



Institute for
Management and
Innovation Review
by Students

ISSUE 4

Technological Innovations for Global Sustainability and Societal Progress

Is Renewable Energy Feeding the Next Financial Crisis?

Displacement, euphoria, and
panic in the energy transition

Blueprint: Bryan Johnson's Protocol for Health and Longevity

Implications of Big Data on the
future of human health



Institute for Management & Innovation
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LETTER FROM EDITORS

Hello!

Thank you for opening our fourth edition of the Institute for Management and Innovation Review by Students (IMIRS). This edition is a unique volume as IMIRS echoes a world post-COVID-19 pandemic - a catastrophic virus that encouraged us to reimagine our human capabilities. As part of 2023 - 2024, our authors reflect on a new world with technological innovations at their prime and understand the role of sustainability as a vital stakeholder. The IMIRS team proudly presents to you:

"Technological Innovations for Global Sustainability and Societal Progress"

The IMIRS collaborated with various students at the Institute of Management and Innovation (IMI). IMI is host to graduate and professional academia within cross-disciplinary studies in biotechnology, sustainability, accounting, urban innovation, and many other programs. The IMIRS publication is an example of authors using academics to bridge knowledge with practical viewpoints. Our IMIRS editorial and illustration/ layout team made it possible to curate a publication with the help of distinguishing authors communicating their perspectives. We invite you to engage with these insights and join the conversation on how innovation can drive societal progress in this new world. Enjoy your read!

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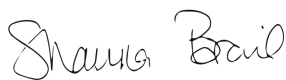
DIRECTOR'S NOTE

It is a privilege to welcome readers to the 4th edition of the Institute for Management & Innovation's (IMI) student journal: IMIRS. At IMI, our mission is to constantly transform thinking to solve the hardest problems facing people, their communities, and societies globally. Through IMI's six professional graduate programs that train learners to become leaders and innovators, we foster an environment that values inclusive excellence, sustainability, shared prosperity, and technological advancement for societal good.

In this issue, you will read about topics such as sustainable and responsible innovation, economic development, technology (e.g., AI/Blockchain) advancements, and the societal implications of technology on health.

I share my congratulations and gratitude with the IMIRS student contributors and the IMIRS Team that brought this year's publication to life. Sharing your work and ideas requires intention, courage, and a willingness to engage in dialogue. IMI takes great pride in your work and achievements!

IMI looks forward to continuing to celebrate our students as their ideas and contributions change the world in meaningful and impactful ways.



Shauna Brail

Director, Institute for Management & Innovation



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INSIDE THIS ISSUE

TECHNOLOGICAL INNOVATIONS FOR GLOBAL SUSTAINABILITY AND SOCIETAL PROGRESS



05 INNOVATIVE APPROACHES TO ENVIRONMENTAL AWARENESS

A Virtual Reality Odyssey Igniting Climate Consciousness



07 ECONOMIC AND COMMUNITY IMPACTS

Sustainable Innovation & Economic Development: Balancing Profits & Environmental Impacts"

Is Renewable Energy Feeding the Next Financial Crisis?

Exploring Community Ownership and Adaptation: Insights from the APOAMF Low-Rise Building Project in Metro Manila, Philippines

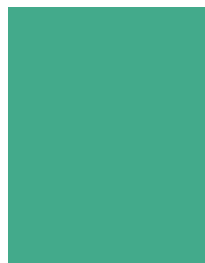


13 TECHNOLOGICAL INNOVATIONS IN ENERGY AND CONSTRUCTION

The promises and perils of large-scale solar projects in India

Net Zero Microgrids to Advance TransformTO Energy Goals

Building as a Material Bank (BAMB): Pioneering Sustainable Construction



22 HEALTH, WELLNESS, AND SOCIAL IMPACT

Using Technology to Improve Social Health Impacted by Technology

Blueprint: Bryan Johnson's protocol for health, wellness, and longevity: a case study for the implications of Big Data on the future of human health



28 BEHAVIOURAL AND CULTURAL SHIFTS

Normalizing Meat-Free Meals: The Effectiveness of Defaulting the Black Bean Burger on Menus for Online Food-Ordering

FUTURUS - A VIRTUAL REALITY ODYSSEY IGNITING CLIMATE CONSCIOUSNESS



By: Hannah Bernard, Siobhan Mehrotra,
and Chloe Wu

In October 2023, our 5 person team participated in the GreenHack Challenge hosted by Hong Kong Baptist University and the Centre for Innovative Service Learning. It was a 48-hour social innovation case competition wherein students from around the world collaborated to develop solutions for pressing environmental challenges. The theme for this year was: *“How can we use technology to solve environmental challenges and mitigate climate change?”*. In response to the urgent call for innovative solutions, our team designed a compelling pitch for **"Futurus"** - a groundbreaking Virtual Reality (VR) experience that transcends the boundaries of traditional gaming. Our innovation leverages gamification and edutainment to bridge the gap between individual actions and their global environmental consequences, focusing on the demographic of young, impressionable technology users.

In the VR world of Futurus, players assume the role of humanity's representative, tasked with navigating pressing climatic dilemmas and making decisions with far-reaching environmental consequences (Appendix 1). The immersive gameplay was designed to evoke deep emotions

through imagery, provoke realizations through decision-making, and thrust players into the heart of the climate crisis, an experience that might encourage individuals to retrospect about the value of our planet. As found through our research on the effects of gaming, Futurus was made to catalyze climate consciousness, ultimately persuading players to make decisions that have a net-positive impact on our planet.¹

We found immersive VR to be an underutilized technology, as vivid imagery is shown to be an extremely impactful educational tool.² Futurus's goal is to provide an experience that challenges players to confront the vast gulf between personal actions and their impact on the global environment. Through a realistic simulation of a complex issue, it makes the intricacies of climate change easier to grasp. This holds particular significance for individuals residing in the Global North who may be insulated from the harshest effects of climate change, such as unpredictable weather patterns and elevated displacement rates, living relatively unaware of these challenges. Ultimately visual immersion aims to leave a lasting impression, therefore, our gameplay would “ignite” a climate consciousness using real-life experiences and potentially collect data on climate-driven decision-making practices.

Visual Assets - Rural



Visual Assets - Arctic Tundra



Pictured are two samples of gameplay for different climate dilemmas- urbanization and wildfires (top), and melting sea ice (bottom). According to the good or bad decisions a player makes, they will either end the scenario with a happy or bad ending (going from the right screen to one on the left).

