primary aim of this study is to pilot a novel reactive carrot approach for improving individuals’ ability to stick to a “practice quit” program in a smoking cessation context. Our participants will be divided into two groups, treatment and control, and those in the treatment. Those in the treatment group will receive a monetary incentive to forego the opportunity to receive subsequent abstention (contingency management) rewards.

Problem Statement

Nearly 270 million Indians currently are estimated to consume smoked or smokeless forms of tobacco and related products, and 100 million out of them smoke tobacco in the form of bidis and cigarettes (GATS-2 2016-17). Thanks to tobacco control efforts by the WHO and implemented by the Indian Government, approximately seven out of ten adult smokers want to quit. However, the decline in tobacco use is not declining as rapidly as it should, with over a million deaths attributable to tobacco related diseases in India annually. It is clear that there is a need for enhanced smoking cessation techniques and support. The smoking rate is higher in rural areas, among those with a lower socio-economic status, and among those with lower levels of education. Similarly, smokeless tobacco use is more prevalent among the socio-economically disadvantaged. Current approaches to quitting tobacco include satisfying a craving (e.g. nicotine gum or patch) or reliance on self-initiated behaviour (e.g. call a friend when experiencing a craving; remembering the reasons to quit). Self-initiated behaviour relies on prospective memory—the ability to recall information from the past but still implement the intended behaviour in the future—and for those that wish to quit smoking, both recalling their intention to quit and enforcing the intended behaviour can be especially difficult (Risko & Gilbert, 2016).

On April 24, 2020, the Government of India imposed a nationwide lockdown as a preventative measure to curb the spread of Covid-19. This forced upon sudden significant changes in habits and lifestyles. During the second lockdown, the Government banned the sale of tobacco and alcohol. This led to an increase in the intent to reduce smoking among a large share of the population due to the following reasons (Brake SJ et al., 2020):

- Inaccessibility to local shops due to public lockdown and non-availability of cigarettes because of shutdown of all businesses.
- Discouragement from smoking in the company of immediate family during extended tie period of home isolation.
- Fear induced in smokers of the increased risk of respiratory distress and mortality from COVID-19.

The potential power of resisted temptation comes from the resistance leading subjects to increase their resolve to change some aspect of their future behaviour. Through our study, Smoking Cessation Program, we hope to induce positive changes in the lifestyles of those enrolled in our practice-quit program, based on a “reactive carrot” incentive, which tests whether resisting a contingent reward can induce any significant changes in one’s smoking patterns. We believe that COVID-19 has had a positive impact on those who wish to quit smoking and we would like to give impetus to this momentum through our study (Gupte et al., 2020). We are aware that enabling cessation of smokeless tobacco use in India also presents a public health opportunity and indeed important for ensuring equitable allocation of resources to all consumers of risky forms of smoked as well as smokeless tobacco. Therefore, the findings from our proposed work among smokers will be adapted for further research and application in smokeless tobacco users as well.

Literature Review

Sunk opportunity costs can causally affect subsequent behaviour. Some evidence for the causal impact of reactive incentives was found in a field experiment that we conducted at a gym in the University of Amsterdam, where new subscribers were randomly assigned to one of several groups. "Temptation" group members were made one-time monetary offers of varying sizes to quit the gym. None of the temptation group subjects accepted the offered compensation to quit the gym. Subjects who were offered a moderate reactive carrot (a cash payment equalling 110 per cent of their initial subscription price to quit) were statistically more likely to visit the gym, to resubscribe, and to earn higher post-treatment grades. Even though the foregone financial opportunities are sunk, they nonetheless affect our subjects' future behaviour.

Leading sunk-cost theories "predict that sunk investments set a mental account 'in the red,' which causes people to escalate their commitment to the current course of action in an attempt to close the account 'in the black'" (Cunha and Caldieraror, 2009). Preliminary results of a lab experiment suggesting that subjects who resist a temptation analogously are motivated to get "in the black" after resisting a monetary temptation. In the lab, we offered all subjects the opportunity to earn ¼ of a Swiss Franc for each math problem that they completed. The treatment group, however, was given a one time (temptation) offer of 5 Swiss Francs if they would give up the opportunity to make money from completing the math problems. The temptation group completed more problems, in part because they made sure that they completed at least 20 problems.

Smoking is an important public health problem and many smokers struggle to quit, while others are unmotivated. This study attempts to evaluate the efficacy of practice quit attempts (PQA) in conjunction with a reactive carrot. The PQA intervention is designed to increase motivation, confidence, and coping skills as subjects don't have the pressure to permanently quit (Carpenter et al 2013). There is significant work that tries to increase motivation and effectiveness of PQAs using a variety of methods such as Nicotine replacement therapy and proactive text messaging (Carpenter et al 2010; Liao et al 2018). There is also methodological work that focuses on developing a procedure to identify the effects of drugs on PQA efficacy (Carpenter et al 2012). This study would contribute to this literature by evaluating whether reactive carrots can improve PQA attempts.

A reactive carrot approach works well with a Practice Quit Attempt trial as subjects are not expecting to fully give up smoking which reduces the risk of this study. Moreover, our previous results from the gym experiment described above suggest that reactive carrots are consistent with a form of self-signalling. Resisting a temptation teaches subjects something about their own resolve that can help establish a "self-reputation" and make it easier to follow through on an activity (like quitting smoking) in the future (Bodner and Drazen 2003). Resisting temptations have also been modelled as "willpower activities." In this setting, resisting temptation is "hard" information that can be used to build an enduring image of themselves even with people with imperfect recall (Bénabou and Tirole, 2004). In this study, people may have imperfect recall about their resolve to attempt to quit smoking, but their resisting temptation is a memorable precedent that signals to themselves of their willpower.

Idea Detail

Purpose

Our study is intended to demonstrate the feasibility of implementing a "reactive carrot" intervention for individuals in a "practice quit" program. All the subjects, treatment and control groups, would be enrolled in a "practice quit" program where they would agree to try to not smoke cigarettes for a period of 2 weeks and all subjects (both treatment and control groups) would be given the opportunity to receive attendance rewards for attending six CO testing meetings as well as abstinence (contingency management) rewards for abstaining from smoking. All together a subject who attended all six CO test meetings and was found to be abstinent in all six CO test could earn 5000 INR (approx. $60.92).

The only difference between the subjects randomly assigned to treatment and control groups is that each member of the treatment group would be tempted at the beginning of their program by being offered a one-time monetary temptation of 2500 INR (approx. $30.46) to forego the opportunity to receive subsequent abstention (contingency management) rewards.

As explained below more fully, treatment group subjects would, at their initial intake meeting after the attendance and abstention rewards opportunity had been described, be given a one-time opportunity to receive a temptation payment to give up the opportunity to receive subsequent abstinence (contingency management) rewards. Subjects who accepted this one-time opportunity would remain enrolled in the practice quit smoking and they would still be eligible to receive attendance monetary reward compensation for showing up to their six testing appointments. The purpose of the study is to test whether resisting the temptation to accept the one-time payment helps steel the resolve of the treatment subjects to follow through and make sure that they earn the subsequent contingency management rewards. More specifically, an intent-to-treat design will allow us to test whether the temptation causes treatment group subjects to have greater success than the un-tempted control group subjects to abstain from smoking during the two-week practice quit period.

We will also be offering behavioural counselling plus nicotine replacement therapy to participants enrolled in our program.

Primary Objective

The primary aim of this study is to pilot a novel reactive carrot approach for improving individuals' ability to stick to a "practice quit" program in a smoking cessation context. Our treatment gives subjects an offer to forego a monetary incentive to forego the opportunity to receive subsequent abstention (contingency management) rewards. Specifically, we predict that treatment group subjects who are offered a 2500 INR temptation will be more likely to earn 2500 in abstinence and attendance rewards. The resisted temptation creates a powerful reference point for them in deciding how much effort to put forth to remain abstinent.

Secondary Objective

This study has broader implications for how resisting initial temptations can make it easier for individuals to stay committed in the longer term to a personal goal. If the treatment group in this pilot study is more likely to stick to the "practice quit" program, it might help provide a basis for studying the efficacy of reactive carrot behavioural interventions in other contexts.

In collaboration with

We intend to work with Prof. Debjani Banerjee PhD, Associate Dean, Vivekanand Education Society's Business School, Mumbai, Maharashtra, and Dr Deepti Bandaru, BDS, MSc, Director of the HealthyFutures Quit Tobacco Clinic, Pune, Maharashtra. Prof. Banerjee has supervised numerous PhD candidates over two decades, conducting and publishing social and behavioural research. Dr Bandaru's work in the HealthyFutures Quit Tobacco Clinic is based on combining nicotine replacement therapies and behavioural counselling according to patient history and nicotine dependence based on the Fagerstrom scale.

The most common risks in smoking cessation trials are related to medicine given (Nicotine Replacement Therapy or varenicline medicine), confidentiality, and assessment burden.

- Nicotine Replacement Therapy: Healthcare practitioners at the HealthyFutures tobacco cessation clinics are trained on best practice guidelines for NRT prescription and behavioural counselling. Any adverse events are managed as per standard protocols.

- Confidentiality: We will use personally identifying information to only contact study subjects and will not use any sensitive information in the data analysis process. All subjects will be given a number that will be used to identify them in the digital database. Our confidentiality plan is described in more detail below.

- Assessment Burden: These are all noninvasive and should add no risk. The major disadvantage is the time it takes to complete these questionnaires. We have done our best to make these questionnaires brief, and our past experience with these measures indicates that they are acceptable to most study participants. Careful efforts aimed at maintaining confidentiality will be made, however loss of confidentiality is a risk.

- Study specific measures like abstinence and alternative tobacco product use will be ascertained via testing appointments and biochemically confirmed via a CO test. The CO breath test is non-invasive and is wide used in smoking cessation studies (Vasthare, Kumar, and Arron, 2018). It poses no physical risks and privacy concerns will be mitigated by conducting appointments alone with the subject.

Testing Plan

Study Design

We will include individuals who are adults and smoke more than 3 cigarettes per week and exclude individuals that have unstable psychiatric/medical conditions (see below for details on the exclusion criteria). At an initial intake meeting, research staff would inform patients about the study. All subjects will be informed that, if they participate, they will each have the opportunity to earn a total of 5000 INR (approx. $60.92) if over the 2 week "practice quit" period they attended all six CO test meetings and was found to be abstinent in all six CO tests. Subjects assigned to the treatment group will be offered a one-time monetary temptation of 2500 INR (approx. $30.46) to forego the opportunity to receive subsequent abstention (contingency management) rewards.

At this intake appointment, patients would be randomised into the two arms, with blocking stratification by Fagerstrom scores. As suggested in the literature, participants would be placed in high nicotine dependence group if Fagerstrom score was greater than 5 (and in low dependence group if their score was below this cut-off) (Schnoll et al 2013). Allocation would be concealed, and each participant would be assigned the next sequential number by a research staff member who was blinded to the allocation sequence using Redcap.

CO testing will be done in person using breathalysers. An administrator will observe the participant taking each CO test and record findings.

Planned Analyses

Data analyses addressing the primary hypothesis will use the Intent-to-Treat (ITT) principle as the primary study population. This means that the analysis will be included in our analysis and analysed according to the group they were assigned. Additional analyses will be supplemented by clearly identified subgroups of the full ITT population for purposes of exploratory/sensitivity analysis and to detect heterogenous treatment effects where appropriate. Outcomes include the results of the CO breath test, abstinence rates, time to first relapse, total CM payments, and whether subjects showed up to their testing appointments. Individuals that do not show up for appointments, in either group, will be assumed to have continued to smoke for the main analysis. We will then run a secondary analysis after dropping such individuals from our sample.

Primary Outcome Variables

The main outcome variable will be the results from a breath Carbon Monoxide test. Abstinence will be coded as expired-air carbon monoxide (CO) levels below 5 ppm (as suggested measure in literature to assure 24-hour abstinence).

Secondary and Exploratory Outcome Variables (if applicable)

- Whether subjects attend their CO testing appointments.
- Total amount of abstention (contingency management) rewards paid to subjects.
- Whether subjects report reduced smoking.
- Time to first relapse.

Handling of Missing Data

Individuals that do not show up for testing appointments will be assumed to have started smoked that day. We will also run a secondary analysis by excluding them from our sample.

Study Population

The study population are adults addicted to smoking and they will be selected from the general population. Breath tests are the only specimen collected from these participants. We exclude participants with severe mental and physical disabilities.

Study Schedule

Study participants will take part in seven meetings: an initial intake meeting plus six more CO testing meetings over two weeks. We will also text subjects after one month and six months to obtain self-reports of their tobacco usage.

Data Collection

There are a few different types of data involved:

- HIPAA identifiers: smoking behaviour, name, contact information (phone, email address) to be collected at information session. This information will only be used to contact subjects and to remind them of their upcoming appointments (via text messages; see more detail below). After intake, each subject will be assigned a number that will be used to track and monitor their study progress during the study period.

- CO Test data: each subject's CO results will be stored as that is the primary outcome variable. However, CO results will be linked with the numbers assigned to subjects, so this information isn't readily ascertained by members of the research team analysing the data.

- Other Smoking behaviours: subjects will be asked at each appointment if they have smoked or have urges to smoke a cigarette on a Likert scale; this information will be maintained/stored in the same way as the CO test data.

Informed Consent

The entire consent form will be reviewed in detail with the participant in a private, one-on-one setting at screening and set-up session. All risks and potential benefits will be described. Any questions the participant may have will be addressed. If the participant wishes, they may take the consent form home and consider it further before signing. They may also request to speak to anyone on the research team about questions they have or to consult others, including their physician and family members. Once the participant has signed the consent, they may withdraw consent at any time. Informed consent must be obtained prior to performance of any protocol specific procedures. For all participants, the research assistant will review the risks of the study medication at intake.

Ethical Considerations: Informed Consent/Assent and HIPAA Authorisation

There is no possible deception in the trial. There are no payments for simply being part of the trial except the initial one which is designed as an incentive for participants to follow through on showing up to future testing appointments. Only data related to their smoking habits and demographics will be collected. The study is likely to not discover new conditions as the only evaluation we perform is a CO test. Moreover, subjects that report having serious medical conditions will be excluded from the trial.

A staff member will obtain informed consent at the study intake. Research data will be collected using in-person interviews and self-reports. All identifiable information will be stored in a locked file cabinet. All participants will be assigned a study participant ID made up of numbers and letters. A list of IDs and the corresponding names will be maintained by the Principal Investigator and stored in a locked research cabinet.

Subject Confidentiality

Several steps will be taken to safeguard the confidentiality of subjects and their data. All research data that is collected will be assigned a study participant number and that number will only identify participants in digital databases. The names of participants will not be associated with this data and assessments will be maintained according to participant study number. A master list connecting participant study numbers to participant names will be kept in a locked file cabinet where it can only be accessed by senior level project staff. Any information published as a result of the study will be such that it will not permit identification of any participant.

Right to privacy for participation in this research will be protected through coding of data and proper storage of research records. The Principal Investigator will maintain a list of numbers and the corresponding names in a locked research cabinet. Consistent with mandated reporting requirements for health providers, we advise participants that in the case of child abuse or neglect, threat of injury to self or others, or intention to destroy property, that we may need to intervene and report that information to the proper authorities. Subjects will be informed of this limit to confidentiality as it is stated in the informed consent document.

All investigators and key personnel have taken the required Yale University HIPAA training. Right to privacy for participation in this research will be protected through coding of data and proper storage of research records. A list of numbers and the corresponding names will be maintained by the Principal Investigator in a locked research cabinet.

Individually identifiable health information will be protected in accordance with the Health Insurance Portability and Accountability Act of 1996 and by additional protections of substance abuse treatment records afforded under Code of Federal Regulations (CFR) Part 2, Subpart E. All research personnel will be trained on human subjects' protection and HIPAA procedures.

Conclusion

We hope to make both a theoretical and empirical case that sunk opportunity costs can impact the future behaviour of people who decide to forego present temptations. Behaviouralists have long understood the powerful impact that sunk costs can have on future behaviour. For example, the governments of France and Britain continued to invest in the Concorde, long after it was clear that the project was not financially viable because they had "too much invested to quit."

Through our endeavour, 'Smoking Cessation program', we will enrol participants who are willing and show inclination to quit smoking. We will use block randomisation to allocate participants to treatment or control group based on their Fagerstrom score, which will quantify their level of dependence on nicotine. Participants in both the groups shall receive our support for two weeks and we will conduct tests to check for abstention using a device called the Smokerlyser.

The only difference between the two groups will be the offer that we make to those in the treatment group. While both groups shall receive monetary rewards for attending and being abstinent on each test, the treatment group will be given the opportunity to earn a lumpsum amount and forgo the opportunity to earn any reward for being abstinent.

We show here that sunk opportunity costs can also make it easier for people to stay the course and conform their future behaviour to their past behaviour. These behavioural effects create the possibility for two new incentive categories. People who resist the temptation to accept a "reactive carrot" experience a sunk opportunity cost in foregoing the incentive. People who resist a "reactive stick" and persist in a short-term behaviour despite a contingent punishment experience a sunk opportunity cost by foregoing the opportunity to avoid the punishment. Both reactive carrots and reactive sticks thus aim to have subjects defy the contingent incentive and take what, because of the incentive, is the harder path. Each of these sunk opportunity cost incentives can impact future behaviour because initial resistance can both help people "self-signal" information about their own resolve and increase the costs of subsequently acting inconsistently.

Reactive incentives open new possibilities for policymakers. Where self-control problems impede individuals from pursuing their own self-interest, reactive incentives provide a new kind of choice architecture to enhance personal resolve. Policy makers would do well to pay more attention to the salience of foregone opportunities. The salience of foregone opportunities might be seen as a policy choice that can be impacted by implementing regulation.

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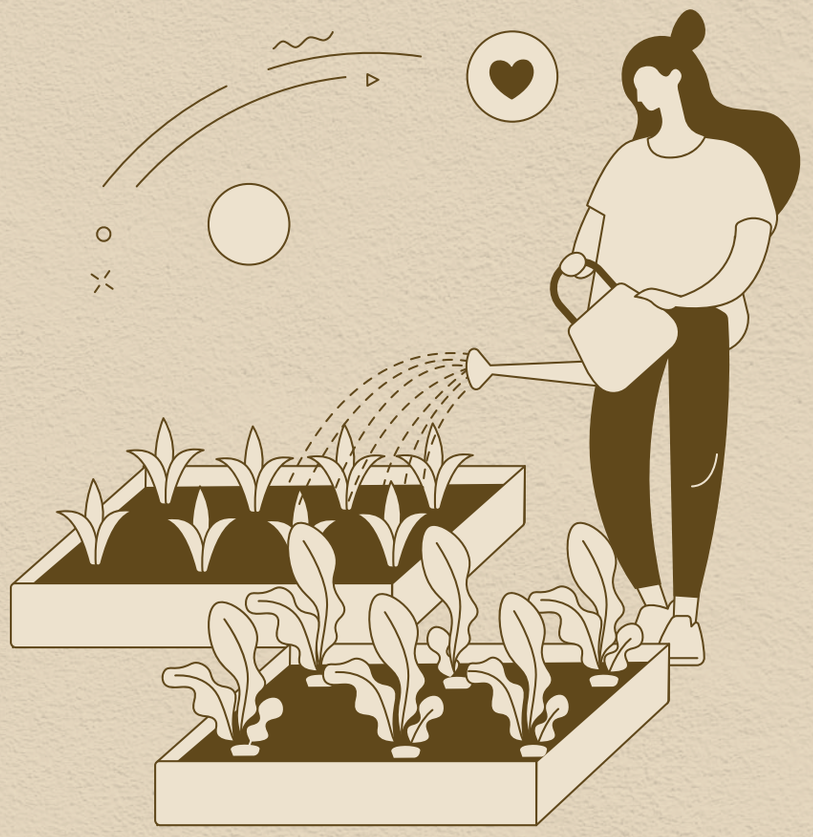

CAN SOCIAL MEDIA BE A TOOL FOR REDUCING CONSUMERS' FOOD WASTE? A BEHAVIOUR CHANGE EXPERIMENT

Ralf Barkemeyer*, William Young** and Susan Lee**

* KEDGE Business School
** University of Leeds

Abstract

This paper builds on a landmark study that field-tested the influence of a large UK retailer to change the behaviour of its millions of customers. Contrary to prior research, which had suggested that social media interaction is a cost-effective means to replicate face-to-face contact with customers, the UK-based study did not find social media-specific impacts. Instead, behaviour change could be identified for various intervention types as well as the control group, indicating that results from prior laboratory-based studies may have over-emphasised the effect of social media as well as other types of behaviour change interventions. As such, the study provided important information regarding nudges in relation to pro-environmental consumer behaviour as well as the limitations of social media interventions in this context. However, there are two major aspects that warrant an update and extension of this study. First, field research for the previous study was conducted in 2014. Given the marked increase in pro-environmental attitudes and behaviours on the one hand, and the accelerating dissemination of social media on the other hand, the effectiveness of nudges more generally, and social media interventions in particular, may have changed in the meantime. Second, there are question marks regarding the generalisability of prior findings for other country contexts. Developed and emerging economy contexts may differ significantly regarding pro-environmental attitudes and behaviours, (social) media consumption and the role of the highly visible companies in this context. For this reason, we replicate and extend the UK-based study, testing the same set of behaviour change interventions in an Indian setting. This setup allows us to add a longitudinal as well as an international comparative dimension to the previous study. More specifically, we report on the impact of three interventions with messages to encourage reductions in food waste. The first is a social influence intervention that used the retailer's social media presence to encourage its customers to interact. Two additional information interventions are used as a comparison through the retailer's print/digital magazine and e-newsletter. Pre- and post-intervention surveys are used to track customers' self-reported food waste one month before as well as two weeks after and five months after the interventions. Finally, the research design includes control groups that are not exposed to any of the behaviour change interventions. The findings of this study will allow us to refine our understanding of social media interventions to change customer behaviour and shed light on changes over time as well as the role of country context in these processes.