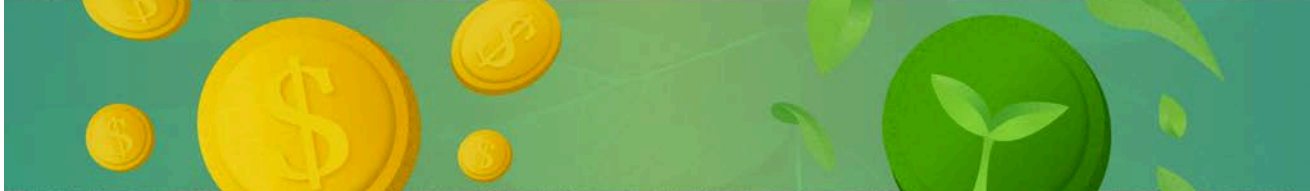
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SUSTAINABLE INNOVATION & ECONOMIC DEVELOPMENT:

Balancing Profits & Environmental Impacts



By: Baoquan Shen

In order to achieve significant economic and social attainments, economic development cannot be separated from sustainable development and innovation. Economic development should not only focus on making short-term profits while exploiting natural and human resources, but also need to integrate interdisciplinary knowledge to facilitate social and economic activities into a virtuous cycle to achieve long-term prosperity. Since the 20th century, numerous cases have proved that if economic development ignores the negative impacts of industrial production and commercial activities, environmental, social, and economic crises will create serious challenges to the health of cities and residents (Jayachandran, 2022). Contemporary challenges, including global warming, industrial poisoning, loss of biodiversity, desertification, and land contamination, have made people realize the importance of sustainability which promotes the emergence of sustainable innovation. Sustainable innovation focuses on using new ideas and inventions to make positive changes in products, services, and processes (Adams et al., 2016; Lee, 2021). Sustainable innovation aims to achieve the balance between making economic profits and generating environmental and social benefits which will promote long-term prosperity for companies, cities, and residents (Adams et al., 2016; Lee, 2021). It also helps create solutions to existing challenges without exploiting future development potential. It also helps companies to

transform their products and services to adapt to the changing social environment and commercial standards. For example, sustainable innovation can be turning certain materials into new products to reduce waste (Lee, 2021). Or, companies can also change their design or production processes to save energy and materials to generate positive environmental impacts. This article aims to provide an overview of the relationship between sustainable innovation and economic development. This article will first introduce the concept of sustainable innovation with some examples. Then, this article will talk about how sustainable innovation can promote economic development, such as changing short-term views to long-term views, adding an ecological lens to economic strategies, and creating new opportunities.

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IS RENEWABLE ENERGY FEEDING THE NEXT FINANCIAL CRISIS?

Our aspirations for the energy transition might be leading to a major economic disaster



By: Lina Contreras

Do investors understand the businesses they are funding? Will those investments deliver competitive returns while meeting requirements for clean energy? Who will take the loss if they do not deliver?

I believe these to be important questions to ask when a new market trend arises. However, it seems they are being ignored, in prioritizing a swift transition to renewable energy. Purpose-led investors became crusaders, investing all resources without questioning the potential consequences of investments gone wrong. It is as if investors did not learn from lessons of previous financial disasters, or wish to believe that they do not apply now.

According to Annex (2023), global new investment in renewable energy skyrocketed to USD 358 billion in the first six months of 2023, a 22% rise compared to the start of last year and an all-time high for any six-month period. Also, venture capital and private equity expansion commitments to renewable energy companies reached USD 10.4 billion in 1H 2023, up 25% from 1H 2022. New equity raised on the public markets totaled USD 12.7 billion during 1H 2023, up 25% from 1H 2022.

In addition to private investments, governments are devoting considerable amounts from their budgets towards clean energy development. Nearly half of the world's low-carbon spending took place in China, according to a recent market analysis by BloombergNEF (2023). The country spent USD 546 billion in 2022 on investments that included solar and wind energy, electric vehicles, and batteries. That is nearly four times the amount invested by US entities, whose investments totaled USD 141 billion. The European Union was second to China with USD 180 billion in clean energy investments.

These findings demonstrate a strong commitment from the public and private sectors to develop clean energy and confront the climate crisis. However, it is worth assessing the potential financial and economic risks that failed returns on investments might cause. Investors, as well as the public sector, might be feeding the initial stages of a financial crisis if they do not look carefully at the red flags that previous experiences have revealed.

I would like to say that I feel like Hyman Minsky (1919 – 1996), very passionate about the origins of financial crises and furthermore, I want to expand its applicability to the renewable energy sector.

It is the optimism, he found, which turns investors more reckless over time, pushing up risk levels in the market, until the bubble bursts (Staveren, 2021). According to Wray (2015), his thesis was that, throughout the cycle, conduct changes in such a way that financial fragility develops making a financial crisis more likely. As part of his legacy, he introduced five stages in a credit cycle which can be identified across diverse financial crises, such as the subprime crisis in 2008-2009 which had massive repercussions worldwide and also relates to the red flags I currently see in the clean energy transition:

- 1) Displacement** refers to the moment when investors' interest is captured by the novelty of a new paradigm. By the 2000s, the Federal Funds in the US went to historic lows incentivizing credits and mortgages (interest rates went from 6.5% to 1% in 3 years (Staveren, 2021). Now, people feel engaged with climate change and want to prove their commitments, while governments are incentivizing the development of clean energy. The common element here is the public sector pushing its agenda across all the economic sectors.
- 2) Boom** is directed to a particular investment because it looks so appealing, causing a rise in its price. Before the subprime crisis, people saw a business opportunity in real estate and started buying various properties simultaneously, causing prices to rise. Nowadays, we see reports from the United Nations, The International Energy Agency, and the World Economic Forum to mention a few, stating how urgent it is to take action against climate change. The similarity here lies in the media stirring interest and our FOMO syndrome in action, creating motivation to rapidly invest. The price impact is clear. According to the S&P Daily Index Dashboard, by April 9th, 2024, the S&P 500 index was 28.91% year-over-year, compared to the S&P 500 ESG Elite with a 33.02% rate of return year-over-year, more
- 3) Euphoria** happens when the financial markets create new instruments to enhance the boom and market participants behave like a herd. Here, I see some common factors between 2008 and today. Both periods have bundled complex financial instruments. In 2008, we had collateralized debt obligations – CDOs, and now we have green bonds, transition bonds, SLBs, and impact investments, among others. Lack of regulation is also a commonality, due to a misunderstanding of supervising entities and regulators, which usually rule after unfortunate events happen. Finally, rating agencies' roles are now more confusing than ever before (previously, agencies assigned AAA ratings to CDOs that were CCC, and now, we have a mix of traditional agencies struggling to adapt their methodologies to ESG rating agencies, that don't assess financial products or payment capacity, but only focus in sustainable practices with different assessments creating asymmetrical practices).
- 4) Profit-taking** occurs in a very high price and asset valuation scenario and some agents prefer to cash their profits, giving a sign of warning. I do not think we are there yet, but it is worth it to keep following up on outflows and selling positions from market participants
- 5) Panic** emerges due to an unforeseen event that crashes the market. According to Forbes (2010), one of the most vivid examples of global panic in financial markets occurred in October 2008, weeks after Lehman Brothers declared bankruptcy and other institutions almost collapsed. In that single month, global equity markets lost a staggering \$9.3 trillion of 22% of their combined market capitalization.



I don't think we are there yet, but there is an interesting cocktail that could trigger a devastating economic scenario at any time. We have geopolitical factors (wars in Ukraine and Israel, China is trying to lead renewable energy and the US to regain their leadership), and analysts are discussing the possibility of a potential economic recession and there is still uncertainty around the success of renewable energy as a business due to its high initial costs, inefficiency and availability (Karami, 2024). On top of that, according to Masters & Temple-West (2023), the anti-woke movement is promoting divestment trends against ESG investments and affecting proxy voting.