Problem Statement

This study expands on a previous study conducted in the UK to evaluate whether social media interventions carried out by a large food retailer can effectively trigger pro-environmental behaviour of its customers, notably in relation to food waste reduction in the household. Behaviour change approaches on environmental issues have hitherto tended to be centred around central and local government initiatives. Typical activities include the provision of infrastructure (e.g., household recycling bins), legal structures (e.g., vehicle emission related taxes), incentives (e.g., such as renewable energy technology subsidies) and related information campaigns to change attitudes and behaviour (Auld et al., 2014). These all try to shift consumer behaviour towards more sustainable lifestyles. Companies also influence behaviour through the marketing of products to customers with declared green criteria (Shrum et al., 1995). What has emerged more recently is that companies are starting to influence the behaviours, habits, practices and actions beyond the traditional company customer relationship (Morgan, 2015). This extension of the relationship from company to consumer focuses on encouraging consumers to reduce the environmental impact of product use within their homes.

In this study, we aim to expand and extend the prior UK-based field experiment with a set of equivalent interventions in the Indian context. In the previous study, a number of different mechanisms had been employed with the aim to induce behaviour change, ranging from more traditional interventions, such as information provided in magazines and e-newsletters, to the use of social media. Extant literature has argued for social media approaches to be more effective than those through conventional channels, based on their potential to replicate face-to-face interactions (Goldsmith and Goldsmith, 2011). Following social influence theory, face-to-face interactions can be seen as a crucial element of effective behaviour interventions (Abrahamse and Steg, 2013). Yet, given that face-to-face interactions are extremely cost-, time- and resource-intensive, it is difficult to scale up these types of interventions to the level of a national supermarket with a customer base of tens of millions of people. In this context, social media interventions such as Facebook could be a promising alternative. The prior study put this to a test, examining a large retailer's use of social media as a tool for reducing food waste in the home. As one of the key findings of this study, it was demonstrated that social media interventions, in line with more conventional ones, showed only limited effectiveness and failed to outperform their control groups. Indeed, the findings showed that results from prior laboratory-based studies may have over-emphasised the effect of social media as well as other types of behaviour change interventions.

However, the marked increase in pro-environmental attitudes and behaviours in recent years on the one hand, and the accelerating dissemination of social media on the other hand, may have changed these relationships and warrant a fresh look at the effectiveness of nudges more generally, and social media interventions in particular. In addition, there are question marks regarding the generalisability of the previous UK-centred study to other country contexts. Developed and emerging economy contexts may differ significantly regarding pro-environmental attitudes and behaviours, (social) media consumption and the role of the highly visible companies in their potential to nudge consumer behaviour. For this reason, we replicate and extend the UK-based study, testing the same set of behaviour change interventions in an Indian setting.

Literature Review

Food waste as a sustainability challenge

After being largely ignored in the 1990s and early 2000s when recycling boomed, more recently, there has been an increased focus placed on food waste (Metcalfe et al., 2012), arguably due to the increasing awareness of the amount of food waste generated and its associated impacts. It is estimated that one third of edible food produced for human consumption is lost or wasted globally each year (Goebel et al., 2015; Graham-Rowe et al., 2014). In a medium-sized economy such as the United Kingdom, 15 million tonnes of food and drink are thrown away annually (WRAP, 2013). However, it is not solely the amount of food wasted that has increased interest in this waste stream but the impact it has economically, socially and environmentally.

According to Graham-Rowe et al. (2014), food waste exacerbates escalating food prices globally which causes food to be less accessible to the world's poorest, increasing the number of malnourished people and demonstrating the direct socioeconomic consequences of food waste. The associated economic impact of buying food that is never eaten and thrown away (Graham-Rowe et al., 2014) costs the average UK household £470 a year, growing to £700 for a family with children (WRAP, 2013). Possibly the most damaging impact of vast levels of food waste is the corresponding environmental effect. For example, production of food that is consequently wasted magnifies the pressure on diminishing forests that are transformed into agricultural land (Graham-Rowe et al., 2014). Additionally, the disposal of food and drink to landfill adds to the avoidable release of gases like methane (Graham-Rowe et al., 2014) and CO_2 emissions (Goebel et al., 2015) into the atmosphere. Ultimately, it has become clear recently that minimising food waste is crucial for obtaining a sustainable food system as it has serious economic, social, and environmental repercussions (Goebel et al., 2015).

This study places particular emphasis on 'avoidable' household food waste. According to Lebersorger and Schneider (2011), the greatest potential for reduction of food waste in the developed world is with retailers, food services and in particular, consumers. 'Avoidable' household food waste is defined as "food and drink thrown away because it is no longer wanted or has been allowed to go past its best" (WRAP, 2013, p.23).

In the UK, food waste derived from households' accounts for 7 million tonnes of total food and drink wasted each year (WRAP, 2013). UK households throw away approximately one third of the food they purchase for consumption (Evans, 2011) with the average annual household waste consisting of 17 per cent food waste (Defra, 2015). However, much of the environmental impact associated with household food waste stems from the production and supply of the food wasted rather than the disposal of food. 4.2 tonnes of CO_2 eq. is avoided by preventing waste compared to 0.5 tonnes of CO_2 eq. avoided by treating waste (Quested et al., 2011). Thus, much of the work being carried out to reduce household food waste has focused on targeting the behaviours that create or exacerbate food waste. In a major emerging economy such as India, up to 50 kilos of food per person are lost each year, according to a recent UNEP study titled UN Food Waste Index Report 2021 (Zhongming et al., 2021). It translates to an astounding 70 million tonnes of food waste generated by households each year, i.e. ten times the amount wasted in the UK. Even though India's per capita wastage is the lowest among South Asian nations, the volumes of loss are substantial, especially given that as many as 27 per cent of Indians occasionally went to bed hungry, per a Hunger Watch poll performed in October 2020. According to findings in the UN report, higher income groups tend to waste more.

There is a growing literature on the drivers of food waste (Priefer et al., 2016; Thyberg and Tonjes, 2016). According to Quested et al. (2011), household food waste transpires from the interaction of multiple behaviours called 'specific food behaviours'. These behaviours relate to planning, storing, preparing, and consuming food (Quested et al., 2011). However, other studies have found it is more than just specific food waste behaviours that exacerbate household food waste. Goebel et al. (2015) argue that consumer expectations around availability, variety, and freshness cause food waste along the supply chain and in households. Conversely, a study by Evans (2011) argues that targeting the attitude and behaviour of consumers is illogical because there is no evidence to suggest consumers are careless or callous about the food they throw away. Instead, just targeting consumer behaviour continues to individualise responsibility and away from government and companies. Metcalfe et al. (2012) concur with this notion by stating that food waste is not caused by irrational excess that can be cut through everyday behaviours and practices.

However, it is our contention that we should be focusing on changing consumers actions that lead to environmental harm (Young and Middlemiss, 2012). This takes a multitude of interventions from many stakeholders with much focused-on influence from local or national government on households (Schmidt, 2016). Hence, the previous study examined whether retailers could use social media as a tool to trigger changes to reduce food waste from households.

Retailers produce less than 3 per cent of food waste in the UK (Defra, 2015; Eriksson et al., 2016; Scholz et al., 2015). Nevertheless, due to their pivotal position in the supply chain, retailers can produce significant reductions by working with their suppliers and influencing their customers. Much retailer activity in the UK on food waste has been coordinated by the formerly quasi-autonomous non governmental organisations (quango) and now independent Waste and Resources Action Programme (WRAP) using multi stakeholder 'Courtauld' agreements (WRAP, 2015). This is a voluntary industry agreement to help UK consumers cut down food waste in households using WRAP and retailer's campaigns. The campaigns have focused on e.g. shopping smarter (using shopping lists), storing products better, planning meals, using up food that could be thrown away and composting food waste where possible. However, it has recently been argued that social influence interventions are typically more effective when compared to mere information provision (Abrahamse and Steg, 2013; Goldsmith and Goldsmith, 2011), and could therefore be seen as a promising avenue in this context.

Social influence behaviour interventions

Consumers' food waste behaviours are complex due the interaction of multiple household activities and influencing these is key (Quested et al., 2013). Social influence theory could be one route where individuals learn from each other leading to attitudinal and behaviour change (Goldsmith and Goldsmith, 2011). Trying to harness this for pro-environmental behaviour change could be the key for households to reduce their impacts on the natural environment.

The results of the meta-analysis of intervention experiments by Abrahamse and Steg (2013, p.1774) found that the social influence approaches that were most effective were:

- "Block leaders and social networks", for example recyclers encouraging their neighbours. This relies on the notion that people are more likely to take act if information is provided by someone in their social network. The stronger the ties in the network the more likely the information will affect behaviour.

- "Public commitment making", for example signing a community pledge to conserve water. Publicly binding someone to a behaviour has been linked to the need for consistency and social pressure to adhere to the commitment.

- "Modelling", for example a couple showing their neighbours how to compost. People are more likely to commit to something if they see other people undertaking the behaviour.

The factor in common with these approaches is the 'face-to-face' interaction which accentuates these influences (Abrahamse and Steg, 2013). Note too that ". . .the type of target group and the type of behaviour did not significantly affect the observed effect size of social influence approaches compared. . ." (Abrahamse and Steg, 2013; p.1783).

In line with this perspective, 'face to face' interactions would appear the most promising in terms of achieving effective food waste reductions (see also Quested et al., 2013). It is, however, challenging to scale up this sort of intervention to a national level without significant investment of resources. Goldsmith and Goldsmith (2011) suggest that online social networks could replicate face to face social influence, which could be an easier route for the influence millions of householders on environmental issues. The reasons for this online influence over behaviour is that people are spending increasing amounts of time on social media and that opinion leaders are also influential through social media and access a significant part of the population. While Goldsmith and Goldsmith (2011) made this assertion theoretically, at the point of the previous study there had been no empirical testing of the efficacy of such an approach. One study that has attempted to address this was the use of Twitter on the issue of climate change (Williams et al., 2015), while another study did so through Facebook (Robelia et al., 2011). What was found was that users tended to segregate into likeminded communities and were influenced by them; making it less likely to be able to reach, and influence, non-advocates. But the social influence mechanism could be through existing face to-face-networks that are used online for spreading messages (Bond et al., 2012). In other domains, however, social media tools like Facebook have been successfully used to influence social networks such as in health behaviour change (Laranjo et al., 2014) as well as in the conventional marketing of products (Seng Chew and Keat Leng, 2014).

Idea detail

This study is an extension of a landmark study that had field-tested the influence of a large UK retailer to change the behaviour of its millions of customers. In the previous we aimed to test a large retailer's use of social media as a tool for reducing food waste in the home. We were particularly interested in Facebook due to its dominance of social media and if successful, this could provide the ability to apply intervention strategies at a much bigger scale and accelerating behaviour change on environmental issues. The primary research question is: Will a social influence intervention approach be effective at encouraging behaviour change on social media compared to information interventions and a control group?

The previous study was the result of a collaboration between the University of Leeds and a leading UK food retailer. The aim of the project was to develop and test scientifically rigorous field-based interventions to determine the extent to which a company could impact the behaviours of consumers while simultaneously contributing to scientific knowledge. This dual approach between researchers and practitioners is known as co-production (Clark and Dickson, 2003). In conducting the research, we, as researchers, deliberately influenced and changed decisions, actions and processes within the company. In turn, employees in Asda provided data, helped shape and implement interventions, and facilitated data collection to fit the activities of the company for maximum effect.

This study intends to expand on the previous study and evaluate the outcomes in the context of India. While the UK based study did not find that social media can replicate the impact of face-to-face interventions on behaviour change, replicating the same study in India may lead to diverse results.The marked increase in pro-environmental attitudes and behaviours in recent years on the one hand, and the accelerating dissemination of social media on the other hand, may have changed these relationships and warrant a fresh look at the effectiveness of nudges more generally, and social media interventions in particular. In addition, there are question marks regarding the generalisability of the previous UK-centred study to other country contexts. Developed and emerging economy contexts may differ significantly regarding pro-environmental attitudes and behaviours, (social) media consumption and the role of the highly visible companies in their potential to nudge consumer behaviour. For this reason, we propose to replicate and extend the UK-based study, testing the same set of behaviour change interventions in an Indian setting.

The previous case organisation

The UK study was conducted with Asda Ltd. which is one of Britain's leading retailers. It has over 180,000 employees serving customers from 600 stores, including 32 Supercentres, 409 Superstores, 27 Asda Living stores, 148 Supermarkets, 3 Home Shopping Centres and 14 Petrol Filling Stations. Asda serves over 18 million shoppers a week in store and its growing home shopping business at Asda became part of Walmart in 1999 (Asda, 2013). Concerning sustainability, Asda takes the lead from their parent company, Walmart. This project was started following customer surveys of Asda's customers that revealed that customers not only want Asda to reduce food waste in its own and supply chain practices but also help them in this context (Asda, 2013). Hence, their customers gave the supermarket the permission to influence behaviour in the home but only on food related issues.

Similar to the UK model, the research study to be conducted in India will require partnering with leading retail brands within the country such as Reliance, Future group, Aditya Birla Group of Retail Stores etc. Using the consumer base and reach of these leading retail brands, the study aims to evaluate the effectiveness of social media a medium to induce changes in individual behaviour.

Food waste interventions

Three one-off interventions had been deemed to be practical and effective for impacting and measuring behaviour for the UK based study. These interventions were designed following a qualitative feasibility assessment of a range of intervention types was conducted against Asda's customer communication channels (magazine, social media, e-newsletter, in-store radio, in-store posters, on products, national media advertising or through local community initiatives). The intervention approaches were discussed within the research team and Asda's sustainability and marketing teams and a shortlist of interventions was developed. This shortlist was then circulated by Asda to gain insight internally and externally. In India's context, our aim is to conduct an equivalent exercise with the partner retailer to identify the most effective interventions that can be used to influence consumer behaviours within their networks.

The set of interventions that was used as part of the UK study is highlighted below, identified as part of the initial deliberation and evaluation exercise with Asda. Once similar deliberations are conducted with the retailers in India, various social media platforms may be utilised for communicating with the consumer base.

Information intervention 1: Asda magazine

Asda Magazine is distributed to 1.9 million readers every month. It is made available to customers in Asda stores as well as online; thus, it can be read both physically and remotely. This intervention consisted of publishing a featured article that provided expert tips to cut down household food waste and provided tips for reducing the waste of specific foods.

Information intervention 2: Asda e-newsletter

The Asda e-newsletter is circulated every two weeks and has a readership of 1.4 million customers. This intervention was circulated once in conjunction with the social media campaign. The e newsletter had two specific features addressing household food waste.

Social influence intervention: Asda Facebook pages

This intervention was designed utilise the success of the interaction element of 'face to face' interaction from previous social influence interventions (Abrahamse and Steg, 2013). The aim was to facilitate discussion among customers on Asda's Facebook site which has 1.4 million 'likes'. Utilising Asda's social media group, this intervention consisted of posting a 'leftovers' campaign on Facebook (shown in Fig. S3 in the electronic Supplementary materials). This campaign asked Asda customers to submit their favourite recipes that involved using leftover food and directed users to a website providing 'Love Food, Hate Waste' tips from WRAP on reducing food waste at home (LoveFoodHateWaste, 2015). The objective of this intervention was to encourage the use of leftover food in the households.

Given that data collection for the previous study had been conducted in 2016, Facebook was selected as the social media platform of choice. In the meantime, however, various other platforms such as Instagram and Twitter have reached user numbers that make them suitable to be utilised for consumer outreach. The selected retail partner must have a substantial social media presence for the interventions to be successful.

Testing Plan

The aim of the proposed research is to replicate the previous UK based study in an Indian setting. Depending on the characteristics of the Indian retailer and its consumer base, the set of interventions, the data that we will be able to collect, different statistical analysis approaches will be suitable. At a minimum, one-way repeated ANOVA tests will be used to measure the significance of interventions. More comprehensive data at the level of consumers would enable the use of more

advanced modelling. Regarding sample size, the aim is to at least match the sample employed in the UK based study (n = 2,018 matching responses over the duration of the project).

An online questionnaire will be used to measure stated behaviour change at three points in time, (1) one month before the intervention, (2) two weeks after the intervention, and (3) five months after the intervention. For the online questionnaire, the aim is to build on the set of questions that had initially been developed by WRAP (2013) and been adapted in the context of the UK based study. As far as possible, the same items as used in the previous UK based study will be used in order to ensure a sufficient degree of comparability. At the same time, it will be important to actively agree on a set of questions with the retailer that are adapted to the Indian context, thus ruling out the possibility that particular idiosyncrasies of the Indian market impact results and comparability. The degree to which consumers engage in food waste behaviours will most likely be measured using two items, including frequency and quantity. Frequency of waste may be measured by asking consumers "How regularly do you think food is thrown away in your household (e.g. as a result of cooking too much or food spoiling)?" Responses will be given on a five-point Likert scale (1 = Never, 5 = Most mealtimes). The quantity of foods wasted can be measured by asking, "Over the past week have you thrown out any of the following items? Please select all that apply". Participants will indicate the types of foods wasted from nine product categories including: fruit, vegetables, salad, bakery, dairy, meat and poultry, seafood, drinks, and other. These will be summed to provide an index of food quantity wasted.

We are aware of a number of limitations affecting our research design. The main limitation of the approach is that we need to rely on self-reported food waste behaviour from customers, which is known to be a pragmatic but relatively imprecise measure of actual waste behaviour compared to e.g. compositional food waste analysis (Graham-Rowe et al., 2014). In an ideal world, we would analyse the contents of household waste bins as in other studies that have employed much smaller samples (Hanssen et al., 2016; WRAP, 2013), but doing this for a large-scale sample as needed in this study would not be financially feasible. Other measurement tools such as interviews and food diaries have been discussed in the literature (Langley et al., 2010; Sharp et al., 2010) but have shown mixed results. In addition, more time- and resource-intensive approaches would carry the risk of discouraging mainstream customers (as opposed to highly motivated green customers) to engage in the project, therefore introducing non-response bias. In order to minimize this type of sampling bias, we are therefore planning to conduct online questionnaires, which have been successfully used in other household waste studies (Dhokhikah et al., 2015; Graham-Rowe et al., 2015; Liu et al., 2015). Another point to consider is that replicating the research design used for the previous UK based study is necessary to ensure a sufficient degree of comparability.

Conclusion

The baseline study conducted with Asda in the UK was amongst the first studies to implement and measure the impact of food waste reduction interventions that have potential to reach up to 18 million supermarket customers. This is important for the research area of behaviour change interventions as it shows how effective (or not) interventions are in the noise of real life such as in a competitive supermarket environment. Whilst theoretically sound and performing better than information interventions under laboratory conditions, our previous field-based results showed that social media interventions did not perform differently from the other intervention types. Crucially, none of the three interventions we tested in the field managed to perform better than the control group. However, there are two major aspects that warrant an update and extension of this study. First, field research for the previous study was conducted in 2014. Given the marked increase in pro-environmental attitudes and behaviours on the one hand, and the accelerating dissemination of social media on the other hand, the effectiveness of nudges more generally, and social media interventions in particular, may have changed in the meantime. Second, there are question marks regarding the generalisability of prior findings for other country contexts. Developed and emerging economy contexts may differ significantly regarding pro-environmental attitudes and behaviours, (social) media consumption and the role of the highly visible companies in this context.

Hence, we propose to replicate the interventions used with Asda in an Indian context, in order to update and extend the previous study. This will enable a cross country comparison over a defined period, and add a longitudinal dimension to the previous research design. Interventions in India will also enrich the study with perspectives from a low - and middle - income country (LMIC) and the potential of social media as a replacement for face-to-face interventions within the LMIC geographical context. It may also be possible that administering the interventions in India may lead to identical results. However, in order to understand and identify the potential mechanisms that may lead to a reduction in food waste globally, it is essential that cross border research is conducted. Both the temporal dimension and the international comparative dimension will improve our understanding of behaviour nudges and have the potential to support the design of more effective behaviour change interventions in the future.

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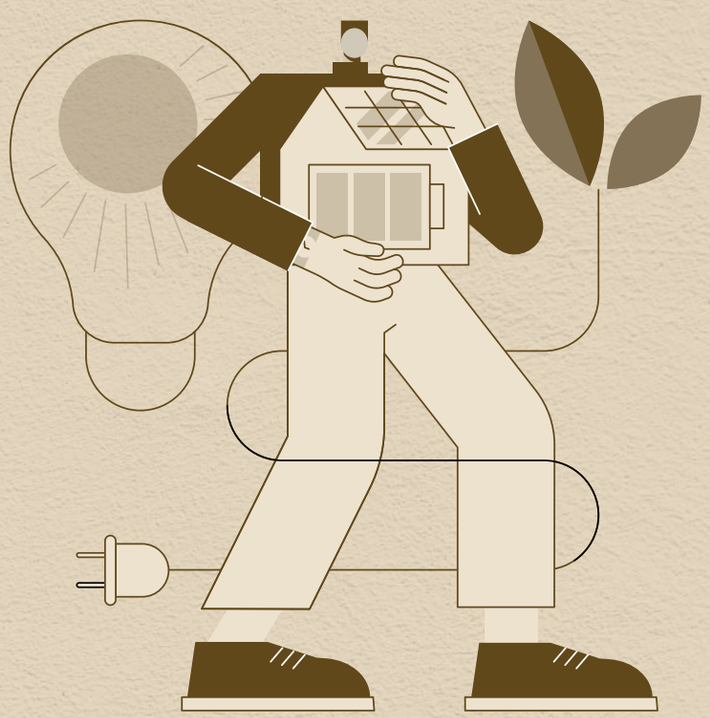
“Our planet is one but our efforts have to be many. One earth, many efforts.”

Shri Narendra Modi
Prime Minister



CHANGING THE HOTEL ROOM CLEANING DEFAULT TO SAVE ELECTRICITY, WATER AND CLEANING CHEMICALS WITHOUT REDUCING GUEST SATISFACTION

Sara Dolnicar, Ljubica Knezevic Cvelbar** and Bettina Grun****

* University of Queensland
** University of Ljubljana
*** Wirtschaftsuniversität Wien

Abstract

We will work with the tourism business and test the effectiveness of a classic nudging intervention that aims to entice tourists to voluntarily waive their daily (and often unnecessary) hotel room cleaning. We will build on one of our studies where we show that we can successfully and substantially – by more than 70 per cent - reduce daily routine room cleaning by changing the default model offered to guests. The result is a win-win situation where the hotel saves money because they pay less for energy, water and cleaning chemicals, and the environment wins because we reduce environmental harm.

Problem Statement

The overarching problem: the risk of irreversible global heating

On 7.11.2022, the UN Secretary-General declared that we are *"on a highway to climate hell with our foot still on the accelerator".* To avoid irreversible heating, emissions must "be reduced by 43 per cent by 2030" (United Nations, 2022). Changing behaviour is essential to climate mitigation: *"Emissions can be substantially lowered through changes in consumption patterns, adoption of energy savings measures, dietary change and reduction in food waste"* (IPCC, 2014, p. 29).

The methodological problem: lack of field experimentation

Social scientists know how to influence behaviour, but the wealth of social science knowledge is currently not being leveraged (1) because different types of behavioural change interventions are not being developed quickly enough for the full range of behaviours that need to change and (2) because most studies rely solely on survey studies, although it is well understood that self-reported pro-environmental behaviour substantially overestimates actual behaviour. A study by Dolnicar shows, for example, that 60 per cent of tourists say they book eco-certified tours, but only 14 per cent do (Karlsson & Dolnicar 2016). A meta-analysis of the association of self-reported and actual pro-environmental behaviours concludes that *"79 per cent of the variance … remains unexplained … possibly leading researchers to draw misleading conclusions about the usefulness of theories"* (Kormos & Gifford, 2014, p. 357). Objective measures are urgently needed to be able to measure the actual impact of behaviour change interventions. Finally,` (3) empirical testing of new behavioural change interventions has to involve experimental field studies to ensure conclusions are valid and enable reliable recommendations to be given to industry on which effective practical measures can be implemented.

Sector-specific problem: tourism contributes 8 per cent to global emissions

Tourism is responsible for 8 per cent of global CO_2 emissions (Lenzen et al., 2018) and 22 per cent of global transport emissions (UNWTO & ITF, 2019). The outlook for these figures is not positive. By 2030, tourism is forecasted to increase total CO_2 emissions by 25 per cent and international transport related emissions by 45 per cent (UNWTO & IFT, 2019). The tourism industry, therefore, is an important sector in which behaviour change for climate change mitigation must be achieved without delay.

The specific problem addressed with this proposal

"Hotel room cleaning is one of the areas where hotels are trying to change their service provision. While these initiatives may be driven primarily by cost saving potential, they still imply a significant reduction in the environmental burden of hotel operations. A number of low-cost hotels have already changed the way they operate: instead of providing routine daily room cleaning – which uses some 35 litres of water, 100 ml of chemicals, 1.5 kWh of electricity in a four-star hotel (Dolnicar, Cvelbar and Grün 2017) – they do not by default clean rooms daily, but ask hotel guests whether they want their room cleaned at an additional fee. Even luxury hotels are making attempts to reduce daily hotel room cleaning. These hotels entice their guests to actively opt out and waive room cleans. Sheraton Hotels, for example, reward hotel guests with points in their Starwood Loyalty program "Make A Green Choice" and beverage gift cards worth $5 if they opt out of their daily room cleaning. Similar incentive-based programs have since been rolled out in a number of luxury hotels" (source: Knezevic Cvelbar, Grün & Dolnicar, 2019). The idea of trying to entice guests to waive their room cleaning voluntarily is not new. But established approaches used by hotels include rewarding tourists for the cheaper and more environmentally friendly option with a drinks voucher or a refund. Our approach is better because it avoids this extra cost for the hotel.

Literature Review[1]

"The theoretical concept at the centre of this study is that of defaults. The default option is defined as behaviour requiring "no action with regard to particular choice opportunity" (Davidai, Gilovich and Ross 2012, 15201). Defaults represent the status quo. Defaults are easy to follow because they require less physical, cognitive and emotional costs (Johnson and Goldstein 2003). The case of organ donation rates provides a good illustration of the effectiveness of defaults: in Austria, 99 per cent of people are potential donors of organs. In Germany, only 12 per cent are (Johnson and Goldstein 2003). This difference in organ donation between two European countries with similar cultural and economic backgrounds is due to defaults. Austria assumes that people will donate their organs in case they die. If they do not want to donate their organs, they need to declare this preference proactively. Organ donation is the default. Germany assumes that people do not wish to donate their organs unless they give explicit consent. People have to opt in proactively (Abadie and Gay 2006). The difference in defaults explains the 87 percentage points higher organ donation level in Austria.

Causing environmental damage in the tourism context is, in some ways, similar to donating organs. When we drive a car, organ donation is not at the top of our minds. When we go on vacation, we do not primarily think about climate change and how we can keep environmental damage to a minimum. Tourists do not make active decisions to harm the environment. Rather, some of the harm done to the environment by the tourism industry is only a consequence of the defaults offered to tourists (Sunstein and Reisch 2013). Changing default options can change human behaviour (Leonard 2008) and has been specifically recommended as a promising climate change mitigation strategy (Girod, van Vuuren and Hertwich 2014). Empirical proof of the effectiveness of changing defaults was provided in a number of empirical studies across a range of human behaviours including, as mentioned above, organ donation (Abadie and Gay 2006; Johnson and Goldstein 2004; Leonard 2008); money donations to charities (Everett, Caviola, Kahane, Savulescu and Faber 2015); selection of health insurance plans (Samuelson and Zeckhauser 1988); and suing as a consequence of a car accident (Johnson, Hershey, Meszaros and Kunreuther 1993).

The concept of the default stems from libertarian paternalism. Libertarian paternalism is a philosophy introduced to the economic literature by Sunstein and Thaler (2003). Paternalism is "interference with a person's liberty of action justified by reasons referring exclusively to the welfare, good, happiness, needs, interests, or values of the person being coerced" (Dworkin, 1971). Sunstein and Thaler (2003) added "libertarian" to emphasise that these choices are "enlisted in the interest of vulnerable third parties" (2003, 1162), advocating that public and private institutions should direct people's choices to increase their welfare without eliminating their freedom of choice. This can be achieved through choice architecture. Choice architecture organises the situational context in which people display specific behaviours (Thaler and Sunstein 2008).

Defaults are believed to be effective for three reasons (Smith, Goldstein and Johnson 2009): implied endorsement, cognitive bias, and effort. Implied endorsement means that people interpret defaults as recommended action by policymakers (McKenzie, Liersch and Finkelstein 2006). They assume that most people will therefore choose this option (Thaler and Sunstein 2003), making it a good one. Cognitive bias means that people take the defaults for granted and worry they may experience loss by not behaving in line with the default (Smith, Goldstein and Johnson 2009). Effort means that people tend to take the path of least resistance. The default option is, by definition, the path of least resistance, requiring minimum effort (Smith, Goldstein and Johnson 2013).

Using changes in defaults to direct people's behaviour has been criticised as limiting freedom of choice (Mitchell 2004). Concerns have also been raised about policy makers using changes in defaults without increasing the wellbeing of individuals, thus violating consumer autonomy through manipulation (Smith and Goldstein 2007). Google Play is one example: Google Play dominates the market of Android app stores. Google allowed Android phone and tablet manufacturers to put the Google Play app on their devices under the condition that they include Google search as the default search option, making Chrome the default browser.

Consumers were not forced to use Chrome, but only one in 10 users downloaded an alternative browser and only one in 100 downloaded an alternative search app. The European Commission fined Google in 2018 for abuse of a dominant market position and misuse of default options (EC 2018).

[1]This section was previously published by Knezevic Cvelbar, Grün & Dolnicar (2019). A full reference list can be found in the original paper.

Whether used to improve or reduce welfare, modifying default options changes human behaviour (Leonard 2008), and represents a promising approach for climate change mitigation (Girod, van Vuuren and Hertwich 2014). Green default options can increase human welfare and help save the environment for future generations. An example of a green default is German consumers' increased willingness to pay for expensive green energy when it is the default: 99 per cent residents in Schönau in Germany – where green energy is supplied by default – use electricity from green sources. In a similar city with a grey energy supply as default, only 1 per cent of citizens chose green energy (Kaenzig, Heinzle and Wüstenhagen 2013).

In tourism, green defaults are not the norm. Some of the negative environmental consequences of tourism result from industry defaults (Sunstein and Reisch 2013). In hotels, for example, daily room cleans still represents the default. Hotels provide guests with soaps, shampoos, conditioners and lotions in one-way containers by default. Hotels offer large breakfast buffets by default, and they stack large numbers of pool towels by default, suggesting that guests are welcome to use as many towels as they please.

To the best of the authors' knowledge, only one academic study has investigated the effect of defaults in tourism to date. Araña and León (2013) tested whether an opting-in or an opting-out model of carbon offsetting for flights is more effective. Typically, passengers are informed about the CO_2 emissions their flight causes, and invited to voluntarily pay to offset them (opt-in default). Alternatively, the carbon offset amount can be built into the price, with passengers having the possibility of opting out to avoid paying the additional cost (opt-out default). These two default conditions were compared from 2009 to 2011 for 1,680 attendees of conventions and conferences in Gran Canaria. Carbon offsets were higher under the opt-out condition, suggesting that current voluntary carbon offsetting schemes are not optimally designed.

Two other studies provide support that default changes are likely to work, but neither of those studies tested true default manipulation. The study proving that reducing the default buffet breakfast plate size by three centimetres leads to 20 per cent less plate waste (Kallbekken and Sælen 2013) was not strictly speaking a study on defaults, because hotel guests had no choice. They were either provided with the large or with the small plate. If the default was the small plate, guests had no possibility to get a large plate. This intervention, therefore, can be classified as a change in infrastructure rather than in choice architecture. A study testing the effect of placing recycled paper serviettes on breakfast buffet tables instead of – less environmentally friendly – thick cotton serviettes (Dolnicar, Cvelbar and Grün 2018) showed that the change in the service setting reduced cotton serviette use by 95 per cent, but hotel guests were only able to choose both serviette types in one condition. When the cotton serviette was provided, recycled paper serviettes were unavailable, again restricting the full choice of hotel guests. Despite neither of those two studies is fully compliant with the definition of defaults, they do suggest that substantial effects can be achieved by changing service settings, indicating that the study of defaults in the tourism context may be promising.

Much past research has studied the effectiveness of pro-environmental appeals. Such appeals can be verbal or non-verbal communications aiming at motivating people to display a behaviour that does not harm the environment (Bolderdijk, Steg, Geller, Lehman and Postmes 2013; Evans, Maio, Corner, Hodgetts, Ahmed and Hahn 2013). Pro-environmental appeals are designed to activate norms and values or change attitudes, typically using as their theoretical basis norm-activation theory (Schwartz 1977) or value-belief-norm theory (Stern 2000). According to norm activation theory, (Schwartz 1977) people's evaluation of right and wrong is driven by moral considerations. Personal norms mediate situational and personality factors, which – together – drive behaviour. According to Stern's (2000) value-belief-norm theory, environmentally friendly behaviour is a consequence of people's environment-related values, their sense of responsibility for protecting nature, and their personal norms. This theory identified two key beliefs suitable for the development of interventions aimed at behavioural change: awareness of consequences and ascription of responsibility. But Stern's (2000) theory has not been developed for behavioural contexts which are driven primarily by the pursuit of pleasure. While tourists state that they want to reduce the environmental footprint of their vacations, there is not much empirical evidence that they are willing to compromise their holiday enjoyment in view of environmental consequences of their vacation choices (Miller, Rathouse, Scarles, Holmes and Tribe 2010). Consequently, attempts of convincing tourists to behave more environmentally friendly have not proven to be very effective in changing behaviour (Dolnicar, Cvelbar and Grün 2017). In everyday life, many pro-environmental behaviours are habitual (Lavelle, Rau and Fahy 2015). These habits typically cannot be transferred to the vacation context (Barr, Shaw and Coles 2011) because the required infrastructure may not be available, and because vacations are fundamentally about maximising pleasure, not saving the environment. As a consequence, the alignment of people's norms and values with their behaviour may be weaker in the vacation context than it is in everyday life; tourists can forgive

themselves for behaving in environmentally unsustainable ways (Juvan and Dolnicar 2014) that are "socially and morally acceptable by peers of those travelling" (Buckley 2011, p. 1180). As a consequence, people tend to give up habits resulting in positive environmental consequences (Dolnicar and Grün 2009). Not surprisingly therefore, successful interventions of behavioural change developed for the everyday living context (Bolderdijk, Steg, Geller, Lehman and Postmes 2013; Evans et al. 2013; Taufik, Bolderdijk and Steg 2015; van der Linden 2015) fail in tourism (Dolnicar, Cvelbar and Grün, 2019a), and tourists are not able to accurately report their pro-environmental vacation behaviours, typically substantially overestimating it (Karlsson and Dolnicar, 2016). To the best of the authors' knowledge, no studies in the tourism context have proven that altering beliefs influences actual behaviour with environmental consequences. Even in the everyday living context, a recent meta-analysis of 171 academic studies concludes that beliefs are only moderately associated with climate change-related behaviour (Hornsey, Harris, Bain and Fielding 2016)." (source: Knezevic Cvelbar, Grün & Dolnicar, 2019).

Idea Detail

Our proposal aims to contribute to this relatively neglected area of investigation. Specifically, we propose to replicate a field study in India, in which we test whether nudging in the form of a default service provision change is effective in reducing the number of daily hotel cleanings. If so, it may represent a win-win situation where hotels save money and the environment benefits from reduced negative environmental impacts resulting from tourism business operations).

The results from the study have direct practical implications for tourism businesses. If the nudging-based intervention tested is successful, it can immediately be implemented by tourism businesses to save operating costs and reduce their negative impact on the environment.

The specific behaviour that needs to be triggered

Voluntary waiving of daily routine room cleaning in hotels

Target audience for the behaviour

Hotel guests

Behavioural principles used

Nudging

Who will implement the idea and how

Preferably the Low Harm Hedonism Team at The University of Queensland (https://business.uq.edu.au/research/low-harm-hedonism) would team up with colleagues in India who would then implement the idea with one or more interested hotels in India. If no partners in India can be identified, we can also implement this by traveling to the hotels once and then working with them remotely throughout the experiment.

Pre-requisites to the implementation

Full engagement of hotel management, hotel system that captures accurately room cleaning and occupancy, availability of hotel staff to supervise and document implementation, funding for travel of the team to set experiment up on site.

Testing Plan

We would like to test this intervention across several hotels in India that differ in star rating and the guest segments they serve. We will first measure the baseline room cleaning rate for 3 months. We will then change the default room cleaning service model for 3 months and test if an improvement is achieved.

Conclusion

We propose to work with hotels in India to test if implementing a nudging intervention will reduce the number of unnecessary daily routine room cleanings. The number of hotels in India reached 1,702,000 in 2020. If each one of those hotels reduce their carbon emissions as a result of this intervention even only by a small amount, the overall carbon emission reduction achieved across India would be significant.

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APPLYING BEHAVIORAL SCIENCE TO REACH A 1.5 DEGREE FUTURE: REFLECTIONS AND INSIGHT FOR INDIA'S LiFE INITIATIVE

Mindy Hernandez and Bharath Jairaj**

*World Resources Institute

The Challenge

With the launch of LiFE, the Government of India (GoI) is recognising an unsettling truth - by focusing on technical solutions and supply-side challenges for the last 40 years, the climate community has forgotten the human side of the equation, and we have therefore been fighting the climate crisis with one hand tied behind our backs.

The latest report from the Intergovernmental Panel on Climate Change (IPCC) underlines a promising way forward - they estimate that comprehensive behaviour changes have the potential to reduce greenhouse gas emissions by 40–70 per cent by 2050—the same amount as completely eliminating emissions from China, the United States, India, the European Union and Russia combined.

As we imagine a world that is more sustainable and more just, we have a fleeting window of opportunity to learn from mistakes made during the COVID-19 pandemic. Specifically, we have learned with piercing clarity the cost of undervaluing the role of human behaviour in tackling global emergencies. Indeed, when the outgoing Director of the United States' National Institutes of Health (NIH) was recently asked what the NIH could have done differently in their fight against COVID, he said: "Maybe we underinvested in behavioural research." We should not make the same mistake in the climate crisis.

How do we do better as the world, and India specifically, begin to apply behavioural insights to the climate crisis? We lay out six guiding principles below.