I believe that the current state of the financial market, in application to renewable energy development, sits somewhere between Boom and Euphoria. It is necessary to maintain skepticism and look out for symptoms of Panic and economic downturn, in order to prevent the next financial crisis. I support the energy transition, but our commitment to sustainability needs to be approached from multiple angles. May we all be more aware and open to these kinds of reflections if we truly seek a sustainable future.

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EXPLORING COMMUNITY OWNERSHIP AND ADAPTATION:

Insights from the APOAMF Low-Rise Building Project in Metro Manila, Philippines.

By: Mena Wogu

The case of the Alliance of Peoples Organizations Along the Manggahan Floodway (APOAMF) in Metro Manila illustrates how marginalized communities can take charge of developing solutions to address complex issues that disproportionately affect them. Confronting devastation from the climate change-induced flooding event, Typhoon Ketsana in 2009 and facing government-led evictions from their informal housing settlements along the West bank of the Manggahan floodway, APOAMF mobilized and fought for over a decade to secure safe, resilient housing. Perseverance and community-driven processes, enshrined in their 'People's Plan,' prompted the creation of the Low-Rise Building Project (LRBP) - a 15-building social housing estate providing climate-adapted apartment units to approximately 900 families.



Reach Research Team Philippines with the APOAMF leadership and Manggahan residents during a site visit in Spring 2023.

At the core of APOAMF's success lay community ownership. Its visionary leadership structure encouraged active participation from all members through councils, committees, building

representatives, and floor leaders. By embracing diverse voices, they cultivated buy-in and a sense of collective responsibility over the phased implementation of the LRBP. A resident expressed how the participatory approach 'fostered a strong sense of ownership of the building process.' This sentiment empowers ongoing resident engagement in advocating for land rights and housing security for marginalized communities.



The second phase of the APOAMF-LRBP has been completed, with six buildings housing 360 families.

Over time, the leadership approach evolved to address changing needs. Initially prioritizing community organizing and resisting evictions, it later shifted to forging cross-sectoral partnerships with NGOs dedicated to the urban poor and housing authorities, overseeing construction, and maintaining building operations. Committees such as Finance and Maintenance were established to enhance community capacity and ensure its long-term sustainability. One building leader explained, "We educate ourselves on how to handle sewage waste...it's not sustainable for the community" to rely long-term on outside experts. This willingness to acquire new technical skills, like sewage waste management, exemplifies APOAMF's commitment to self-sufficiency.



People's Plan process (adapted from APOAMF's presentation about its experience in community organizing and engagement with government agencies)

Furthermore, advancements in information technologies enabled community ownership of the LRBP process. Leaders utilized platforms such as Zoom for virtual meetings when in-person sessions were restricted during the COVID-19 pandemic. This adaptation allowed community participation and oversight to persist despite external barriers, particularly at the height of the lockdown and construction restrictions. Technological tools also played a crucial role in monitoring building safety and operations.

The community's proactive engagement prompted a recognition of the significance of reliable internet and power supply, leading to advocacy for their integration into their housing design. Today, community leaders maintain these essential utilities, thereby enhancing the residents' overall quality of life.

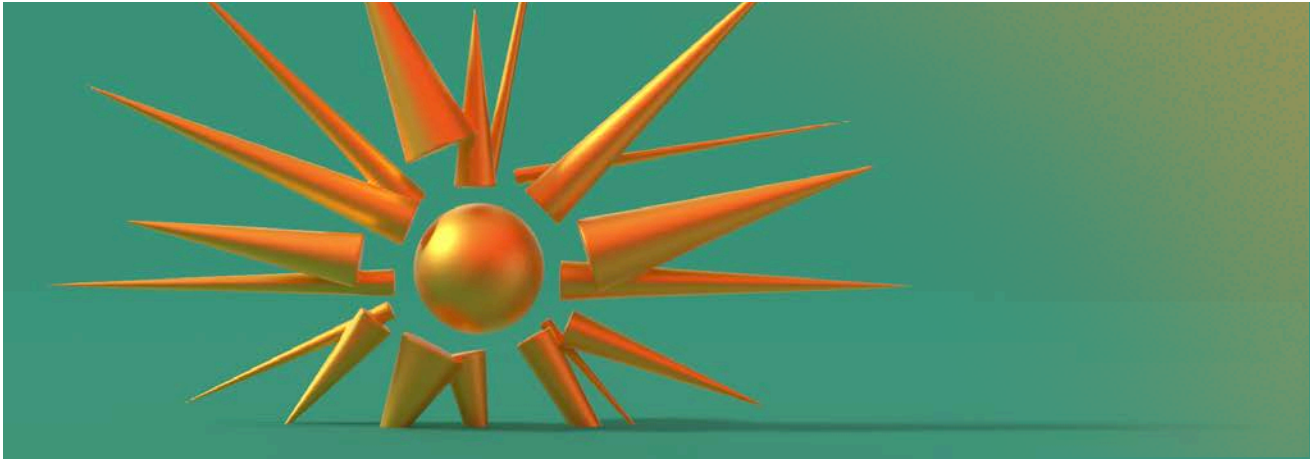
The success of the APOAMF project extends beyond its immediate context. The 'People's Plan' framework presents a replicable mechanism for marginalized communities worldwide to engage in the development of locally suitable, climate-resilient housing solutions. As extreme weather events become more frequent globally, it is imperative to empower grassroots groups to integrate their invaluable expertise into urban planning processes.

The APOAMF case is a compelling illustration of how grassroots organizing and participatory approaches can influence policy in favor of

vulnerable communities. By leveraging technology to foster local capacity building and enable self-management of climate adaptation efforts, this Low-Rise Building Project in the Philippines establishes a noteworthy precedent for community-led initiatives beyond the shores of the typhoon-prone region of southeast Asia.



THE PROMISES AND PERILS OF LARGE-SCALE SOLAR PROJECTS IN INDIA



By: Reshmi Rajan

GLOBAL SOLAR OUTLOOK:

Global energy systems are undergoing rapid change to low-carbon renewable (RE) sources. Large-scale solar projects (LSSP) such as solar parks are one of the most visible components of this transition. These projects require thousands of acres of land and produce 10 megawatts (MW) or more of energy, and have increased steadily over the last decade. Deserts, farm lands, and rural lakefronts are currently being transformed in India for this purpose. To get a sense of scale, for each MW of capacity, roughly 3,000 solar panels are installed, and a 200 MW project would be as big as 550 American football fields (Mathis and Eckhouse, 2020). Cheap equipment and installation costs, beneficial political climate, and operational efficiencies due to economies-of-scale make LSSP a lucrative opportunity for governments to meet renewable energy mandates and the private sector to cultivate new business ventures.

LARGE-SCALE SOLAR PROJECTS (LSSP):

The unprecedented growth of solar energy coincided with a massive proliferation of LSSP in the Global South, where there is a need to get

energy as fast and cheap as possible. Compared to fossil fuels and Global North, renewables such as solar energy are more abundantly available at lower cost and most competitive in sunny regions (Butler-Sloss, 2022). India ranks fourth globally in RE capacity, where solar energy is abundantly available at lower costs. Solar parks have taken centre stage in national climate strategy missions. In 2022 alone, LSSP in India increased by 33% from the previous year and made up 87% of new solar photovoltaic capacity (Feldman et al., 2023). Utility-scale solar installations are growing faster than rooftop solar projects year on year. Recently, the government approved 57 new ultra LSSP with an aggregate capacity of 39.28 GW (MNRE, 2023). Most importantly, due to its 'green projects' tag, LSSP are exempted from undergoing environmental and social impact assessments (Government of India, 2017).

LAND CONFLICTS & LACK OF PARTICIPATION:

There is an emerging need for research into the negative social complexities of solar energy deployments in India. LSSP involves conversion of large tracts of land into non-agricultural use. Unregulated land acquisition strategies by state and non-state actors such as solar project developers, leads to enclosure of commons

(Baka, 2013; Baka et al., 2017) through exploitative land grab tactics. Non-technical barriers such as poor engagement with local communities to solar adoption and land use change related procedural injustice exists in India's LSSP across most of its constituent states (Cloke et al., 2017). Loss of lands push local, economically vulnerable communities whose livelihood depends on these lands (Yenneti et al., 2016) to precarious conditions. They have a legal right to access these grazing and farming lands as per governmental regulations, but they are often not consulted at any stage of conception or execution of these projects.

In the state of Kerala, India, Panchayats (local governance bodies) and Adivasis (indigenous peoples) without legal land titles opposed the state government's acquisition of their land for the 200 Megawatt (MW) Kasargod Solar Park and ultimately reduced the project to 50 MW (Bedi, 2019). Case studies highlight procedural injustices, such as lack of participatory decision-making in Charanka mega solar park located in the state of Gujarat, India (Yenneti and Day, 2015, 2016). An analysis of the unequal distribution of socio-economic benefits of SE at the 2 GW Pavagada solar park in Karnataka state, India (Ghosh et al., 2022) confirms that in the race to meet national climate mandates, social inequalities have been widened. The voices of powerless groups, such as landless small farmers and laborers, pastoralists and tribes are getting suppressed, and the potential benefits of SE are not equitably shared.

ROLE OF SOCIALLY FOCUSED RESEARCH IN ENERGY TRANSITIONS:

Progress for the sake of progress must be tempered with caution, especially in this modern world. Research on green technologies through a social lens allows policy makers and environmental decision makers to understand more about the type of issues that grab the attention of the public eye and have a significant impact on energy justice. To our knowledge, there is no past work done on these issues in a modern

context specifically addressing the case of LSSP in India. A comprehensive overview of socially sensitive issues that arise from the energy transitions and its overall implications to developing countries like India is the need of the hour. This will ensure an inclusive future where people of all walks equally participate and gain value from the journey towards a sustainable planet.

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NET-ZERO MICROGRIDS TO ADVANCE TRANSFORM TO ENERGY GOALS



By: Angelica Chow

INTRODUCTION

As countries and organizations focus on reducing greenhouse gas (GHG) emissions to reach net-zero by 2050, the City of Toronto has established an ambitious climate action plan, TransformTO, aiming to achieve net-zero emissions by 2040 [1]. One specific energy goal is to increase the percentage of community-wide energy deriving from renewable and/or low-carbon sources [1]. Alongside, Toronto also faces energy security and cost concerns. More than half of Toronto's GHG emissions derive from natural gas usage in buildings [2], pushing the need for building electrification. Increasing electrical demand combined with decreasing provincial grid capacity due to upcoming nuclear plant decommissioning and refurbishments [3], leads to energy gap issues. Net-zero microgrids (NZMs) can be a way of aggregating multiple renewable and low-carbon distributed energy sources to power communities while reducing GHG emissions and cost-effectively enhancing local resilience [4].

RESEARCH OBJECTIVES

This paper aims to answer the following research question: How can community-scale NZMs be

feasibly implemented in Toronto? The paper provides a comprehensive analysis of NZMs and a qualitative assessment of challenges and barriers to NZM deployment within the City of Toronto, evaluating the currently available microgrid technologies, the sustainability aspects of NZMs (environmental, economic, and social), and the current energy policies and standards within Canada related to NZMs.

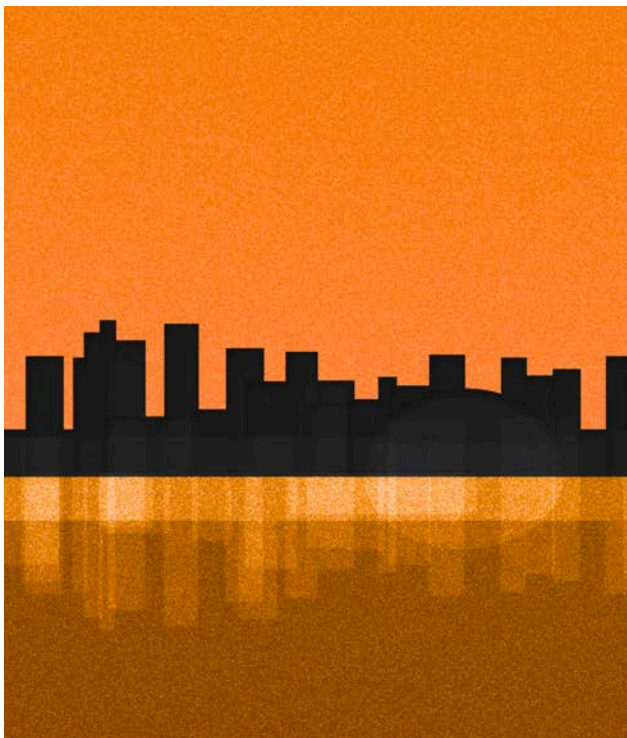
RESEARCH METHODOLOGY

This paper deploys an interdisciplinary literature review of academic and grey literature to further understand NZMs, along with interviews with energy professionals within Canada to help assess the challenges and barriers to NZM adoption within Toronto. Interviewed organizations include Natural Resources Canada (NRCan), Toronto Hydro, Ontario Ministry of Energy (MOE), Ontario Energy Board (OEB), City of Toronto, Ontario Power Generation (OPG), and Hydro One.

RESULTS AND DISCUSSION

The main difference between traditional microgrids and NZMs is the selection and usage of generation based on renewable, clean, and low-carbon energy and storage systems. Technologies for NZMs include generation sources (solar, micro-

wind, micro-hydro, hydrogen fuel cells, geothermal, microturbines with renewable fuel sources, e.g., biogas and carbon capture turned into hydrogen or methane); energy storage systems (batteries, flywheels, hydrogen fuel cells, SuperCapacitors, thermal); microgrid controllers; voltage inverters; and smart meters [5-9]. The flexibility of NZMs allows consumers to evaluate and select the technology most suitable for the geographic location, financial capabilities, and energy needs. Research findings echo the sustainability benefits provided by NZMs. When accounting for sustainability factors (e.g., utility bill savings, community resilience, social cost of carbon, public health costs, job creation, and lower operating costs), NZMs provide more net present value than diesel-only and hybrid microgrids [10]. The main barriers to NZM adoption within Toronto are the high capital costs and a lack of financial incentives. Although NZMs currently come at a higher capital cost than traditional microgrids, technology improvement, and increased competition will help lower costs [11]. The Energy-as-a-Service (EaaS) business model is emerging as a popular financing method compared to owner-financed microgrids [12].