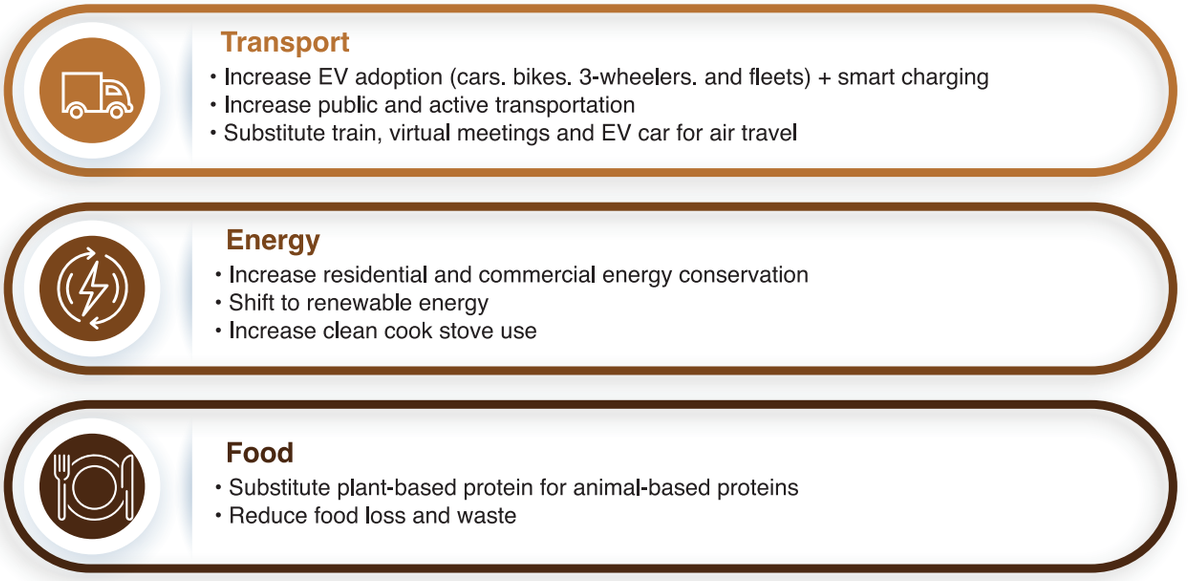
The first four principles focus on how to apply behavioural science broadly, while the last two focus on specific behavioural insights that will be important to leverage as the LiFE movement tackles climate behaviours.

Six Key Principles

Focus on the behaviours that matter most for the people and the planet

At the World Resources Institute, we use the term hotspot behaviours (from The Finnish Independence Fund, Sitra) to describe the most impactful behaviours for planetary and human wellbeing. These include how we eat, how we travel, and how we light and heat our commercial and residential buildings. Each hotspot behaviour has a corresponding resilience behaviour. These are actions that, if adopted at scale, would produce drastic emissions reductions by 2030. See Figure 1.

Figure 1: Eight resilience behaviours



Source: World Resources Institute, 2023

Resilience behaviours have benefits that reach beyond climate. These shifts can produce well-being impacts like food and nutrition security, increased household savings, increased economic opportunities and improved health, especially for those most marginalised.

For example, traditional (non-electric or hybrid) cars are one of the major sources of fine particulate matter (PM2.5) in urban areas. In India, vehicular emissions account for approximately 40 per cent of PM2.5 pollution in major cities. This particulate matter has been linked to a range of negative health impacts, including increased risk of respiratory and cardiovascular diseases and premature death.[1]

In fact, one study estimates that exposure to ambient PM2.5 pollution alone was responsible for 1.67 million premature deaths in India in 2019.[2] Shifting people out of traditional cars is critical to improving health. In an example of what is possible, a study conducted in Bengaluru found that a 10 per cent reduction in vehicular traffic could reduce PM2.5 concentrations by up to 16 per cent, resulting in significant health benefits for the population.[3]

Changing behaviours may be good for people and the planet, but the GoI, like all governments, faces limitations on time, money, and political will. Focusing on high-impact behaviours specifically can result in more efficient and effective use of these resources while achieving significant impact. For example, a recent report by the International Energy Agency found that just four actions – increasing renewable energy, phasing out coal, accelerating electric vehicle adoption, and reducing methane emissions – could achieve 75 per cent of the global emissions reductions needed by 2030 to reach the Paris Agreement goals.[4]

In addition, by prioritising the most impactful behaviours, the GoI can allocate resources to shift these behaviours not only through small pilots but at scale. This approach can lead to significant emissions reductions through the eight key resilience behaviours and create a domino effect, where insights gleaned from these efforts are translated to emissions reductions in other sectors.

Lastly, given India's rapidly growing population and economy, it is critical to prioritise the most impactful behaviours to reduce emissions while still allowing for continued economic growth. Focusing on too many behaviours simultaneously could result in less effective use of resources and slower progress towards achieving India's climate and broader SDG goals.

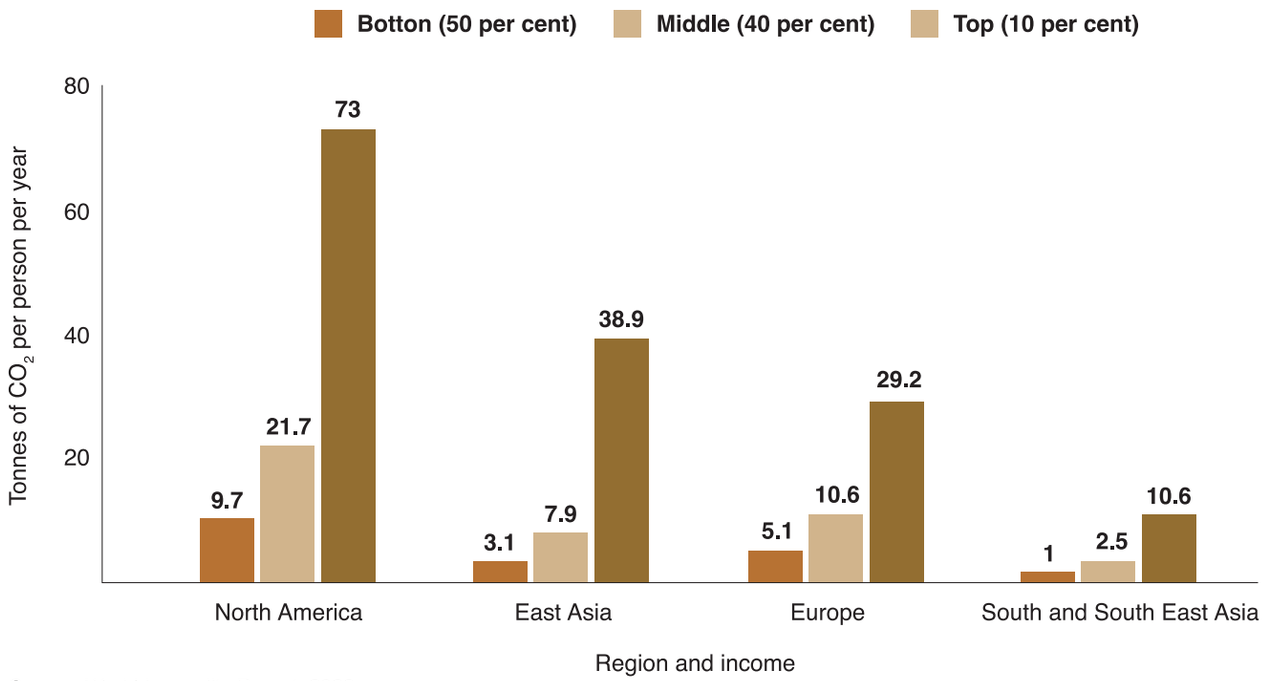
Create a strategy that takes into account regional and socioeconomic differences

The climate crisis is global, but its causes and impacts vary drastically by region and household wealth. Increasing energy efficiency in growing, emerging economies like India is critical, but behaviour change efforts must recognise that significant portions of the population still lack — and need — access to reliable electricity. And while much of the global north can shift away from meat, it is important to recognise that many people around the world need access to more protein, including meat.

Therefore, applied behavioural science needs to take a tailored approach to behaviour change. For example, a focus on decreasing meat eating makes sense in the U.S. and European Union (two of the highest consumers of meat), but not in India.

In addition to a regional approach, we must consider socioeconomic differences. Intra-country emissions vary drastically by income. For example, in South-East Asia, those with incomes in the bottom 50 per cent produce only 1 tonne of CO_2e per person per year. But those with incomes in the top 10 per cent produce 10.6 tonnes per person per year, exactly the same as the average European. (Though still significantly less than the average American.) See Figure 2.

[1]Lelieveld J, Evans JS, Fnais M, Giannadaki D, Pozzer A. The contribution of outdoor air pollution sources to premature mortality on a global scale. Nature. 2015;525(7569):367-371. Available from: https://www.nature.com/articles/nature15371
[2]Pandey, A., Brauer, M., Cropper, M. L., Balakrishnan, K., Mathur, P., Dey, S. Dandona, L. (2021). Health and economic impact of air pollution in the states of India: the Global Burden of Disease Study 2019. The Lancet Planetary Health, 5(1), e25-e38.
[3]Saksena, S., & Shankar, A. (2016). Mitigating urban air pollution: evidence from Bangalore. Environmental Research, 150, 305-317. Available from: https://www.sciencedirect.com/science/article/pii/S0013935116300405
[4]International Energy Agency. (2021). Net Zero by 2050: A Roadmap for the Global Energy Sector. https://www.iea.org/reports/net-zero-by-2050



Source: World Inequality Report, 2022

Figure 2: Per capita emissions across the world, 2019

Tonnes of CO_2 Per Person Per Year, 2019

Behavioural interventions should take income and emissions stratification into account by designing interventions focused on the unique needs and responsibilities of different segments of the population.

For example, decreasing current behaviours (decreasing single occupancy car use, or decreasing home energy use, for example) should be aimed at those who consume the most, the wealthiest. In contrast, for India's emerging middle class, which is expected to swell to encompass 41 per cent of the population by 2025,[5] efforts should focus on shifting consumption behaviours from fossil fuel-based goods to sustainable goods.

This is especially important in the car and mechanical air conditioning space, both of which have been exploding in India roughly in line with the increasing middle class. The passenger car market in India grew by 22 per cent in August 2021 compared to the same month in the previous year.[6] The Indian air conditioner market is anticipated to grow at an average of 6.08 per cent a year from 2023 to 207[7]. Financial incentives, rebates and targeted messaging can help these new consumers pick the most sustainable car and air conditioning options.

Finally, for those living in the bottom 10 per cent of the income scale, efforts should be focused on improving conditions and practices. For example, this might involve policy-level interventions to provide more educational opportunities to young girls since increased education for girls has been shown to decrease fertility rates, which can lead to reductions in emissions.[8] Or it might mean extended infrastructure projects that include electric buses and tuk-tuks that connect people living in poverty with central business districts, thus providing low-emissions access to jobs and opportunities.

[5]Beinhocker, E. D., Farrell, D., & Zainulbhai, A. S. (2007). Tracking the growth of India's middle class. McKinsey Quarterly, 3, 50.
[6]Society of Indian Automobile Manufacturers. (2021). Annual Report 2020-2021.
https://www.siam.in/uploads/filemanager/319SIAMAnnualReport2020-21.pdf
[7]India Air Conditioner Market, By Product Type (Splits, Windows, VRF, Chillers, and Other includes Cassette, Ductable Splits, etc.), By End Use Sector (Residential, Commercial, and Industrial), By Region, Competition, Forecast & Opportunities, 2017-2027. (2022)
[8]World Bank. (2015). Population and Climate Change in India: Exploring the Impacts. Retrieved from
https://openknowledge.worldbank.org/bitstream/handle/10986/22060/9781464804691.pdf?sequence=1&isAllowed=y

Community-level interventions might reflect the fact that almost 54 per cent of Indian households are still either fully reliant on biofuels (like firewood, crop residue, and cow dung) or supplement it with LPG (liquefied petroleum gas). While this represents a significant reduction from previous years, it still means that about half of India's households rely on traditional biomass for cooking, with all of the residual negative health impacts it produces.[9] A resulting intervention might enlist community health workers as messengers who can introduce households to clean cookstoves, thus lowering the barriers to access and information. Adding a financial incentive would also lower the barriers to entry and help move significant portions of the population to sustainable cooking solutions, lowering emissions, deforestation and improving the health of women and girls especially.

Consider how systems and individual change can be mutually reinforcing

Applied behavioural science has been narrowly focused on changing the behaviour of individuals rather than changing the larger policy context that often determines how individuals behave. In the fight against climate change, this focus on the individual is not accidental.

Powerful political and business forces have pushed the narrative that reducing emissions is the role of individuals and not industries or governments. As applied behavioural scientists and policymakers working in this space, we have to be very careful not to perpetuate this narrative.

In a recent paper, two well-known social scientists lay out the challenge this way - the field [of applied behavioural science] has “mistaken deep systemic problems of political economy and conflicts of interest for problems of individual human folly and responsibility.”[10] The article goes on to expose the initial roots of the carbon footprint calculator.

In the midst of the climate wars, British Petroleum, or BP, developed a clever strategy to promote the idea of a personal "carbon footprint." They put out a carbon footprint calculator to help people determine their personal impact on the planet. For BP, the campaign was a resounding success, and individuals, campaigners, media organisations, and government agencies all provided their constituents with access to carbon calculators to help them reduce their impact on the planet.

The implicit message was clear - if people could decrease their personal carbon footprints, then we could collectively reduce the problem of climate change. By framing the issue of carbon reduction as one of individual responsibility, BP encouraged people to focus on their personal actions and overlook the role of broader systems and policy interventions in driving change. This framing ultimately detracted from the need for systemic change.

Individual and systems change do not have to be mutually exclusive; instead, they should be mutually reinforcing. We need to shift downstream individual behaviours as well as the upstream system-level behaviours (e.g., of industry leaders, policymakers, employers) that determine what choices are available to individuals in the first place.

For example, behaviour change can mean “nudging” households to modify diets, reduce flights and use energy more efficiently. But it should not stop at individual actions. The food industry can invest in plant-based meat alternatives, employers can institute flight reduction policies, and policymakers can offer financial incentives to make investing in solar and wind solutions more accessible.

Some work may focus on the individual, but our aim should always be to go bigger — to push for neighbourhoods, workplaces, industry practices and policies that make it easier for people to live healthier, greener lives.

[9]Mani, S., Agarwal, S., Jain, A., & Ganeshan, K. (2021, September). State of Clean Cooking Energy Access in India
[10]Chater, Nick, and George Loewenstein. "The i-Frame and the s-Frame: How Focusing on Individual-Level Solutions Has Led Behavioral Public Policy Astray." Behavioral and Brain Sciences, September 2022, 1-60. doi: 10.1017/S0140525X22002023. PMID: 36059098.

Focus on social justice

Changing the way we live to align with a 1.5-degree future can also move us toward a more equitable world — but only if changes are made intentionally, including a hard look at how historical and structural barriers and inequities impact behaviour. Our failure to tackle bias, discrimination and stigma will sabotage our fight to protect the planet. For example, gender bias can decrease access to education for girls. But, as previously mentioned, education decreases fertility rates, which can decrease emissions. A behaviour change campaign to encourage people to bike, instead of driving or using fossil-fuel based transit, must recognise the state's role in expanding protected bike lanes, which tend to be clustered in only the wealthiest neighbourhoods, to poorer neighbourhoods so that everyone has access.

Behavioural change efforts should also be designed to explore the social impacts of resilience behaviours on health, income, and equity because we know that many behavioural shifts can produce well-being impacts in terms of food and nutrition security, increased household savings, increased economic opportunities and improved health, especially for those most marginalised. By demonstrating that climate actions are not only investments in long-term planetary health but are also near-term investments in the people they serve, we will equip policymakers and industry leaders with the evidence they need to invest in the highest-impact changes.

As mentioned above, while the first four principles focused on how to apply behavioural science broadly, the next two focus on specific behavioural insights that will be important to leverage as the LiFE movement tackles climate behaviours.

Social comparisons, combined with actionable tips, can shift behaviour

From an equity and economic development perspective, it is critical for more households — especially in emerging economies like India — to become electrified and share the advantages that electricity provides with more people. However, electricity use in India is a major contributor to rising greenhouse gas emissions and other externalities (like air pollution) because of the Indian grid's dependence on fossil fuels. To fight this, more must be done to shift to cleaner energy sources and improve energy efficiency.

VidyutRakshaka, a joint project between Technology Informatics and Design Endeavor (TIDE) and WRI India, produced "behaviourally designed" household energy reports that have been found to incentivise more sustainable energy use. The reports compared a home's energy use to that of neighbouring households — because insights from behavioural science tell us that our behaviour is informed by what others do. It also included specific, actionable recommendations to help bring down energy use and costs, such as switching off fans when you leave the room or investing in LED bulbs. Social scientists have found that because people procrastinate on tasks that seem complicated or unclear, simplifying the steps can increase positive behaviours.

The project's findings suggest that receiving these behaviourally informed energy reports decreased energy use by an average of 7 per cent. This may not seem like a lot, but individual actions can add up quickly when expanded to entire populations. If the whole city of Bangalore received these reports, 604 million kilowatts of energy a year would be avoided, and households would save almost $60 million per year.

Similar results have been found with energy audits elsewhere, including in the U.S. and the United Kingdom. Imagine if presenting energy bills this way was the default for all major Indian cities. That would be a structural change built off an understanding of human psychology with the potential for massive and lasting impact.

Small incentives and targeted messages can have big impacts

According to the India State of Environment Report 2021, the transport sector contributed to approximately 7 per cent of India's total greenhouse gas emissions in 2018.[11]

Electric vehicles (EVs) produce half to a third of the emissions of traditional cars per mile and therefore have been embraced as a promising pathway to realizing a 1.5-degree future. However, increased EV adoption poses a new challenge to the world's electrical grids.

Unmanaged charging, the default charging method for most EVs, can lead to peak-time grid overloads and surges in network losses, which are expensive and disruptive to the electric utility and consumers.

Smart charging, or vehicle-grid integration (VGI), is a potential solution that involves controlling the time of charging, power output, direction of power flow, and/or location of charging. For example, instead of everyone in Delhi charging their cars from 6pm-12pm; coordinated charging via VGI would manage charging at varied times, increasing grid stability, avoiding or postponing costly infrastructure upgrades, and smoothing intermittency issues. Going further, utilities can even harness excess energy in an EV's battery to power homes or even commercial buildings. Because utilities see so much value in VGI, they are willing to offer financial incentives to customers for agreeing to participate. Therefore, VGI offers financial savings for current EV consumers and can increase the base of EV consumers by effectively decreasing the cost of ownership.

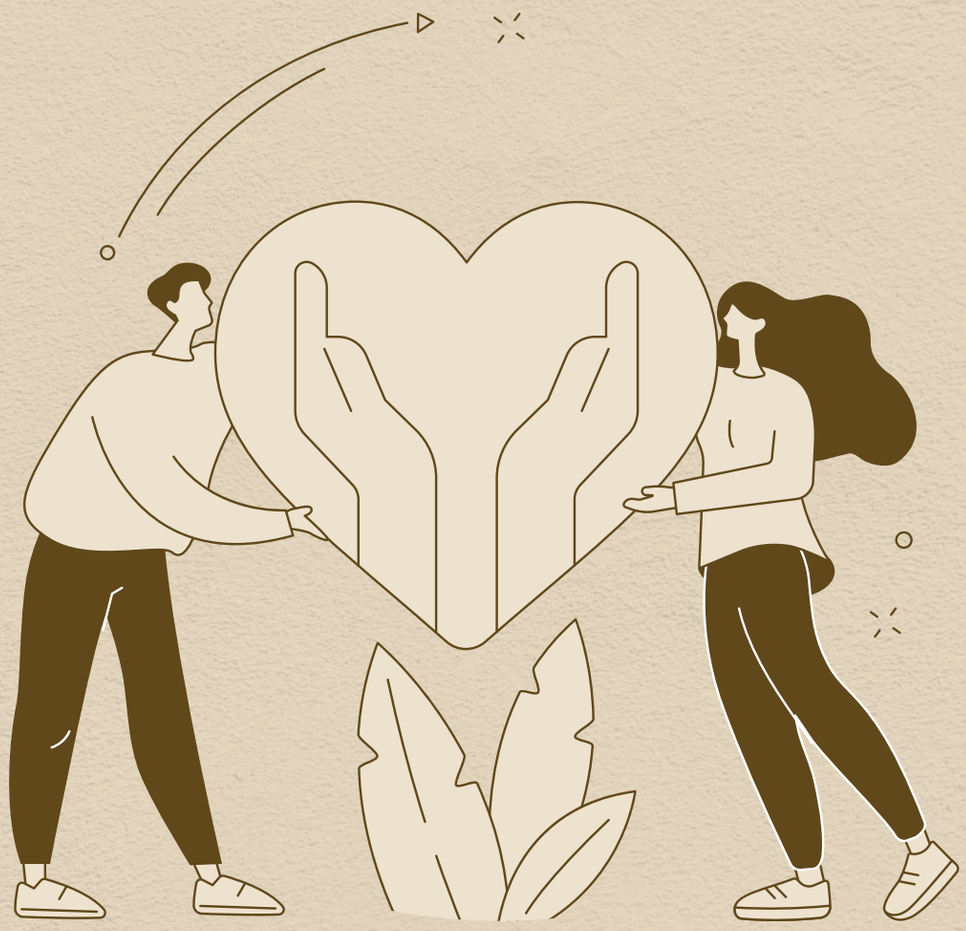
But VGI's success will depend on widespread acceptance by consumers and almost no research has been done on consumer behaviour in this space. It is one of many issues where the behavioural side has been overlooked. To address this gap, WRI partnered with Honda Motor Company in 2021 to survey over 3,000 prospective and current Honda EV customers in the United States. We found that while EV owners are largely wealthy, small incentives make a big difference: interest in participating in VGI increases almost 90 per cent for every $100 incentive increase. With an incentive of $300-$1,000/year, 80-89 per cent of respondents reported being interested in purchasing an EV that can participate in VGI programs.