There are only a few available government funding programs for innovative smart grid projects: NRCan Smart Grid Program (federal), IESO Grid Innovation Fund (Ontario), retrofits and Development Charge Refund Program (Toronto) [13]. The Toronto Green Standard mandates buildings after 2030 must be net-zero, and the Net-Zero Existing Buildings Strategy requires existing buildings to be net-zero by 2040 [14]. These standards push for more sustainable design requirements for buildings in future standard revisions, including increased procurement of renewable energy. NZMs can help new and existing residential and commercial buildings incorporate more local renewable energy. Other key challenges and barriers include a lack of a business case for most consumers to install NZMs; the lack of strategy to figure out which generation and storage sources are most suitable for Toronto; technical difficulties with integrating NZMs into the main grid (interconnection challenges); and policy implications with community net metering (CNM) and utility rate planning not designed to support NZMs.

KEY TAKEAWAYS

NZMs help increase renewable and low-carbon energy deployment, reduce GHG emissions, and provide community resilience. There are opportunities to leverage and integrate NZMs with existing and developing thermal energy networks, shallow geothermal systems, and deep lake cooling systems within Toronto. With high capital costs and a lack of financial incentives creating a lack of business cases, the City of Toronto should target critical institutions, campus-sized institutions, and real estate developers that can benefit from the added resilience of NZM adoption. The City can provide these targeted consumers with business case planning and NZM configuration optimization tools to help with cost planning and reaching targeted GHG reductions. As the local municipal government, the City of Toronto has direct communications with a majority of the stakeholders: homeowners, business owners, developers, Toronto Hydro, and the provincial government. Therefore, the City of

Toronto is in a unique position to bridge the gap between energy institutions within Ontario and the consumers. For consumers ready to install an NZM, Toronto can help facilitate planning sessions to work through technical grid connection challenges and negotiate community net metering and utility rates with Toronto Hydro and OEB. As a result of this research, a professional workshop was facilitated by the University of Toronto (Urban Climate Action Project and Climate Positive Energy) and the City of Toronto to bring energy stakeholders across Ontario to brainstorm short-term and long-term solutions to increasing low-carbon and renewable energy deployment within Toronto.

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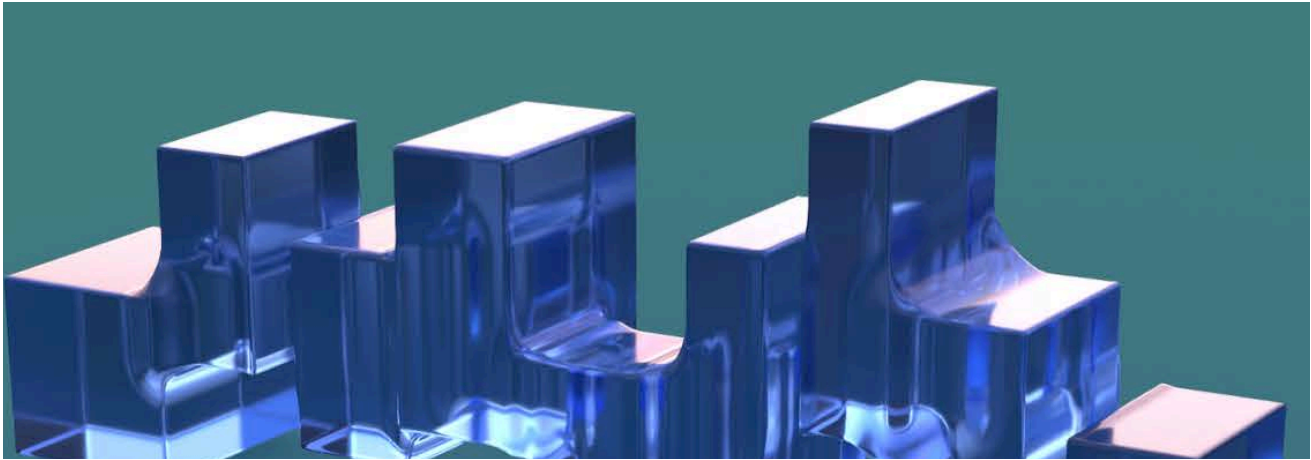
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BUILDING AS A MATERIAL BANK (BAMB): PIONEERING SUSTAINABLE CONSTRUCTION



By: Wenhui Yao

This article explores the Building as a Material Bank (BAMB) concept, a revolutionary approach in the construction industry aimed at promoting sustainability. It examines key enabling technologies such as material passports, Building Information Modelling (BIM), RFID, IoT, and blockchain, which facilitate the circular use of building materials. Through real-world examples like the ICEhouse in the USA, Grosvenor in the UK, and the Madaster Platform in the Netherlands, the article illustrates the practical application and benefits of these technologies in achieving sustainable construction. It also addresses the challenges faced in implementing BAMB and envisions its future prospects in the industry.

The construction industry, historically known for its significant environmental footprint, is undergoing a radical transformation. The Building as a Material Bank (BAMB) concept is at the forefront of this change, advocating for a circular economy where buildings are not seen as an endpoint of material use but as temporary storages of valuable resources. This approach is underpinned by several key technologies that facilitate the sustainable management of building

materials throughout their life cycles. Projects across the globe are already demonstrating the feasibility and benefits of this approach, offering insights into the future of sustainable construction.

KEY ENABLING TECHNOLOGIES

The transition to a sustainable construction model is driven by key enabling technologies that provide the backbone for the BAMB concept. These technologies play a pivotal role in managing the lifecycle of building materials and ensuring their circular use, which is crucial for reducing the construction industry's environmental impact. We will explore these technologies and their significance in fostering sustainability in construction.

Material Passports: Material passports are akin to a digital biography for building materials, detailing everything from their origin and composition to their current state and potential for future use. These passports are critical for enabling the circular use of materials, as they provide the necessary data for identifying, tracking, and managing materials throughout their lifecycle.

BAMB encompasses several pilot projects, including the development of a new office building in Essen, Germany, designed according to Cradle-to-Cradle principles. This initiative involved using material passports to track and manage the materials throughout the building's lifecycle, ensuring that each component could be reused or recycled effectively.

Material passports serve as detailed records of the materials used in construction, providing information on their origin, composition, and potential for reuse or recycling (Baldwin, 2021). They are crucial for facilitating a circular economy in the construction sector, where buildings are viewed not as end products but as temporary storages of valuable resources. In the case of the Essen (Greco et al., 2022) project, material passports were instrumental in planning for the building's eventual disassembly and reuse, aligning with sustainable and circular construction practices.

These passports also support more informed decisions in both new constructions and existing buildings, guiding renovations and maintenance to prioritize sustainability. By documenting the details of building materials, they enable better valuation of a building's material worth and promote the reuse and recycling of materials, thereby reducing waste and environmental impact (Block et al., 2020)

Building Information Modelling (BIM): BIM technology goes beyond traditional 3D modelling, offering a dynamic approach to building design and management. It incorporates various data dimensions, including time and cost, facilitating a comprehensive understanding of the entire building process. BIM's capabilities make it an indispensable tool for implementing BAMB, as it allows for the detailed planning of a building's construction, maintenance, and eventual deconstruction in a manner that prioritizes material reuse and recycling.

The concept mirrors the way libraries track books, providing each material in a building with a unique

identity. This system has been notably applied in projects like the Triodos Bank headquarters, designed by RAU Architects (Rau and Oberhuber, 2021), where every material used in construction was registered in a material passport, facilitating their potential future reuse and ensuring their value is maintained. This project represents a sophisticated application of the BAMB principles, with BIM playing a critical role in tracking and managing the lifecycle of building materials to support a sustainable, circular economy in construction.

Moreover, BIM-based web tools have been developed to act as Material and Component (M&C) banks, managing detailed information about materials and components used in buildings. These tools aim to support the circular economy by facilitating the recycling of materials and reuse of components, underlining BIM's potential to transform buildings into fully documented repositories of material resources. Such tools leverage BIM to provide a comprehensive database that can influence design and construction processes, ensuring materials can be efficiently reclaimed and reused, thus significantly reducing construction and demolition waste (Jayasinghe and Waldmann, 2020).

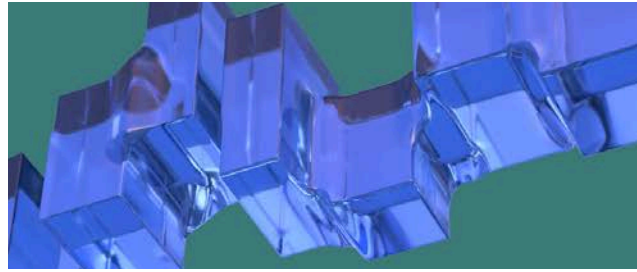
RFID and IoT: The use of RFID tags and IoT devices in construction materials enables real-time tracking and monitoring, ensuring that the status and location of materials are always known. This technology supports the efficient use and reuse of materials, significantly reducing waste and promoting sustainability in the construction process.

RFID technology, used in construction, enhances asset management, reducing loss and theft while providing centralized records of location and status data. HID Global (2024) showcases this through a case study with Speedy Services, which offers on-site equipment rentals. An automated walk-in unit uses durable RFID tags for tool tracking, improving equipment availability, reducing costs, and enhancing sustainability. This

application demonstrates RFID's role in efficient resource management and sustainability in the construction sector, aligning with the principles of BAMB.

Blockchain Technology: Blockchain offers a secure and transparent way to track the lifecycle of building materials. By creating an immutable ledger of material transactions, blockchain technology ensures the integrity of data related to material reuse and recycling, fostering trust among all stakeholders in the construction process.

Blockchain technology is being explored in the construction industry for its potential to innovate and reorganize how actors within the sector interact, particularly in the context of material banks. The technology is seen as a systemic innovation that could influence both the openness and closedness of innovation ecosystems in construction. The role of blockchain in construction is examined through how it can orchestrate the network of organizations involved, facilitating more efficient, transparent, and collaborative processes (Papadonikolaki et al., 2022).

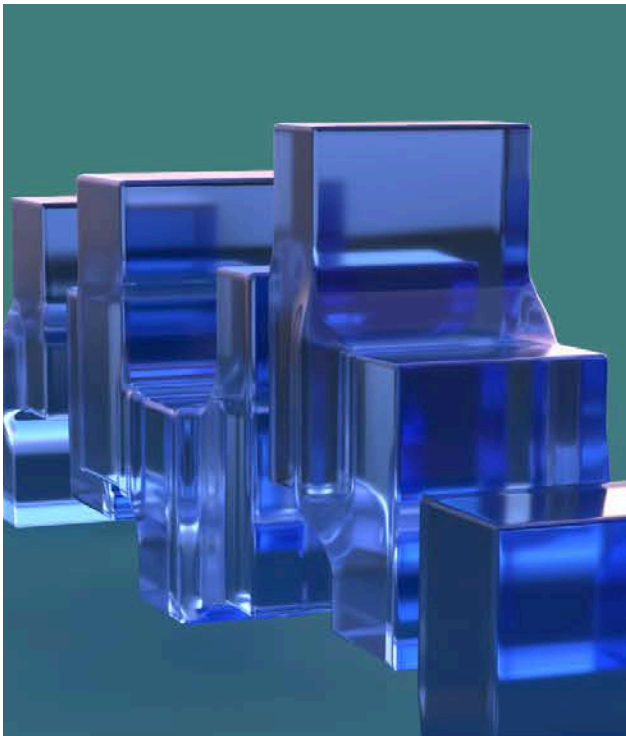


ILLUSTRATIVE PROJECTS

The ICEhouse, USA: Designed for the World Economic Forum in Davos, the ICEhouse (2016) showcases the practical application of material passports. Each component of the ICEhouse is documented and tracked, ensuring that materials can be easily disassembled, moved, and reused, demonstrating the principles of the circular economy in action. As its creator, William McDonough says, “putting the ‘re’ back in ‘resources’”, which is the foundation of the Circular Economy.

Grosvenor, UK: Grosvenor Britain (2023), along with other forward-thinking businesses like Elliott Wood, Arup, Orms, and HETA, is conducting research to find chances for education and information exchange to integrate material reuse into standard operating procedures. The material database is at the heart of the development of the circular economy and leverages advanced BIM technology to implement Material Passporting that embodies efficiency and adaptability for material reuse. The precision and efficiency facilitated by BIM not only streamline the construction process but also ensure that materials can be reused, aligning with BAMB objectives.

Madaster Platform, Netherlands: The Madaster Platform (2024) acts as a registry for materials, applying the concept of material passports on a large scale. By cataloguing materials and providing detailed information about their potential for reuse, Madaster makes it easier for construction professionals to implement circular economy principles in their projects, promoting the sustainable use of resources.



THE INTEGRATION OF TECHNOLOGY AND SUSTAINABILITY

The projects highlighted above demonstrate the diverse applications of BAMB-enabling technologies. From the material passports of the ICEhouse that facilitate the tracking and management of materials for reuse to the detailed planning and documentation capabilities of BIM as showcased in Grosvenor's reuse acceleration network, these technologies are proving to be indispensable tools in the pursuit of sustainable construction.

Moreover, the integration of RFID, IoT, and blockchain technology into the construction process enhances the efficiency and transparency of material management, further supporting the goals of the BAMB concept. By ensuring that materials can be easily tracked, managed, and authenticated, these technologies reduce waste and promote the reuse of materials, contributing to a more sustainable construction industry.

CHALLENGES AND FUTURE DIRECTIONS

Despite the promising developments in BAMB and its enabling technologies, challenges remain. These include the need for widespread adoption of these technologies, the development of standardized practices for material passports and BIM, and the overcoming of regulatory and economic barriers to material reuse and recycling.

However, the continued evolution of technology and growing awareness of sustainability issues in construction suggest a bright future for BAMB. As more projects around the world demonstrate the practical benefits of this approach, it is likely that BAMB principles will become increasingly integrated into mainstream construction practices. This will not only reduce the environmental impact of construction but also promote innovation and efficiency in the industry.