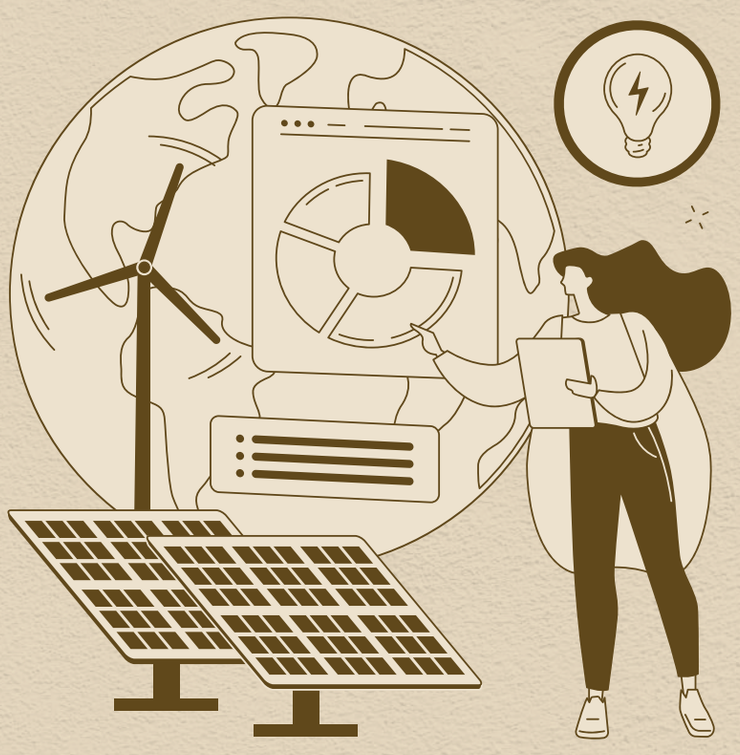
Further, we found that the vast majority of EV owners are concerned with key features of VGI, namely data privacy and battery concerns. But when consumers are given specific messages that VGI can help them save energy, make their cities "greener", and include a financial incentive, we find that more than 85 per cent of respondents ask to be notified of opportunities to participate. This high level of interest, despite reservations, is notable and in accordance with behavioural theories that small changes and incentives can make a big difference.

Conclusion

By leaning into our ambition and optimism to design for the world we want, rather than the one we have, we advance the fight for climate and social justice. Our goal should be to use behavioural sciences as a tool to support the transition toward a more sustainable and equitable India.

[11]Source: "India State of Environment Report 2021", Centre for Science and Environment (CSE), http://www.indiaenvironmentportal.org.in/content/469584/state-of-environment-report-india-2021/





SMART FACES: A DATA ANALYTICS SYSTEM TO NUDGE ENERGY SAVING BEHAVIOURS

Leticia Ozawa-Meida and Graeme Stuart**

*De Montfort University

1. Abstract

This proposal takes a systematic approach to impacting energy usage behaviours, encouraging both proactive and reactive approaches to optimising energy end-use efficiency whilst mitigating behaviours that lead to unnecessary energy waste. Energy usage is often considered invisible, data analytics systems can deliver information which helps individuals and communities become consciously aware of their usage. The primary focus of the proposed pilot is on government schools in India, though the concept is widely applicable across many non-domestic and public buildings.

We propose a pilot project in which an energy data analytics system will be implemented in a small group of 10 primary schools. Around 100 teachers and 10 facility managers will be trained to use the system and to deliver associated awareness campaigns to 3,300 pupils. The structured provision of on demand, timely, and user-friendly information provides a powerful tool for nudging behaviour. The focus is on providing convenient tools for communities of stakeholders (primarily pupils and teachers, but also building managers and those responsible for paying the bills) to monitor usage patterns and to evaluate the impact of steps taken to minimise waste. Establishing a feedback loop between buildings and their users supports a systematic behaviour nudge towards improved efficiency and reduced waste.

This pilot project can very easily be scaled up to much larger projects across thousands of schools and can engage a wider community of stakeholders at the local and state level. The increased capacity of using information to reduce energy consumption and knowledge exchange on energy saving opportunities can support sustainable energy policies in India, such as the roll-out of smart metering on government buildings in urban areas through the "Integrated Power Development Scheme" (IPDS), which is a priority scheme of the Ministry of Power of the Government of India.

2. Problem Statement

In 2021, the building and construction sectors accounted for 34 per cent of the global final energy demand, 9 per cent of this energy demand is related to non-domestic (non-residential) buildings (UNEP and GABC, 2022). Although the energy consumption in non-domestic buildings varies by type of building use and geographical location, in the UK some of the highest consuming building uses of gas are the education sector (9 per cent) and offices (8 per cent), whereas electricity are offices (15 per cent) and warehouses (12 per cent) (BEIS, 2022). Therefore, the focus on non-domestic buildings represents an opportunity to improve energy efficiency and contribute towards zero-emissions, efficient and resilient buildings. Some of the recommendations of the sixth assessment report of the mitigation working group (AR6 WGIII) of the Intergovernmental Panel on Climate Change (IPCC) to reduce barriers for decarbonisation in the building sector are: the provision of information on practices and technologies that can reduce energy demand and increase energy efficiency and changing practices and behaviours to reduce energy wastage and make more efficient use of delivered energy services (UNEP and GABC, 2022, p44).

This proposal is for a systematic approach to mitigating behaviours that lead to energy and water waste in non-domestic buildings and encouraging both proactive and reactive approaches to optimising energy and water end-use efficiency. Waste in this context is defined as energy/water usage which is not intentional and does not contribute to the activities of building users. We are not proposing methods for restricting energy and water usage in general. The focus is on providing convenient tools for communities of stakeholders (primarily building users and wider energy/water management communities) to continually monitor usage patterns and to evaluate the impact of steps taken to minimise waste.

Examples of such waste include (but are not limited to) poorly set controls leading to out of hours usage (e.g. lighting/heating/cooling spaces when unoccupied overnight or on weekends) and other forms of inefficient operation such as spaces kept at high or low temperatures. It can also include uncontrolled equipment being left on or persistent failures such as water leaks causing constant usage.

The impact of the idea in this proposal can be felt at multiple levels. Individuals will be better armed with knowledge of where and how waste often occurs in their place of work. Communities of building users will have access to tools which allow them to become conscious of wasteful behaviours whenever they occur and will gain strategies for identifying and avoiding waste when it does occur. Wider communities of stakeholders will be able to evaluate the impact of changing behaviours on energy and water usage patterns and integrate this knowledge into strategic governance of energy and water usage.

The day-to-day actions of a wide variety of stakeholders have an impact on the energy efficiency of the building stock. The behaviours we are targeting are wasteful behaviours on the part of direct energy users as well as wider communities of practice in organisational settings (e.g. building managers, energy managers). From simple good housekeeping measures such as turning off lights and equipment when not in use, to careful building energy management control setting to avoid wastage. Without visibility of recent usage and historic trends, managing energy usage is virtually impossible.

However, data harvested from metering systems are complex and require expertise to analyse. Our intention is to bridge the gap between the non-expert stakeholder, whose behaviours and decisions are impactful in terms of energy efficiency, and the precise and timely data generated by automated meter reading systems and 'smart meters'. Deploying a user-friendly intermediate which can act as a 'sixth sense' can not only detect energy wastage, but also offer a clear signal for users to interpret unambiguously and present the evidence for wastage in a form which supports further investigation and mitigation. The system acts as a constant reminder that energy is being used and indicates whether action may be required.

3. Literature Review

Energy usage is often considered invisible (Burgess and Nye 2008; Hargreaves et al. 2010). If building users cannot see energy usage, then it is also not easy to see which behaviours and individuals are causing or mitigating wastage. In non-domestic buildings, energy consumption and its effects are largely invisible to building users if the space is comfortable, and equipment is working (Stuart et al., 2013; Goulden and Spence, 2015). In organisational settings, building users usually do not have direct financial incentives to reduce energy use or user motivations for efficiency measures as they do at home because they do not have to pay energy bills and they rarely have access to information regarding their consumption levels and patterns (relative to previous periods) (Carrico and Riemer, 2011).

Previous research has highlighted the usefulness of energy feedback in changing behaviour by 'making energy visible' (Stuart et al., 2013; Hargreaves et al., 2010). The majority of this research has been conducted in the domestic context using direct feedback (smart meters, in-home displays) and indirect feedback (enhanced billing, personal goal setting and feedback) (EEA, 2013). However, less research has been conducted in non-domestic settings.

A key element of energy feedback is the availability of monitoring systems that can make energy and water usage visible to organisations and their staff. Monitoring systems do not save energy or water directly, but they have the potential to improve the efficiency and effectiveness of energy management processes and energy efficiency interventions by making information available that can be readily used.

3.1 Energy feedback, communication, and visualisation

Communication-based campaigns, as one feature of a many-factor energy efficiency intervention, are well suited to encouraging curtailment behaviours, which involve forming habits around switching off unused appliances and turning down thermostats (Gardener and Stern, 2002; Wilson, 2014). This type of contribution to an energy efficiency intervention is underpinned by the idea that more and better information will encourage consumers to conserve energy use (Delmas et al., 2013). Communication campaigns tend to be more successful when they are organised by trusted local partners with messages tailored to the targeted user group and a simple and explicit presentation of the content. This content should be comprehensible for the receivers with interesting and attractive materials and applicable to their situation and their needs (Atkins and Rice, 2013).

Some research combining energy efficiency training or communication campaigns and energy feedback in non-domestic settings has been conducted by Carrico and Riemer (2011), who found that providing monthly feedback via email of historic energy consumption to employees in a U.S. university in combination with peer education (in the form of 'energy coaches') led into a reduction of 8 per cent in energy use. In another university, Dixon et al. (2015) observed a 6.5 per cent reduction in energy use per floor area through the provision of comparative feedback (weekly individualised emails, website updates and posters detailing competition related statistics) during an energy conservation campaign.

A closed feedback loop can be achieved when information from a monitoring system is made available to stakeholders, such as building users, in a way that can influence their actions. When these actions impact building performance, they will feed back into the data collected by the monitoring system and ultimately, back to the user. This feedback loop transforms information into embodied knowledge about how the building responds to different behaviours. This kind of feedback loop can be established for building users only if the monitoring system is sensitive enough to detect the impact of the actions taken and if users of the system are able to interpret the information provided and convert it into action.

Two critical aspects of a robust feedback loop are the effectiveness of the information uptake by users and its conversion into action. Energy data must be transformed into information and presented in a form that is easy to absorb by the target audience. The selection and visualisation of information will determine how accessible the system is and how persuasively it communicates to the user (Francisco et al. 2018; Chalal et al. 2022). Based on the clarity of the information provided and the ability of the user to process this information, the communication can prompt immediate thoughtful behavioural choices or long-term cognitive engagement and enduring behaviour change (Petty & Cacioppo 1986a, 1986b; Darby, 2006; Delmas et al. 2013; Anderson et al. 2017).

By using monitoring and feedback systems, highly engaged users can act as peer educators disseminating their knowledge on energy saving opportunities to colleagues (Carrico & Riemer 2011). Formal and informal networks (communities of practice) can emerge introducing and diffusing new models, concepts and practices, so these can become part of the organisation's culture (Hargrave & Van De Ven 2006). Social norms can be enhanced when users perceive competition of energy performance improvement between buildings (Ozawa-Meida et al. 2017). Competitive approaches (energy reduction competitions) and incentivisation models (gamification) can help to intensify knowledge exchange and participation among building users as well as promoting cooperative behaviour (Vine and Jones 2016). In this way, embodied knowledge can be upgraded to a kind of collective wisdom that can anticipate issues and avoid wasteful behaviours instinctively with clear visibility (via the most engaged community members) of energy usage data.

3.2 Innovative data analytics and visualisation system

Modern smart meter technology can monitor thousands of buildings at high resolution. For example, a standard utility meter in the UK generates a reading every thirty minutes, producing 17,520 data points in a normal year (compared to 12 data points per year in a monthly monitoring system). Data analysis approaches using monthly data have been adapted for use with higher resolution data from smart meters (Stuart et al. 2007). Inverse modelling of historic usage patterns can be used to predict dependent variables based on the values of independent variables (for example, to predict gas usage for a given building based on outside air temperature). Inverse modelling approaches allow for a highly structured and reproducible method for generating predictive energy usage models based on historical usage and weather data (Fels 1986; Kissock et al. 2003).

These models allow for a hypothesis testing approach where the null hypothesis is that a building is continuing to operate as 'normal' (where normal is defined as the prevailing pattern during the last 12 months) and that no special attention is required. By observing the pattern of consumption relative to the forecast produced by an inverse model, it is possible to reject the null hypothesis if consumption patterns diverge in a statistically significant way. Such tools convert data into usable information. By applying this approach to many hundreds of utility datasets on a regular (e.g. half-hourly) basis, it is possible to detect rare events such as water leaks or control failures in a timely manner (i.e. within half an hour).

The SMARTSPACES project (Saving Energy in Europe's Public Buildings Using ICT, EU ICT 297273, 2012–2014) built a prototype system for integrating the perspective of energy managers with responsibilities for large and diverse building portfolios into a user-friendly, non-technical interface (Stuart and Fleming 2014). In this project an evaluation framework was developed and used across 11 European public authorities (Wilson and Stuart, 2014) (see section 6.1). The follow-up EDI-Net project (The Energy Data Innovation Network; EU H2020 695916, 2016–2019) developed the SMARTSPACES concept further and deployed a scalable implementation of the data analytics and visualisation platform in over 1,000 buildings in three large EU public authorities (Stuart and Ozawa-Meida 2020).

This research led to the development of integrated systems including innovative data analytics and visualisations with intuitive and accessible user interfaces. These systems effectively transform raw data into accessible information that can be readily absorbed by users. This supports stakeholder participation in feedback loops in which users learn how their actions can influence their building's energy performance. Being accessible to all users, the system improves communication between stakeholders, fosters collaboration and collective action, encourages peer-to-peer learning and enables effective energy-saving behaviours (Stuart and Ozawa-Meida 2020; Ozawa-Meida et al. 2017).

The DMU data analytics system uses a combination of advanced modelling and analytics (continuously calculated by a data analytics engine) and intuitive visualisations delivered via a user-friendly interface. The modelling approach is described in detail in Stuart and Fleming (2014). The core of the calculation is an inverse model and a unitless performance indicator. The algorithm was originally developed from a prototype designed in the SMARTSPACES EU project. Real-time (e.g. half-hourly) data is continually imported into the system from automated meter reading systems. The data is cleaned and mapped against local weather data drawn from open sources (OpenWeather, 2023). For each building, the system builds a mathematical model which can be used to estimate what is 'normal' usage (gas, water, electricity, heat) from historic data. Each week, a new baseline model is fitted to the latest 12-months of data (i.e a rolling baseline). The baseline model is used to generate a prediction based on current weather conditions. In order to reflect the uncertainty of the baseline model, the model residuals (errors) are analysed to give percentile values (10th, 25th, 75th and 90th) that, when added to the model prediction, represent the 'normal' expected range.

Figure 1 shows the diagnostic report provided by the user-facing interface as a tool for expert users (though it is made available to all users and can be readily interpreted without expert knowledge). In the example, we can see that actual usage (the black line) is roughly in line with the expected levels (it is mostly within the yellow 'normal' zone) during occupied periods and very low (at the low edge of the green 'low' zone) overnight. We can also see that on Friday 25th and the morning of Saturday 26th, usage was higher than expected (in the 'red' zone) during the occupied period.

To present the data in a less technical, more user-friendly and condensed way, the data is reduced to a unitless performance indicator reflecting the 'zone' in which the actual consumption falls. This performance indicator is then visualised as a simple, unambiguous smiley face (see Figure 2). The indicator can be aggregated e.g. per day or per week by taking the simple mean value.

Figure 3 shows the top-level league table interface. League tables show a list of similar buildings (for example, all primary schools) sorted according to the average value of the performance indicator over the last 7 days. Each item shows the building name against smiley faces for each utility plus a larger face calculated by averaging the utilities (i.e., gas, water and electricity).

Figure 1. Example of a diagnostic report of the data analytics system

Figure 2. Electricity usage improvement shown by the Smart faces

Figure 3. Screenshots of the Smart faces dashboard and league tables

This simple format provides users with an overview of current performance across their entire building portfolio and highlights buildings where consumption is higher or lower than past performance suggests is normal. In this way, users can isolate buildings where performance issues are indicated, and trigger highly targeted further investigation armed with high quality data.

4. Idea Detail

4.1 Target audience and specific behaviours to be triggered

Our research has identified that the direct communication and discussion of building energy performance to non-technical users is a significant contributor to support behaviour change and improve energy management through increased cooperation and engagement among users. This engagement can help to decrease excessive energy consumption through the creation of communities of practice or through competitive approaches.

This paper proposes to focus on communication-based awareness and engagement campaigns using the data analytics and visualisation system described in section 4.2 in schools and universities. The freely available web-based dashboards and league tables (user-facing parts of the system) are easily accessed by teachers in schools or by university staff and students, keeping energy savings at the forefront of everybody's minds and facilitating discussion about the performance of their buildings.

Case studies in the European projects have found that teachers welcome monitoring and visualisation tools that can be used in the classrooms to increase environmental awareness with their students (Stuart and Ozawa-Meida, 2020). In Nuremberg (Germany), one teacher mentioned that she uses the smiley faces with young children to highlight how the school uses heat and electricity, while she asks older pupils to evaluate the energy performance of the building through the diagnostic reports. In Leicester (UK), the data analytics system has been used to support training sessions, teachers and business manager meetings, information to schools' governors and meetings with premises officers. Through the tools and training, users have been empowered to understand their consumption. School leaders can review their consumption and compare it to other schools. Teachers can easily show the school's energy performance with students, parents and the wider school community. Students use the data analytics tool to monitor changes that have taken place in the school on a daily basis, and to display the smiley faces on their eco-boards to raise awareness of energy and water savings. These case studies in Leicester and Nuremberg demonstrate the ability of the tool to increase knowledge and understanding of energy efficiency by different communities inside and outside the school settings.

4.2 How and who will implement the idea

Awareness raising and engagement campaigns can run in several ways across municipalities. School teachers can embed energy and environmental campaigns in the curriculum of schools. Teachers and facilities managers can take the role of 'energy coaches', who can help to answer queries about the energy and water use in their buildings and guide staff and students to implement actions to reduce consumption. Energy coaches can also operate as contact points between the building users (teaching staff and school pupils) and the energy and facilities management staff. In this way, energy coaches can enhance not only the technical knowledge of the 'building communities', but also the legitimacy of the learning process.

Comparison of energy performance with other buildings can enhance social norms when users perceive competition among buildings and through the interaction of those who do change behaviour. The league table introduces an implicit competitive element which implies that a building community should aspire to perform well relative to its peers in similar buildings. This creates a fertile ground for engagement activities such as competitions with prizes, rewarding individuals or groups towards energy saving attitudes and behavioural change (Fraternali et al. 2019). Each building has a simple public indicator which shows whether the building is performing at, above or below its 'normal' level of usage for the given period and conditions. If there are opportunities to make savings in a building, then it is very easy to climb the list by taking advantage of the opportunities.