CONCLUSION

The BAMB concept, supported by cutting-edge technologies like material passports, BIM, RFID, IoT, and blockchain, represents a significant step

forward in making the construction industry more sustainable. By viewing buildings as temporary repositories of valuable materials, BAMB challenges traditional construction practices and opens up new possibilities for reducing waste and promoting the circular use of resources. The practical application of BAMB principles is not only possible but also advantageous, paving the way for a more sustainable and effective future in construction, as projects in the USA, UK, and the Netherlands have shown.

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USING TECHNOLOGY TO IMPROVE SOCIAL HEALTH IMPACTED BY TECHNOLOGY



By: Henrique Cesar

Ever since the COVID-19 pandemic, social structures have changed to adapt towards lockdown, and the lasting impact of this change is apparent. As lockdowns have been lifted, the application of Zoom persists, with businesses, organizations, and governments utilizing the platform for a hybrid workstyle. This provides the flexibility of being able to work in-person and virtually, massively altering work environments.

Naturally, as people are adapting to this new structure, issues start to arise. A prominent health problem that is a direct result of this change is Zoom fatigue, appropriately named for the feeling of mental and psychological weightiness due to excessive use of Zoom or other similar virtual conference platforms.

As I have transitioned from finishing my undergraduate thesis completely online, to now having meetings and interviews both in-person and hybrid, Zoom fatigue certainly plagues my well-being throughout as I struggle to balance the need to rest and to work. This started to change, however, after having a professional development

session with Chris Cummins recently during the MMI program on how to make oneself more appealing amongst interviewee candidates using technology. Hence, zoom meetings become more enjoyable for both parties and less tiresome.

Known for being an expert at using multimedia platforms, and being the founder of Cummins Media Inc., a business dedicated to providing speaking-related professional training, Chris Cummins provided a lot of insights on using technology to combat, or even completely neutralize Zoom fatigue. In this essay, I hope to share what I have learned and how I am currently applying these tips to my strategies during online meetings, improving my mental well-being along the way.

When planning out your schedules, you should make sure you are not going through consecutive interviews or meetings for an extended amount of time. Unlike phone calls, you are committed to sitting through the Zoom meeting as you are present on camera, and this can add to the fatigue [2]. In addition to being intentional when planning your schedule, you should be acutely aware of the form of meeting you are going into.

For instance, a Zoom meeting may easily be replaced with a phone call or an email if the purpose of the conversation allows that, though note that there may be circumstances where you are forced to attend a Zoom call, perhaps due to the supervisor enforcing this rule [1]. In order to ensure intention, it would be best to not multitask during Zoom calls as they detract you from the conversation.

Eye strains are one of the many symptoms associated with Zoom meetings. Supplying your workplace with enough lighting can help prevent eye strain [4]. Furthermore, limiting exposure to blue light can reduce the likelihood of Zoom fatigue. A common practice to reduce eye strain involves the 20-20-20 rule, where every 20 minutes, you give your eyes 20 seconds to focus on an object 20 feet away from you. These are all viable methods to ensure you can stay engaged in your meetings.

Disengagement may occur if one experiences Zoom fatigue. In fact, this can occur in any form of communication. Online communication is susceptible to network delays and bad sound quality, reasons that are not due to intentional disengagement. Research has shown that a delay of 1.2 seconds can result in disengagement from communication simply because there are no cues available for the other party to know if you are attentive [5]. As such, you need to check if there are any hardware issues on your side. It may be worthwhile to invest in your microphone to ensure you are projecting the best audio you can.

As you can see, most of the tips are not necessarily limited to Zoom meetings, or for interviews. For any form of conversation, it would naturally be more effective if the environmental conditions of the discourse matched with your intention. Hence, this article focuses on how you can better prepare for a meeting. As an endnote, if you are curious about your Zoom fatigue levels, there is a Zoom Exhaustion & Fatigue (ZEF) scale available for a self-evaluation [3].

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BLUEPRINT: A CASE STUDY FOR THE IMPLICATIONS OF BIG DATA ON THE FUTURE OF HUMAN HEALTH



By: Jeremy Vandenhazel

THE STORY

Bryan Johnson self-proclaims as a professional rejuvenation athlete, and as the most measured person in history. More commonly, Johnson may be known as a “Biohacker”.

Johnson’s latest venture, Project Blueprint, is largely an algorithm to improve one’s health through sleep, diet, and exercise, and one that was very expensive to develop. Johnson spent \$2 million a year, with the payoff being a near-complete loss of autonomy. “My mind no longer decides”, “I fired myself”, he says.

A few steps in the Blueprint Protocol Starter Guide include taking more than 100 supplements a day, consuming a specified number of calories, and eating two meals on repeat.

There is grandiose and noble intent. In an interview with the Rolling Stone, Johnson stated that “[while] Blueprint may seem like it’s about diet, sleep and health, it’s not. It’s about how we survive as a species. ...before Blueprint, I had a variety of goals ... I had conflicting outcomes.

And I just ran this experiment to say, could I effectively align my 35 trillion cells to a single objective? It’s the same thing we’re doing on planet Earth: Can humanity align to an objective to keep our biosphere healthy?”

Blueprint is publicly available. You can go to its website and see the protocol in great detail; diet, supplements, workout routine, and a guide to tracking progress in specialized blood panels. Results from Johnson’s two to three years in the program are also listed. For example, did you know that Bryan Johnson has a chronological age of 46 years old, but is aging at a pace of 0.69 biological years/ chronological time? [1,2] It may sound absurd, but Johnson does a lot of tests (Table 1).

THE RELEVANCE

Blueprint is all about Big Data. “My team and I had endeavoured to do what no one else had done: enable a body to run itself”. “I enable my [organs] to speak for themselves what they need to be in their ideal state. [My mind] is unauthorized to grocery shop, peruse the pantry, spontaneously order pizza ... – to basically make any food-related decision. This is my Autonomous Self.”

Table 1. A sample list of technologies and data points used in Bryan Johnson’s Project Blueprint

MRI	Ultrasound	RHR
HRV	VO2Max	LV septal A’ mitral
Aortic root diameter	LA E’ latbasal	RVSP
LV sepal E/E’	RV E/a	MaxHR
LV E/A	Intraventricular relaxation time	ALT
BMI	Fasting plasma glucose	Body Fat
Cholesterol	DHEA	GGT
Glutathione	Grip Strength	HbA1C
HDL	hsCRP	IGF-1
Thyroid volume	Testosterone	20th percentile telomeres

Blueprint’s marketing pitch can be condensed to this: “Aspire to look and feel your best? Opt into a system where your body + science and data do the work. It’s akin to saying yes to the internet, computers and AI to improve our lives in ways that exceed our natural abilities”

The payoff?

“This Automation – and the elimination of self-destructive behaviours – allow us to improve at the rate in which you can automate important functions without thinking about them – in this case, your health”. “Improve at the speed of compounded gains, opening up a future of possibilities more expansive than our imaginations are capable of grasping”.