The gamification element of the league tables has proven to be highly engaging and a powerful learning tool for schools, which has the potential to bring about a transformative cultural shift towards more deeply engaged building users (Buchanan et al. 2016). For example, engaging with teachers and pupils in schools to support their efforts to mitigate their own environmental impact can have a cumulative effect on a public authority, impacting on policy. Allowing building users to share their experiences of energy management and collaborate to engage with energy management can ensure interventions achieve maximum impact and are fit for purpose on the ground.

Based on experiences of the SMARTSPACES project (Ozawa-Meida et al. 2017), it is also advisable to conduct periodic "energy savings campaigns" at specific times of the year; for example, campaigns related to heating (cold season), air conditioning or space cooling (hot season) and minimisation of electricity use. In this way, building users can be trained on different energy efficiency measures they could act upon in each campaign and building users can visualise the results of their efforts in terms of energy reductions through the visualisation tool. The visibility and acknowledgement of actual energy and cost savings as a result of the users' efforts for achieving those savings can strengthen the collaboration among building users.

4.3 Prerequisites to the implementation

Although energy efficiency awareness and engagement campaigns can take place using monthly energy/water data (or indeed, no data at all), our proposed idea relies on the establishment of a robust closed feedback loop between buildings and their communities of users. This feedback is established via automatically generated utility meter data.

Such a feedback loop requires a monitoring system sensitive enough to detect the impact of different behaviours (see section 3.1). A data analytics and visualisation system, as described in section 3.2, requires high resolution (i.e. hourly or better) data from automated meter reading (AMR) technology or smart meters that allow utility meters (such as water, gas, heat or electricity meters to generate data automatically and transfer them to a central database where they are analysed and made the information available in the monitoring systems.

Despite smart metering offering several benefits to energy suppliers and consumers, such as collecting information about the energy distribution grids, supporting decentralised generation sources and energy storage devices, and billing the customers according among others, there are several challenges to overcome for a wider deployment of smart meter systems. Even in Europe, where a large-scale roll-out of smart meters strategy is in place, the deployment of smart metering still faces different challenges. For example, limited interoperability of smart meters with energy management systems in Germany; difficulties in obtaining permission to access metering data by various departments in local authorities in France; lack of transparent procedures on metering data exchange in the UK or access to sub hourly metering data only once a month in Spain (Vogt 2018). In developing countries, the deployment of smart meter systems would involve huge budgets to upgrade not only the existing energy infrastructure, but also the communication systems. In addition, the political priorities in these countries to support the deployment of smart metering systems alongside smart grids may be focused more on the supply side to increase energy access to their national populations, reduce high transmission and distribution losses, and decrease illegal connections and power thefts among others (Ponce-Jara et al. 2017).

5. Testing Plan

5.1 Methodology for testing – Evaluation framework

Figure 4 illustrates the recommended evaluation framework and the data collected at each stage during the project. The individual effects are the focus of the baseline and final surveys (green), while the mid-term interviews concentrate on the institutional and social effects (red) (see section 5.1.1). Changes in energy use were also assessed to produce a measure of impact on energy consumption at each city (blue arrows) (see section 5.1.2).

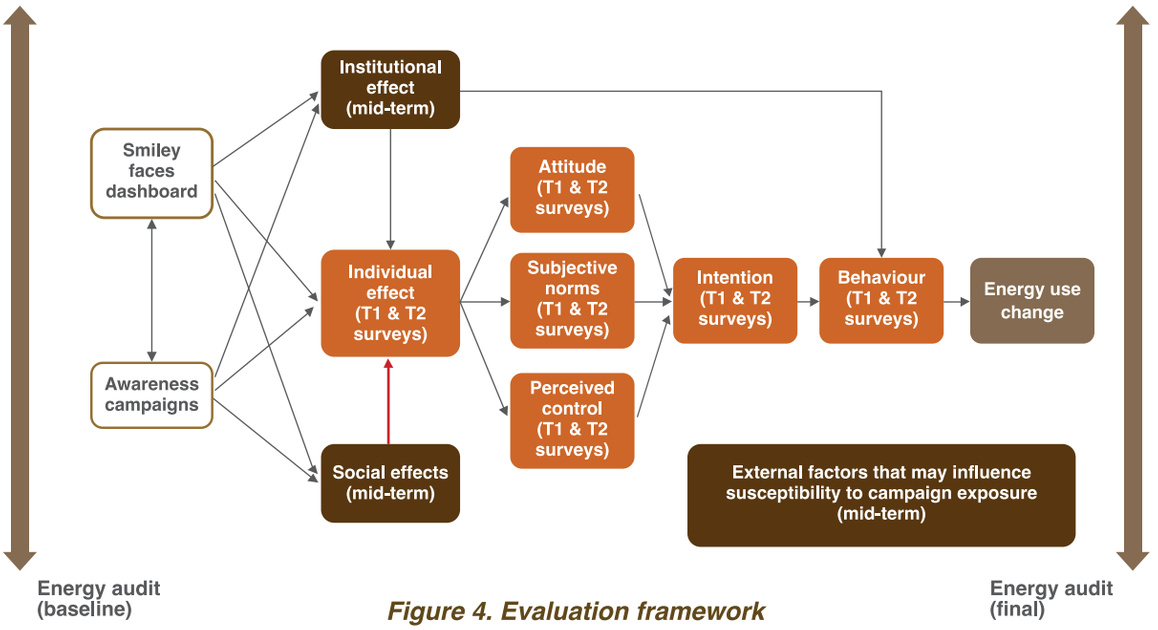


Figure 4. Evaluation framework

5.1.1 Individual, social and institutional effects

To measure the behaviour change impact due to the data analytics system and communication campaigns, the Elaboration Likelihood Model (ELM) is used to understand how communication can influence attitudes. The ELM helps to understand how communication can prompt cognitive engagement by focusing on the recipient's motivation and ability to process information (Petty and Cacioppo, 1986a, 1986b), and also their evaluation of the source and quality of the message (Wilson and Irvine 2013). To track attitude change, the Theory of Planned Behaviour (TPB) is used to examine which attitudes, subjective norms and perceived behavioural controls are most likely to predict intentions and behaviour (Ajzen, 1991, 2011). Further variables are also considered as precursors of attitude change (awareness and knowledge) and initial conditions to engage in energy saving behaviour (Lo et al. 2012; Wilson and Stuart 2014). This theoretical framework is fully described in Wilson (2014).

To assess the individual-level behaviour change, the researchers can conduct a pre-post comparison of attitudes and behaviours of building users using repeated measures. This means that the same participants take part in the ex-ante (T1-baseline) and ex-post (T2- final) surveys. In addition, a control group of participating schools or universities would help justify that observed change was due to the intervention (use of the data analytics tool), and no other external factors.

The variables of the TPB measured in the baseline and final surveys are: *awareness,* to measure the extent that respondents believe that energy use causes serious environmental problems, such as climate change; *knowledge,* to explore the levels that respondents know about how to reduce energy use; *attitude,* to investigate respondents' beliefs about reducing energy; *subjective norms,* to measure the extent that respondents believe that people important to them are taking action to reduce energy use; *perceived behavioural control,* to understand how respondents perceived that reducing energy use is easy or difficult; and *intention to reduce energy,* to ask respondents about their intent to reduce energy use over certain period of time.

In addition to the variables measured in the baseline survey, the final surveys also explore respondents' views about the usefulness of the information provided by the data analytics tool and the awareness campaigns based on the ELM variables (Petty & Cacioppo, 1986a; 1986b). This model examines factors internal to the receiver, such as: the motivation or involvement of users regarding their thoughts towards the ideas or concepts exposed in the messages of the campaigns; their *ability to process* the information on how useful or engaging users find the communication message for them. The model also assesses variables external to the receiver, such as the *perceived quality of the argument* in the message (if the information provided in the tool and campaigns is understandable and clear) and the degree to which users consider that the institutions providing the information are credible, expert and competent.

To elicit factors above the individual level that are difficult to assess in surveys, qualitative data should be gathered allowing for exploration of further impacts at the individual level but also to offer insights into how the project operates at the 'social' and 'institutional' levels. For this part of the evaluation, a series of interviews can capture insights from "key players", such as facilities managers focused on the energy performance of the buildings or teachers implementing the awareness campaigns in schools, who can provide insights of specific situations. Interviews aim to assess how the energy-efficiency communication-based campaigns are actually implemented and to identify differences at each site. Interviews can also provide the opportunity to obtain feedback about how engaged building users are and on whether attitudes to energy and water consumption are changing. By investigating contextual factors as well as other confounding variables, interviews can offer insight into why and how changes in the energy or water consumption take place (Stuart et al., 2015), and also offer triangulation of evidence (Atkins and Rice, 2013).

5.1.2 Energy and water savings

Energy/water savings can be estimated as the difference between the measured sub-hourly data and the consumption forecast during the reporting period. Baseline data for a one-year period (where possible) should be gathered before the intervention(s) and fitted into a statistical model for each building and used to forecast the consumption for the reporting period (duration of the project). The model estimates the buildings' specific base temperatures considering how the buildings respond in the baseline period to fluctuations in outside air temperature. In this way, the model is able to account for seasonal temperature changes (Stuart et al. 2015; Ozawa-Meida et al. 2019).

5.2 Sample size and pre-identified limitations of the testing process

Based on our experience from previous projects in the implementation of the data analytics system and capacity building in public buildings, we propose that this project is tested in government schools within urban areas in States in India where smart metering has been deployed, such as Delhi, or is under implementation, such as Himachal Pradesh, Madhya Pradesh, Punjab, Rajasthan (MoP, 2023).

It would be desirable that the participating schools have access not only to electricity, computer and internet facilities, but also to half-hourly electricity data. According to the 2020-21 Report on Unified District Information System for Education Plus (UDISE+), the majority of government schools in Delhi and Punjab have access to electricity, computer and internet facilities (see Table 1) (MoE, 2021). Access to half-hourly electricity data will need to be further investigated through the State-owned distribution companies and State/UT Power Departments (DISCOMs). Ideally, participating schools should also have at least 12 continuous months of historical data to ensure that the baseline data reflects seasonal effects.

State	Government schools	With functional electricity	With computer facility	With internet facility
Delhi	2,751	2,751 (100 per cent)	2,751 (100 per cent)	2,470 (100 per cent)
Himachal Pradesh	15,391	14,875 (96.7 per cent)	3,760 (24.4 per cent)	2,186 (14.2 per cent)
Madhya Pradesh	99,152	66,144 (66.7 per cent)	6,624 (6.7 per cent)	4,020 (4.1 per cent)
Punjab	19,330	19,330 (100 per cent)	19,279 (99.7 per cent)	19,260 (99.6 per cent)
Rajasthan	68,813	53,967 (78.4 per cent)	22,141 (33.7 per cent)	19,255 (28.0 per cent)

Table 1. Government schools with functional electricity, computer and internet facilities (MoE, 2021)1

This project could initially focus on primary government schools in Delhi (1,635 schools) or in Punjab (12,891 schools). Due to the short term of the pilot project, we suggest that the sample size to evaluate its effectiveness is 10 schools in the treatment group (with access to the data analytics system and awareness campaigns) and 10 schools in the control group (with monthly electricity data only) in the same geographical area.

Despite the sample size being small compared to the target population, the pilot project could train around 100 teachers and 10 facility managers on the use of the data analytics system and associated awareness campaigns delivered to 3,300 pupils in the primary schools of the treatment group.[1]

[1]Estimation based on an approximation of the average number of teachers per school in primary government schools in Delhi (19,304 teachers and 1,635 schools) and its corresponding pupil teacher ratio in primary schools (33) (MoE, 2021).

Based on the lessons learned in this pilot project, the trained teachers and facility managers can become the trainers of staff in other primary schools in the short-term future, while smart metering is being rolled out in more government schools.

6. Conclusions

The overarching aim of this proposal is to mitigate behaviours that lead to energy and water waste in non-domestic buildings through a systematic approach of improving energy information and communication to building managers, staff and building users. The focus is on providing convenient tools for these stakeholders to continually monitor usage patterns and to evaluate the impact of changing behaviours on energy and water usage patterns, with particular emphasis on good housekeeping, such as turning off lights when not in use, and early fault detection rather than large scale investment on energy efficiency technologies.

The project idea is to combine energy feedback with energy efficiency training and communication campaigns in government schools to nudge energy saving behaviours through a closed feedback loop.

The energy feedback will be provided through a data analytics and visualisation system developed by De Montfort University. This system transforms the energy raw data into accessible information presented in an easy-to-interpret format that can be readily absorbed by building users. Through the freely available web-based dashboard and league tables (user-facing parts of the system), teachers, facilities managers and pupils in schools can easily access the energy information, keeping energy savings at the forefront of their minds and facilitating discussion about the performance of their school buildings. The data analytics system can support training sessions with teachers and facilities managers, provide relevant information (e.g. energy costs) to schools' business managers and governors as well as show the energy performance to students, parents and the wider school community.

Communication campaigns tend to be more successful when messages are tailored to the targeted user groups, with a simple and explicit presentation of the content and interesting and attractive materials applicable to the users' situation and needs (Atkins and Rice, 2013). In schools, the simplicity of the data analytics dashboard (both visually and process-wise) has been recognised by staff and pupils. In previous projects, the tool was found to be easy to use and to understand even for the very young students in infant schools (ages 4+). In one primary school in Leicester, the facilities manager considered that the "smiley and sad faces communicate better than words", explaining that children can easily interpret that a sad face means that the school is not performing well. Energy awareness and raising campaigns can be organised by teachers as part of the environmental-related curriculum in schools with young children and older pupils using the smart faces to understand how the school uses energy or the diagnostic reports to evaluate the energy performance of the buildings.

The closed feedback loop can be achieved when the information of the data analytics system is communicated to the building users in a way that can influence their actions. When the actions impact the building performance, then they will feed back into the data collected by the monitoring system and ultimately, back to the user. For example, in a 'switch off' campaign, building users can use the data analytics system to see their energy performance before and after the campaign and observe the benefits of their actions to save energy. These competitive approaches (energy reduction competitions) can help to enhance participation among building users, promote cooperative behaviours and intensify knowledge exchange on energy saving opportunities. Ultimately, the energy information prompts action that supports user participation in feedback loops in which the information is embodied as knowledge of how the system reacts to different actions. The social impacts of transparency and gamification serves to magnify this effect and build collective knowledge via peer-to-peer learning.

Based on the learning from this small-scale project, its implementation could be scaled up to government schools at the city or state level in India alongside the roll-out of smart metering. In the case of Delhi, the expansion to all primary government schools can have an impact on around 19,000 teachers, 1,600 facilities managers and 882,500 students (MoE, 2021). From the capacity building perspective, teachers and facility managers trained in the pilot project can become the trainers of staff in other schools on how to use information derived from the data analytics system to reduce energy consumption in their buildings and exchange knowledge in delivering successful campaigns and sharing best practices. The capacity building and knowledge exchange of larger projects can accelerate the implementation of sustainable energy policies in India, such as the roll out of smart metering on government buildings in urban areas through the "Integrated Power Development Scheme" (IPDS), which is a priority scheme of the Ministry of Power of the Government of India.

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PROMOTING SUSTAINABLE CAMPUS COMMUTE IN INDIA THROUGH THEORY-DRIVEN, CONTEXT-AWARE INTERVENTIONS ON SMARTPHONES

Jan-Dirk Schmöcker*, Satoshi Nakao*, Varsolo Sunio** and Junghwa Kim***

* Kyoto University
** University of Asia and the Pacific (UA&P).
*** Kyonggi University

Abstract

Our objective is to influence students of a university in India to adopt sustainable behaviour in the domain of mobility. Sustainability in mobility means a reduction in habitual trips by private vehicles, and the substitution of such trips by public or active transport. For this purpose, a smartphone application is developed which interacts with Bluetooth low energy (BLE) beacons placed in strategic locations within and outside the university premises, which provide users with localised and tailored information. The conceptual and theoretical underpinnings of the proposed study are based on the previous works of the authors. The design strategies combine gamification, provision of context-aware information and tailoring through stage-based models implemented as smartphone applications. A pilot experiment is conducted in a university setting to demonstrate the effectiveness of the smartphone application to nudge individuals towards environmentally-friendly behaviour. The study can be extended to other settings apart from university campuses such as workplaces.

Problem Statement

Universities can affect the surrounding communities in so many ways, but commuting activities constitute the "single largest impact" that they have on the environment (Rotaris and Danielis, 2015). This is because universities are among the largest trip attractors/generators in a certain community (Rotaris & Danielis, 2015). Transport use is among the top three contributors to a university's ecological footprint (Bonham and Koth, 2010). Given this, the universities are urged to implement travel demand management (TDM) measures as part of their environmental management or sustainability plans (Bhattacharjee et al 1997).

Globally, travel demand management measures have been implemented at several universities. These measures can be classified into economic, physical, legal and information/education. Sunio (2018) conducted a global survey of the TDM measures implemented in 15 universities worldwide (Table 1). From this survey, 12 of the 15 universities (80 per cent) enforced economic measures to reduce car use. These measures are mostly in the form of partial or full subsidies for public transport services (e.g. unlimited access) or an increase of car parking costs. Eight (53 per cent) made physical/technical improvements to encourage use of alternatives, including improvements of existing transit services or provision of new ones (e.g. express and shuttle bus), construction of infrastructure (e.g. cycling networks or reserved lanes), and relocation of parking lots. Five (33 per cent) implemented legal policies, mostly parking restrictions. Only four (27 per cent) carried out education and information campaign (e.g. TravelSmart or Cycle Safe).

Table 1. Travel demand management (TDM) Measures

Category	Examples	per cent of the total N=15
Economic	Unlimited transit access and parking pricing	80 per cent
Physical	Improvement of transport service Infrastructure for cycling/walking	53 per cent
Legal	Parking restriction	33 per cent
Information / Education	TravelSmart and Cycle Safe	27 per cent

Applied to the university setting in a developing country context such as India, Sunio (2018) recommends that among the four types of measures (economic, physical, legal and information/education), the last type — also known as voluntary travel behaviour change (VTBC) programs — may represent the most viable TDM measure for universities in the Global South, since it is not capital-intensive, coercive, nor politically contentious.

Developing a suitable and effective VTBC program, however, is not easy. Traditionally, in these programs, participants of the study are given feedback by the coaches based on their reported travel behaviour. These programs have relied so far mostly on traditional technologies, namely face-to-face communication, regular mail, telephone and email (Fujii and Taniguchi, 2006). This severely limits the potential of these programs for scaling up, since additional resources are needed for wider deployment and implementation (Sunio and Schmocker, 2017). In recent years, the mobile platform has emerged, which has the potential to broaden the applicability of travel demand management programs (Meloni et al, 2015). However, in their review of these so-called mobility behaviour change support systems, Sunio and Schmocker (2017) find that they only have limited effectiveness.

The research problem is thus: *"How do we increase the adoption/use of mobility behaviour change support systems among university students and enhance their effectiveness in changing travel behaviour?"*

Literature Review

In this section, we provide an overview of TDM measures that have been implemented, the insights from these measures, and the critical gaps that can be addressed by future work.

Figure 1 shows the various soft measures implemented as TDM in universities all over the world. The horizontal axis presents the theoretical basis of the interventions, while the vertical axis shows the media platform used to reach the target users.

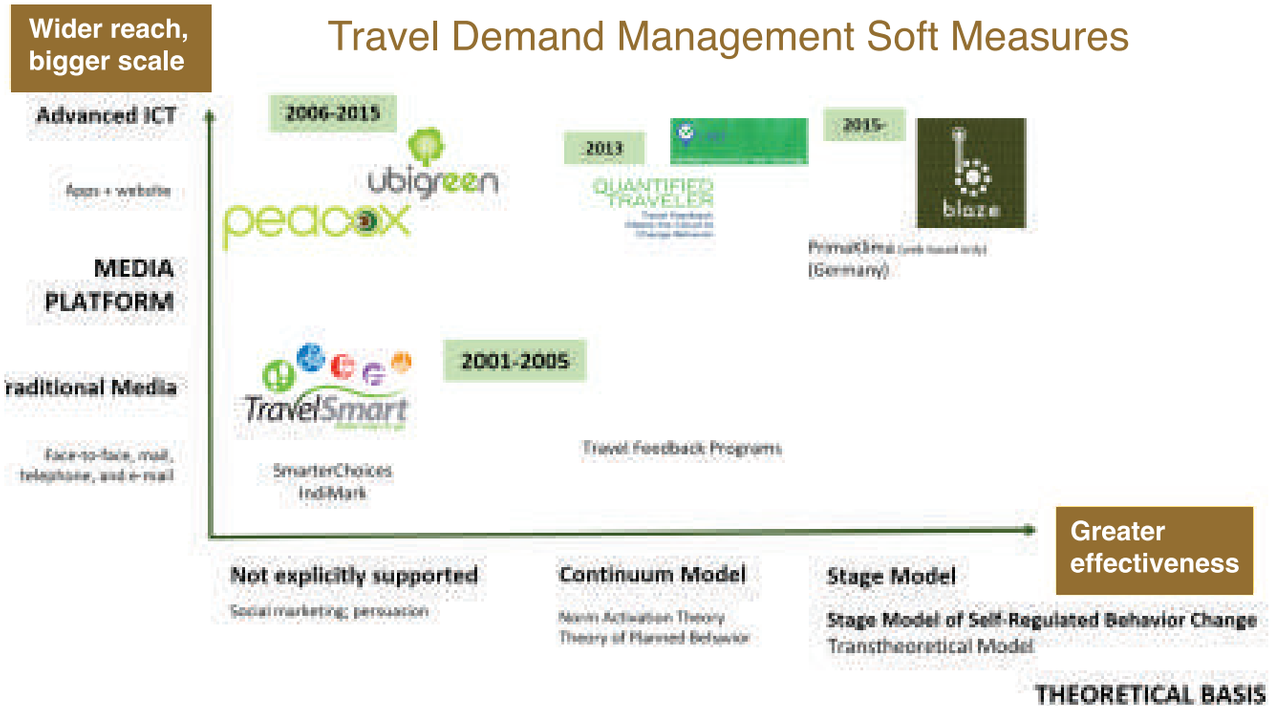

Figure 1. Examples of voluntary behaviour change programs

Sunio and Schmöcker (2017) recommend that for travel behaviour change interventions to increase their effectiveness, they must be designed explicitly based on a theory of behaviour change (e.g., continuum or stage model). Furthermore, for them to improve their reach and scale, they need to be implemented on advanced ICT platforms.

Based on these recommendations, Sunio, Schmöcker and Kim (2018) developed Blaze mobility behaviour change support system (Figure 2) that was piloted, deployed and tested among more than 200 students of the Ateneo de Manila University in Metro Manila, Philippines. Results of the preliminary evaluation indicate a significant effect on changing travel behaviour, albeit with a small effect size.

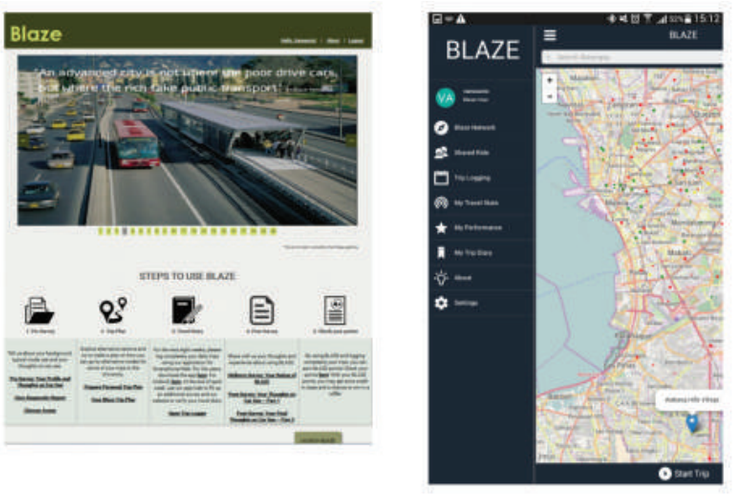

Figure 2. Blaze mobility behaviour change support system

Although Blaze was designed based on the stage model of behaviour change, the delivery of interventions is menu-based (Sunio and Schmöcker, 2019), which is static rather than dynamic. “Static” means that the interventions do not adapt or adjust based on the changes in inputs from the users.

To further improve the effectiveness of smartphone-based applicants targeting behaviour change, below are possible suggestions from the literature:

- Design, develop and deploy dynamic interventions based on the stage model of behaviour change with tailored, localised and context-aware information

Bamberg et al (2015) pointed out that the small effect sizes of travel behaviour change programs may be due to the static nature of the interventions and thus recommended developing dynamic and adaptive interventions based on stage models. These stage-specific interventions can be further personalised and tailored through the provision of localised information (Nakao and Schmöcker, J. D., 2023).

- Exploit the potential of “social identity” in triggering collective action at a larger scale (e.g, Schulte et al, 2020)

Schulte et al (2020) argued that promoting individual behaviour change alone is not enough to tackle societal challenges, and recommended exploiting the power of “social identity” to trigger collective action towards pro-environmental behaviour change (see also Bamberg, Rees, and Seebauer, 2015).

- Implement gamification to further promote the adoption of smartphone applications

The fact that it is quite a challenge to sustain the engagement of the users of smartphone applications is well-known in the literature (Wu et al, 2021). Gamification is one of the ways to sustain or increase user engagement over time, thereby mitigating drop-out and attrition (Timpel et al, 2018).

Despite all these findings in the literature, to the best of our knowledge, there is no mobility behaviour change support system yet that incorporates all these principles in designing and developing the intervention modules.

Idea Detail

The specific behaviour that needs to be triggered includes:

- Mobility (shift away from or reduction in the use of private vehicles)

Target audience for the behaviour or the actor(s) who need to perform the behaviour includes:

- Young people in their 20’s who are familiar with smartphone (or new technology) use in India
- We target young people as influencing this cohort represents a significant potential for long-lasting societal change (c.f. Kim, Schmocker and Fujii, 2016)

Behavioural principles that will be used in informing the idea, if any, include:

- Stage model of behaviour change (Bamberg, 2013) as the theoretical basis for developing dynamic and adaptive behavioural interventions
- Nudging with localised, context-specific information through BLE tags which can further promote the use of the applications through gamification (Nakao and Schmöcker, J. D., 2023)
- Social identity as a resource for large-scale transformation (Schulte et al, 2020)

Who will implement the idea and how:

- A partner university in India
- This university will still have to be identified, but initial candidates include the Indian Institutes of Technology

Prerequisites to the implementation, if any, include:

- Prior to actual deployment and testing, there is a need to develop a smartphone application and install BLE tags within and outside the university.
- Ethics clearance also needs to be secured from relevant authorities, considering the study requires personal data from the users to be collected and analysed

Testing Plan

Variables that will be tested include:

The variables to be measured are based on the stage model of behaviour change (Bamberg, 2013):

- Number of trips by car, by public/active transport
- Progression (regression) along the stages of behavioural change
- Psychological variables of the stage model

Sample size of the study:

- N=400 students (200 students will be assigned to the control group; 200 students to the experimental group)

Methodology for testing:

- Recruitment of students: A survey is administered to measure baseline behaviour
- Assignment of students into control or experimental groups
  - Those in the experimental group will register and use the smartphone application for about 4 months
  - Those in the control group will receive no intervention, but the baseline behaviour and the behaviour after the testing period will be measured so that results can be compared with the experimental group
  - Incentives for participation will be offered
- Four months after the first contact, a second survey will be administered to both in the control and experimental groups

Pre-identified limitations of the testing process include:

- The gold standard for testing the effect of an intervention is randomised control trial (RCT). However, given the limitations of the resources, this testing approach is not always possible. In this study, we plan to conduct the testing, not via randomised control trials (RCTs), but quasi-experimental, which is already acceptable (Bamberg and Rees, 2017).

Conclusion

We aim to develop a mobility behaviour change support system for sustainable commuting to the university campus by students in an Indian university. Our system, implemented as a smartphone application, is designed with dynamic and adaptive intervention modules based on the stage model of behaviour change, supplemented by tailored, context-aware and localised information gathered by Bluetooth low energy (BLE) beacons placed in strategic locations within and outside the university premises. The design strategies combine gamification, provision of context-aware information and tailoring through stage-based models. The (potential) effectiveness of this smartphone application is demonstrated through a pilot experiment conducted with 400 students of a university in India. The proposed study has both theoretical and practical significance. From the viewpoint of the extant literature, this represents a novelty as it applies theory to the development of interventions. From the perspective of policy and practice, this may contribute to the promotion of sustainable travel behaviour through stage-tailored interventions. Designing appropriate interventions is a challenge for policymakers for two reasons.

On the one hand, programs aiming to change individual behaviour are typically delivered by personal coaches who tailor the interventions to the personality of the target participants. The challenge with these programs is that they are hardly scalable due to the additional resource requirements needed. On the other hand, programs which target the population are often 'one-size-fits-all', and thus ineffective because of the lack of personalization and tailoring. The use of stage models is a promising approach to designing individually tailored interventions that can be scaled up at the population level. The study can be extended to other settings apart from university campuses, such as workplaces.

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EATING TO SAVE THE PLANET: EVIDENCE FROM A RANDOMISED CONTROLLED TRIAL USING INDIVIDUAL-LEVEL FOOD PURCHASE DATA

*Joshua Tassoff**

*Claremont Graduate University

Abstract

Meat consumption is a major driver of climate change. Interventions that reduce meat consumption may improve public health and promote environmental sustainability. This proposal looks into an intervention on randomised controlled trials to examine the effects of an awareness-rising that was conducted and studied over 3 years across. This model used a dataset of more than 100,000 meal selections in college dining halls. The intervention investigated evidence on the impacts of information campaigns on meat consumption patterns across colleges/universities/schools. This showed that participants in the treatment group reduced their purchases of meat and increased their purchases of plant-based alternatives after the intervention. The probability of purchasing a meat-based meal fell by 4.6 percentage points ($p < 0.01$), whereas the probability of purchasing a plant-based meal increased by 4.2 percentage points ($p = 0.04$). Our study provides evidence that an intervention based on informing consumers and encouraging voluntary shifts can effectively reduce the demand for meat. Our findings help to inform the international food policy debate on how to counter rising global levels of meat consumption to achieve climate change goals. To our knowledge, our study is the first to assess the effectiveness of an educational intervention to reduce meat consumption using such high-quality data (i.e., individual-level food purchases) over a prolonged period. We aim to conduct this intervention across residential colleges/universities in India to test out previously generated findings that show that informational interventions can be cost effective and generate long-lasting shifts towards more sustainable food options.

Problem Statement

Meat consumption is a major cause of climate change, resulting in roughly 15 per cent of all anthropogenic greenhouse gas (GHG) emissions—more than those from the global transportation sector. However, the considerable environmental externalities of animal agriculture often go unrecognised. Globally, livestock production is one of the leading sources of methane and nitrous oxide, two powerful GHGs, and is responsible for approximately 80 per cent of rainforest deforestation, along with its attendant emissions of carbon dioxide. Meat production pollutes ecosystems via manure and fertiliser runoff, contributes substantially to biodiversity loss through land conversion and ecosystem degradation, and uses vast amounts of scarce resources, such as fresh water and arable land. Projections based on current dietary trends indicate that global meat consumption is likely to double by midcentury, relative to 2005 levels, due to population growth and rising incomes in the developing world.

Amidst these trends, a host of international organisations have warned that the current scale of livestock production is unsustainable and have advocated for shifts towards healthier, plant-based diets to achieve climate change goals. Plants are vastly more efficient than meat, resulting in anywhere from 2× to 167× less CO_2 equivalents per gram of protein produced. In addition, excessive levels of meat consumption, as seen in the developed world, are strongly linked to rising rates of non-communicable diseases (NCDs), such as obesity, heart disease, type-2 diabetes, and some cancers. A recent report from the EAT-Lancet commission, which establishes scientific targets for a global food system capable of supplying healthy and sustainable diets to 10 billion people by 2050, concludes that consumption of plants will need to increase by more than 100 per cent, whereas consumption of meat, in particular red meat, will need to fall by more than 50 per cent. The report also concludes that such a dietary shift would substantially reduce the incidence of chronic diseases and mortality, reflecting a win-win situation for both the environment and public health. Another recent report from the Intergovernmental Panel on Climate Change (IPCC) of the United Nations echoes these recommendations, calling for shifts towards plant-based diets to mitigate climate change.

The urgency of the environmental crisis has prompted a call for increased research on interventions to reduce meat consumption and promote plant-based alternatives. However, little direct evidence exists on the effectiveness of interventions to decrease the demand for meat. Many studies rely on non-randomised designs, limiting causal inferences. In addition, measuring behavioural change is difficult since acquiring high-quality outcome data, such as individual-level food purchase data, is expensive and time consuming. Most existing research has relied on self-reported outcomes, gathered via surveys, food diaries, or selections in virtual settings to gauge the response of consumers—yet; such measures may provide inaccurate indicators of actual behaviour due to recall bias and an inclination among study participants to offer socially desirable responses.

The lack of evidence on whether interventions to reduce meat consumption change actual behaviour fosters global policy

inaction. A widespread, albeit unverified, belief that dietary change away from animal-sourced and towards plant-based foods is too complicated or impractical may be partially responsible for the underinvestment of resources in policies to curb rising worldwide levels of meat consumption. Such beliefs amongst policymakers are unlikely to change in the absence of research that demonstrates behavioural shifts with data on actual food purchases.

Literature Review

There is limited study or papers on similar interventions to reduce meat consumption. Schwitzgebel et al,2023, conducteda study on meat consumption and university students. This was also backed by previous studies that reflect on the impact of ethical messaging and instructions (Schwitzgebel et al. 2020).

Haile et al, 2021, discuss the role of social movements in bringing about shifts in public attitudes and values in the context of the animal advocacy pamphlets on meat consumption. Overall, the lack of evidence on whether interventions to reduce meat consumption change actual behaviour fosters global policy inaction. A widespread, albeit unverified, belief that dietary change away from animal-sourced and towards plant-based foods is too complicated or impractical may be partially responsible for the underinvestment of resources in policies to curb rising worldwide levels of meat consumption (2). Such beliefs amongst policymakers are unlikely to change in the absence of research that demonstrates behavioural shifts with data on actual food purchases. The results hold valuable policy implications. Because it tracks actual behaviour, the findings are more reliable and relevant for policymakers than studies that rely on self-reported outcomes, which may be prone to social desirability and recall bias. The results suggest that the underinvestment of resources in policies to counter rising levels of meat consumption may be a product of the paucity of research on this topic rather than a lack of efficacy. A recent report by Chatham House concludes that governments and other organisations are reluctant to implement policies to reduce meat consumption out of a perception that dietary change is too complicated or impractical (Bailey, 2014). By contrast, the results show that a 50-minute educational intervention caused a long-term substantial reduction in meat consumption. The intervention, which operates via education to encourage voluntary behavioural shifts, is one of the least intrusive measures policymakers and program administrators could adopt to counter rising global levels of meat consumption.

Additionally, international organisations and governments could embark on public awareness raising campaigns to shift demand, similar to 20th century campaigns to reduce tobacco use. Because behavioural shifts may be more likely in settings with readily available alternatives, improvements to the choice architecture in private and public canteens, as many governments have recently undertaken, may be needed, in conjunction with education-based campaigns (Cardoso S, 2018). The intervention fits into a class of policies that influence decisions without restricting choice (Thaler RH, 2003). In contrast to nudges that change the choice architecture to steer decision making, this intervention is a “boost”—a policy designed to foster people’s competencies to make better choices (Hertwig R, 2017). While boosts may require more investment than nudges (e.g. education to select better choices versus repositioning of better options in more accessible locations), boosts may have broader effects by changing behaviour across multiple settings

Idea Detail

Intended Behaviour Change

- Public awareness about the link between meat and global warming.

Target Audience and Actors

- On Campus College students from an Indian University from about 10 classes.

Behavioural Principles Used in Idea

- We designed the intervention based on the findings from two recent Chatham House reports. Chatham House conducted a study in a diverse set of countries (Brazil, China, France, Germany, India, Italy, Japan, Poland, Russia, South Africa, the UK, and the US) and concluded that (1) public awareness about the role of livestock in climate change is low, and messages that emphasise co-benefits of reduced meat consumption (e.g. environmental and health) are more likely to elicit behavioural change than singular messages. Across countries, Chatham House observed that some participants considered meat to be an essential component of a healthy diet and alternative sources of protein to be inadequate—misconceptions that likely need to be addressed before initiating behavioural change.

• In contrast to most other dietary interventions that focus primarily on improving one's own health, our intervention contains a prosocial message that emphasises altruistic motivations: saving the planet. According to our analysis of the mechanisms behind switches in food choices, study participants who reported caring more about climate change responded more strongly to the intervention. Our findings suggest that the treatment largely worked by persuading and motivating people who already cared about global warming to change their behaviour. Those who self-reported to care less or stated they were less knowledgeable exhibited weaker treatment effects. These results indicate that those individuals who already had a nascent interest were more likely to initiate behavioural change. The broader implications of these findings are that individuals with little prior knowledge or interest in the issue may be less likely to respond immediately to awareness-raising interventions.

• However, such interventions may help to push those individuals towards future behavioural change through repeated exposure. For instance, the literature on campaigns to promote smoking cessation suggests that behavioural change is more likely to occur as a result of an accumulation of messaging that raises overall societal awareness and gradually moves consumers toward action.

Implementation Partners

• A partner Indian University (yet to be selected)
We will track students' food purchases over the course of an eight-month academic year, amounting to nearly 50,000 meals or more. Food outcome data come from the cashier registers at the campus dining facilities. All students who live on campus (more than 80 per cent of the student population) are required to have a meal plan, and most students who live off campus also possess a meal plan. Students purchase food at the dining facilities using their meal plan. At the point of purchase, cashiers swipe student ID cards and select one of four buttons that record the type of main entrée: beef, poultry, fish, and veg. Vegetarian and vegan meals, i.e. the "veg" option, are available, alongside meat-based meals, at every food station, providing students with a choice between a plant-based and meat-based option. Meals are a la carte, as opposed to buffet, permitting us to identify participants' food choices. The prices of the meat and veg-based options at each food station are usually equal. The dining facilities are the only locations where students may purchase meals on campus. Survey data come from three surveys. Study participants in both the treatment and control group completed the first survey, which collects demographic characteristics and views about global warming, prior to the intervention. Study participants in the treatment group completed the remaining surveys. The second survey, administered after the intervention, asks participants about dietary intentions and the third survey, administered four weeks after the intervention, asks whether participants changed their diet, along with reasons. Consent forms to students disclosed that participation involved three components: listening to a lecture, completing surveys, and authorising the researchers to analyse data from student ID cards. Students were not made explicitly aware that we would be analysing their food purchase data.

Control and Treatment Groups

• We will randomise ten undergraduate e classes into treatment and control groups. Treatment groups received a 50-minute lecture about how food choices affect climate change, along with information about the health benefits of reduced meat consumption. Control classrooms will receive a lecture on a placebo topic, economic inequality. The same individual will deliver the lectures for both the control and treatment groups. We will analyse students' meal purchases in the college dining halls both before and after the lecture.

The Intervention

• Conduct a soft "awareness-raising" intervention rather than a hard intervention that involves more intrusive measures, in part, because soft interventions, particularly those that focus on education, are likely a necessary first step in the sphere of public policy.

The intervention, including time spent completing surveys, is roughly 55 minutes. We focus the first 25 minutes of the intervention on the role of meat consumption as a driver of climate change. We note that more GHG emissions originate from livestock than from the global transportation sector. We stress three primary reasons: (1) ruminant animals produce methane as a byproduct of the digestive process; (2) the raising of livestock generates nitrous oxide via manure and nitrogen-based

fertilisers used in the cultivation of animal feed; and (3) deforestation to clear land to graze livestock and grow feed releases carbon dioxide, both directly when forests are cut down and indirectly since leveled forests can no longer reabsorb emissions from the atmosphere. We emphasise that the production of meat requires far more resources (land and water) than plant-based alternatives, such as legumes (beans, lentils, peas), and that the GHGs associated with the production of meat from ruminants (cattle, lamb, goat, sheep) are substantially higher than those from non-ruminants (poultry, seafood).

We incorporate a variety of approaches to communicate this information. We show videos of (1) a team of researchers collecting methane, via an inflatable bag, from a feeding cow, (2) manure cesspools from a large hog farm, and (3) the cutting down of forests in Brazil to clear land to graze cattle. We play a four-minute expert podcast interview on the link between meat overconsumption and climate change (18). As an interactive exercise, we present a series of slides in which we ask students to select the meal option, between two choices, that has the lower carbon footprint.

We then pivot to discuss the health benefits of reduced meat consumption for 20 minutes. This portion of the intervention conveys two main messages: (1) While meat contains valuable nutrients, it is not necessary to eat meat if consumers have access to a diversified portfolio of plant-based foods; and (2) The overconsumption of meat, in particular processed and red meat, is linked in the scientific literature to rising rates of NCDs.

We conclude our intervention by (1) reiterating the main message, i.e. the overconsumption of meat is a major driver of climate change and contributes to rising rates of non-communicable diseases in Western countries, and (2) encouraging students to opt for plant-based options. We showcase to students a rich cultural variety by projecting images of plant-based meals from diverse heritages (African, American South, Chinese, Japanese, Jewish, Korean, Latin American and across India). Lastly, we provide students with a handout containing resources, along with a list of plant-based food options at the dining facilities on campus.

Testing Plan

Our plan is to conduct a randomised controlled trial in a university or secondary school environment. We would deliver a guest lecture on the climate-change impact of food choices to the treatment group, and a guest lecture on a neutral topic to the control condition. Critically, we would need an infrastructure for monitoring students' food choice: vegetarian meals versus meat meals. We need to measure students' meal choices, pre-intervention, to establish a baseline level of meat consumption. More data is better, but at least 50 meals per student would be ideal. Then we need to track students' food choices after the intervention. The longer we can track students, the less students we would need to verify that the intervention was effective. In our original study, Jalil, Tasoff, and Vargas-Bustamante (2020), we had 215 students that we tracked over approximately 8 months total.

As far as statistical methods, we would use differences-in-differences estimation, using logit average marginal treatment effects, as in Jalil, Tasoff, and Vargas-Bustamante (2020, 2023). We need the order of 50,000 meal choices or more to have sufficient statistical power to detect the treatment effect.

In spite of the unique nature of the data and the strength of its findings, we acknowledge study limitations. First, our sample consists of college students who may not be representative of the average population. Second, the same individual delivered all guest lectures and the study occurred in a supportive setting. Whether the results would carry over to other situations would likely depend on the design and implementation of the intervention and the availability and price of plant-based options.

Conclusion

The objective of the proposed intervention is to expand on a study that evaluated the impact of informational interventions on individual meat consumption. It builds on prior research that examines the willingness of consumers to reduce their meat consumption in response to awareness-raising messaging (28,29). The findings indicate that dietary change occurred as a result of a 50-minute intervention. Study participants shifted from meat towards plant-based alternatives. The results of the intervention were then evaluated after a period of 3 years, and it was found that the decline in meat consumption persisted over time. This proposal extends the prior research to an Indian context to identify if the results persist when subjected to geographical and demographic variation. Reduction in meat consumption is expected to reduce individual carbon footprint, thereby aligning with the ethos of Mission LiFE introduced by the Government of India. While the initial pilot may be limited to a smaller sample size, if effective, the informational intervention may be scaled across colleges and universities across the country.

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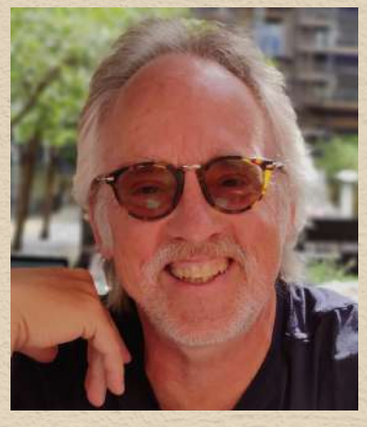
“Let us Act Together.
It is time for Action.”

Shri Narendra Modi
Prime Minister

OUR CONTRIBUTORS

Robert Aunger



Robert Aunger is Associate Professor in Evolutionary Public Health at the London School of Hygiene and Tropical Medicine. He has taught at Northwestern University, the University of Chicago and King's College, Cambridge. He has published books on cultural evolution, the evolution of human behaviour, and ethnographic methods. He is the lead developer of a novel approach to behaviour change called 'Behaviour Centred Design'. He has helped implement public health projects in water, sanitation, hygiene, nutrition and HIV using this approach in multiple countries on the African and Asian continents. He has also consulted on behaviour change for the World Bank, UNICEF, the Global Alliance for Improved Nutrition, Unilever, Procter and Gamble, Kimberly Clark, and GoJo Industries.

Michael Kremer

Michael Kremer directs the Development Innovation Lab at the University of Chicago, where he is a University Professor. His research focuses on innovation, including in education, health, finance, and agriculture in low - and middle - income countries. He has also researched Advance Market Commitments (AMCs) and helped to design the 2009 Pneumococcal AMC. In 2023, Kremer launched a high-level Innovation Commission for Climate Change, Food Security and Agriculture. He is a 2019 Nobel Laureate, a recipient of a MacArthur Fellowship, and a Member of the National Academy of Sciences. He is also the Scientific Director of USAID's Development Innovation Ventures.

Arthur Baker

Arthur Baker is Chief of Staff to Professor Michael Kremer at the Development Innovation Lab at UChicago. He works on topics including water treatment and pandemic preparedness. In 2021 he won an Emergent Ventures Prize for work as part of the Accelerating Health Technologies group on investment in COVID-19 vaccines. Previously he was a Research Associate at the Centre for Global Development, where he researched topics including climate finance, aid effectiveness and aid transparency. Before that, he managed randomised control trials at Innovations for Poverty Action in Sierra Leone, including on election debates and incentives for childhood immunisation.

Imara Salas

Imara Salas is a manager with the Development Innovation Lab (DIL). She is a member of the Secretariat of the Innovation Commission for Climate Change, Food Security and Agriculture, a high-level global Commission led by Michael Kremer. Before DIL, she was a consultant with the World Bank and an applied researcher with the Center for Public Policy in Chile, where she evaluated government programs related to innovation and agriculture. Imara has an MPP from the Harvard Kennedy School and a BSFS in Economics from Georgetown University.

Ganga Shreedhar

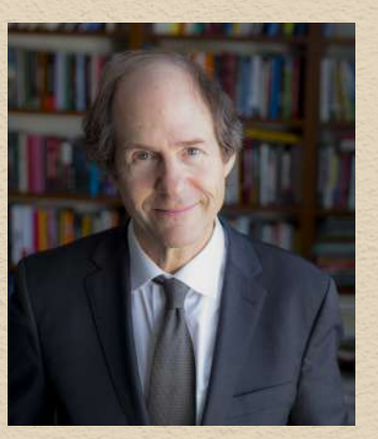
Ganga is an Assistant Professor in Behavioural Science at the London School of Economics and Political Science. She is an applied behavioural and experimental economist studying how to change human behaviour in ways that benefit people and the planet. Her research uses lab and field experiments to study environmental and ecological consumer and citizen motivations and choices and to evaluate the direct and spillover effects of how behavioural interventions.

Kate Laffan

Kate Laffan is an Assistant Professor in Behavioural Science at The London School of Economics and Political Science (LSE) and a Visiting Fellow at University College Dublin. Her research lies at the intersection of psychology and economics and examines the drivers of environmentally significant attitudes and behaviours and how to influence them. In addition, Kate chairs a working group on Applied Behavioural Science for Sustainable Lifestyles as part of the UN's One Planet Network (OPN).

Cass Sunstein

Cass R. Sunstein is currently the Robert Walmsley University Professor at Harvard. He is the founder and director of the Program on Behavioural Economics and Public Policy at Harvard Law School. In 2018, he received the Holberg Prize from the government of Norway. In 2020, the World Health Organization appointed him as Chair of its technical advisory group on Behavioural Insights and Sciences for Health. From 2009 to 2012, he was the Administrator of the White House Office of Information and Regulatory Affairs. After that, he served on the President's Review Board on Intelligence and Communications Technologies and the Pentagon's Defense Innovation Board. He serves as an adviser to the Behavioural Insights Team in the United Kingdom.



Lucia Reisch

Professor Lucia Reisch is a behavioural economist. Her research interests focus on the theory and application of behavioural insights to promote behavioural change in individuals and organisations towards societal welfare and sustainable development. She has two decades of experience with high-level policy consulting on consumer behaviour and policy, including with the EU, the OECD, the UN, the World Bank, and governments worldwide.

Lucia is the inaugural Director of the El-Erian Institute for Behavioural Economics and Policy at Cambridge Judge Business School and the inaugural Professor for Behavioural Economics and Policy for Sustainable Development at the University of Cambridge, UK.

Elena Zinchenko

Elena is an Adjunct Associate Professor of Behavioral Science, Booth School of Business, University of Chicago.

Anant Sudarshan

Anant Sudarshan is a faculty member at the Department of Economics at the University of Warwick and a Senior Fellow at the Energy Policy Institute at the University of Chicago (EPIC). Before joining the University of Warwick, he was the South Asia Director of EPIC and taught at the Harris School of Public Policy at the University of Chicago. He received his PhD in Management Science and Engineering from Stanford University and holds undergraduate and master's degrees in Mechanical Engineering from the Indian Institute of Technology (Delhi) and Stanford University, respectively. His research spans several aspects of energy and environment policy, including the design of environmental regulation, reducing air pollution, climate change, energy efficiency, electricity access, and renewable energy policy.

Ian Ayres

Ian Ayres is a lawyer and an economist. They are the Oscar M. Ruebhausen Professor at Yale Law School and a Professor at Yale's School of Management.
Ian has published 13 books (including the New York Times best-seller Super Crunchers and Ian's latest book, Weapon of Choice) and over 100 articles on various topics. Ian co-founded stickK.com, a website that helps you stick to your goals.
In 2006, Ian was elected to the American Academy of Arts and Sciences. Professor Ayres has been ranked as one of the most prolific and most-cited law professors of their generation.

Ralf Barkemeyer

Ralf Barkemeyer is a Senior Professor of CSR and Director of the Doctoral School at KEDGE Business School. Previously, Ralf held positions at the University of Leeds and Queen's University Belfast, where he received his PhD. His research focuses on the interface of business, environment and society. Among others, he is interested in sustainable consumption, CSR and development, sustainability reporting and sustainability performance assessment. Ralf is Co-Editor-in-Chief of Business Ethics, the Environment & Responsibility (Wiley). He has published in outlets such as the Journal of World Business, Journal of Business Venturing, Ecological Economics, Nature Climate Change, and Business Ethics Quarterly.

William Young

William Young is a Professor of Sustainability and Business at the Sustainability Research Institute, University of Leeds. William is a sustainability behavioural scientist. His research is focused on consumer behaviour around sustainability issues working with retailers, suppliers and consumer organisations. He develops real-world experiments to test behaviour change interventions and then measure the resulting behavioural and sustainability impacts. He also develops theoretical frameworks and applied tools that understand and change consumer behaviour in purchasing and using products. The frameworks and tools use indicators to show measurable reductions in environmental impacts.

Susan Lee

Susan Lee is a Research Fellow within the Consumer Data Research Centre (CDRC) employed by Leeds University Business School at the University of Leeds, focusing on ethical and sustainable consumption. CDRC have major projects such as with the Institute of Grocery Distribution (IGD) and 20 food retailers and manufacturers. In her research, she assesses consumer behaviours through research relating to eco-labelling and the impact of diet on sustainability, greenhouse gas emissions, land and water use, and biodiversity. Her work includes data analysis as well as outreach activities. She is a Fellow of the Royal Meteorological Society.

Sara Dolnicar

Sara Dolnicar holds a Masters's and PhD from the Vienna University of Economics and Business and a Masters's degree in Psychology from the University of Vienna. Sara is best known for her work in improving market segmentation methodology and testing and refining survey measures used in social science research. She has also worked in the areas of environmental volunteering, foster care and public acceptance of water alternatives. Currently, she is focused on developing and testing interventions that trigger pro-environmental behaviour in tourists.

Ljubica Knezevic Cvelbar

Ljubica Kneževic Cvelbar (PhD) is a full professor at the School of Business and Economics, University of Ljubljana and a visiting professor at more than 30 universities worldwide. She holds a PhD in Economics from the University of Ljubljana, while her expertise is in the fields of tourism economics and sustainable development. Ljubica has 15 years of academic and professional experience as a professor, researcher and consultant. She has been involved as a researcher or consultant in more than 70 projects, including European Commission-funded projects, UNDP grants, and research and consulting projects for the national governments of Slovenia, Croatia, Macedonia, and Montenegro. She has published more than 40 papers in refereed tourism journals, including top-tier Journals such are: the Journal of Travel Research, Annals of Tourism Research and Journal of Sustainable Tourism.

Bettina Grun

Bettina Grün is an Assistant Professor at the Institute for Statistics and Mathematics at Wirtschaftsuniversität Wien. She holds a PhD in Applied Mathematics from the Vienna University of Technology and a Venia Docendi in Statistics from the Johannes Kepler Universität Linz. She is interested in improving model-based clustering methodology and implementing statistical software packages for R, an open-source environment for statistical computing and graphics. In addition, she enjoys applying statistical methods in a wide area of applications, including economics and business, to help extract useful information from data.

Mindy Hernandez

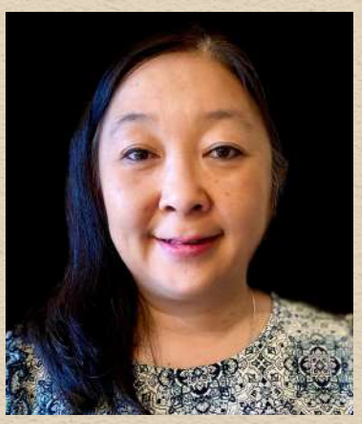
Mindy Hernandez leads The Living Lab for Equitable Climate Action at WRI. As an applied behavioural scientist, she has advised governments, companies, donors, and NGOs worldwide on applying cutting-edge behavioural science to improve programs and policies measurably. Before WRI, Mindy was the liaison to the White House's Social and Behavioural Science Team for the US Agency for International Development and a Senior Researcher with ideas42. Mindy received her undergraduate degree from Cornell University and her Master's in Public Policy from Princeton University.

Bharath Jairaj

Bharath Jairaj is the Executive Director at World Resources Institute India, where he leads the energy program which seeks to inform and catalyse India's energy transition. He was part of the team that developed and implemented Vidyut Rakshaka. Bharath also leads the Energy Governance Practise, which is part of WRI's Equity Centre and serves as a member of UNDP's Global Advisory Group on Energy Governance. Bharath has been involved with multiple initiatives and efforts focused on social inclusion, reducing poverty, improving governance and making cities more equal and sustainable. Bharath has a law degree from the National Law School of India University, a Master in Public Policy from the Lee Kuan Yew School of Public Policy, Singapore and a Master of Laws from the National University of Singapore.

Leticia Ozawa-Meida

Dr Leticia Ozawa-Meida is a Senior Research Fellow at the Institute of Energy and Sustainable Development at De Montfort University. She has worked for over ten years teaching and researching Energy, Climate Change and Sustainable Development. Her research is focused on the estimation and reporting of greenhouse gas emissions at organisational and sectoral levels, public engagement and impact evaluation of digital technologies to improve awareness of energy efficiency and water environmental challenges and the analysis of the integration of sustainable development goals into local climate action plans. Leticia teaches at the postgraduate and undergraduate levels and supervises PhD students.



Graeme Stuart

Dr Graeme Stuart is a Senior Lecturer at the Faculty of Computing, Engineering and Media at De Montfort University. In his PhD, Graeme developed a novel energy data analysis technique for energy management whereby changes in building energy performance are detected and quantified. With broad computer programming skills, Graeme has developed custom energy management software to automate data analysis on a large scale. His research interests include using the Internet of Things, information systems, data analytics and user interface design to harness and support adaptive and emergent solutions to complex problems.

Jan-Dirk Schmöcker

Jan-Dirk Schmöcker is an Associate Professor within the School of Global Engineering and the Department of Urban Management at Kyoto University. He studied at Technical University Berlin, Newcastle University and Imperial College London, where he obtained his PhD. A major longstanding research topic of his is the modelling of passenger behaviour in public transportation networks, including aspects such as fare structures, crowding, bunching and real-time information. Jan-Dirk's current research interests further cover the usage of crowdsourced data for understanding travel behaviour in general and urban tourism in particular. The overall motivation is to induce more sustainable travel patterns within cities.

Varsolo Sunio

Vars is a lecturer and the Chief Research Fellow at the University of Asia and the Pacific (UA&P). He finished a PhD in Urban Management at Kyoto University. He was also a visiting scholar at the University of Tokyo, Japan. Vars had a stint at the Philippines' Department of Transportation, working as part of the Data Science Team. He is also a Research Fellow (for transportation and logistics) at the Department of Science and Technology.

Vars specialises in the reform of public transport systems in the Global South, focusing on digitalisation, electrification, service contracting, governance, justice, and financing.

Junghwa Kim

Junghwa Kim is a professor at Kyonggi University and worked as an associate research fellow at the Korea Research Institute of Human Settlement (KRIHS) in Korea. She completed her PhD in urban management at Kyoto University in 2013. Her current research interests include planning for smart mobility, as well as social and psychological approaches to improving the effectiveness of transport systems. Junghwa specialises in measuring the service quality of public transport systems from a psychological perspective, exploring the correlation between travellers' psychological aspects and their travel behaviour.

Satoshi Nakao

Satoshi Nakao is an Assistant Professor in the Department of Urban Management at Kyoto University. He initially studied at Kyoto University and then graduated from Kyoto University in 2018 with an MSc and PhD in Civil Engineering. Satoshi's main research interest is mobility management to change travel behaviour with a focus on social psychology and a narrative approach. In recent years he also looked at various topics, such as the social acceptance of automated vehicles.

Joshua Tasoff

Joshua Tasoff is an Associate Professor at Claremont Graduate University's Department of Economic Sciences. His research focus is behavioural economics, a subfield of economics that focuses on enriching economic analysis with psychology. He received his PhD in economics from the University of California, Berkeley and his SB from MIT.

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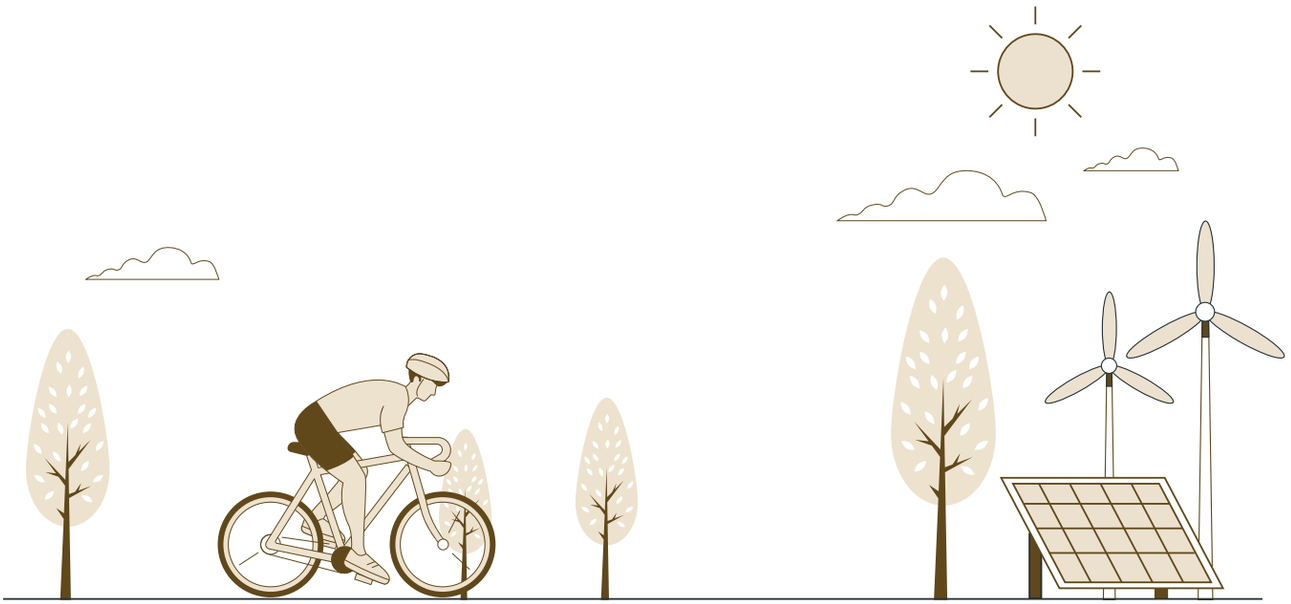


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