THE CRITICISM

Longevity expert Dan Buettner is skeptical, saying that Johnson’s routine is unsustainable; Johnson has stated that he has followed the Blueprint protocol for 3 years. Also of concern, is the applicability to other people. Sure, Johnson and his team of 30+ doctors and health experts screen treatments using existing research, but

ultimately, what sticks is what works for him. For example, Johnson undergoes electromagnetic stimulation to strengthen his pelvic floor in order to prevent the use of the washroom in the middle of the night. I imagine that the majority of 24-year-olds would find little benefit in undergoing such therapy. In doing my own research, I also revealed a blurring of lines in what is The Project Blueprint Protocol and what is Byran Johnson’s Project Blueprint Protocol. This is because Project Blueprint is an “n-1” trial; a trial with one participant. It is continuously unfolding, and being marketed in near real-time.

Dan Buettner’s research has revealed that socialization and purpose are what ground people who live the longest. Johnson sleeps alone (as a requirement of His/ The Protocol), but seems to be a proud member of the goth community. “Don’t die” is his mantra, but he has stated his intent to only reverse and slow down his pace of aging until his biological clock matches his chronological age. There seem to be mixed messages, but isn’t time a construct?

LOOKING OUTSIDE OF THE BOX

Johnson is smart. He has taken the tabloid attention gained over the last year and used it to promote his own line of olive oil, snack packs, and apparel, living up to his new moniker, “the Kardashian of Longevity”. He sold Braintree Venmo in 2013 for USD 800 million, and he founded and has invested some USD 54 million in Kernel, producing hardware, a software and services platform to measure brain activity. He acknowledged limitations in the applicability of Project Blueprint for reaching female users, and has begun training and measuring a subject known as “Blueprint XX”.

There is a push right now for protocol. The world is so incredibly complex today, with so much information available at our fingertips. We need a structure or else we fall beneath a wave of progress, lost in the infinite sea of “Big Data”.

Bryan Johnson isn't alone. Michael Snyder, Ph. D., is the director of the Center for Genomics and Personalized Medicine at Stanford University. Snyder wears four smartwatches and carries around a device that he calls an exposometer, that "breathes" the same air that he does. Snyder engages in regular bloodwork and MRIs, wearing an Oura ring that tracks his sleep quality. All together, Snyder has collected 9 years of data on heart rate and skin temperature. He has access to continually updating glucose monitor graphs that visualize the effect that diet and exercise have on his blood sugar.

What unites Bryan Johnson and Michael Snyder, aside from turning their bodies over to science, is a common mission. Snyder's research into the exposome, identifying the cumulative airborne environmental biotic and abiotic exposures of 15 individuals over 890 days, and over 66 distinct geographical regions, combined with his personal, long-term commitment to tracking his health using an array of technologies, is indicative of a larger trend towards personalized medicine, the scalable potential of underlying technologies, and the research findings which they enable when applied at a large scale. All of this, in a continuous feedback loop, accelerates innovations in healthcare and medicine.

This feedback loop, without intervention from state institutions and processes such as peer-reviewing, has the potential to waste more money than it has to do good (note that the Project Blueprint website states a disclaimer for lack of evaluation by the FDA). But, with that said, there is certainly a need for technological innovations, and for greater accessibility to personalized health data and medicine.

A study in 2021 at the University of California found 109 different industrial and consumer chemicals in participants' blood. More than 50 of the chemicals had never been seen in people before, and 42 were chemicals of unknown origin. Almost none of the 80,000 potentially toxic chemicals that are currently in use in the US are

closely monitored by the EPA.

Incapable of testing blood for chemical composition, the global smartwatch market shows another potential. In 2023, it was valued at USD 29.31 billion, and is expected to grow to USD 77.22 billion by 2030 (CAGR of 14.84%).

Smartwatches, and rings and bracelets such as Oura and Whoop use heart rate monitors, gyroscopes, and GPS to check heart rate statistics and to position oneself in space and time, with application in measuring stroke rate while swimming, or swing count in golf. There are also medical uses, such as the Apple Watch's ability to detect atrial fibrillation. Although devices used by doctors are sure to be more accurate, it's a start. Technology should ultimately be about empowering the people.



Bryan Johnson represents a certain evolution in humanity, which I believe to be necessary. To navigate our surroundings is a mission; we are bombarded with information, and actively seek it out to make sense of the complex world in which we live. We learn not to trust with our eyes, as media evolves.

Dan Buettner says that socialization and purpose are what ground people. But perhaps with the time saved in trying to fit workouts and naps into our busy schedule, and with the clarity of mind afforded by health interventions, we may spend more quality time with the ones we love. At least, that was what I took away from this story.

FOOTNOTES

[1] ..., is accumulating aging damage slower than the average 10-year-old, and slower than 88% of 18-year-olds, according to a DNA methylation biomarker?

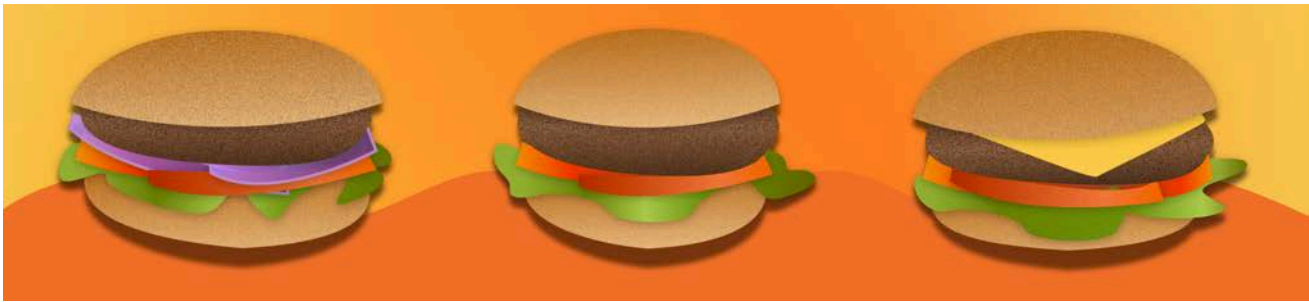
[2] Johnson's team has compiled hundreds of biomarkers for 70 organs. All measurements are used in a biological age formula, with relative weighing of each organ's age based of clinical relevance.



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NORMALIZING MEAT-FREE MEALS: THE EFFECTIVENESS OF DEFAULTING THE BLACK BEAN BURGER ON MENUS FOR ONLINE FOOD-ORDERING



By: Vicky Boyd

What comes to mind when you think of a burger? Most people likely picture a meat patty on a bun, and this is likely the first and most prominent option you'll see on a menu because meat is the social norm. It's the default; it's what is assumed to be the food order unless otherwise stated. The normalization of meat consumption has led to an industry which continues to grow and is responsible for 15% of global greenhouse gas emissions.

But a burger doesn't have to be made from conventional animal meat. There are other proteins which are made into burger patties, and menus will often have vegetarian or vegan burger options listed. However, to order these, you'll have to actively reject the meat norm by explicitly asking for that alternative protein. People tend not to opt-out and instead will stick with what is presented to them – a phenomenon known as the default effect bias.

THE INNOVATIONS OF ALTERNATIVE PROTEINS

While plant-based proteins (e.g. soy, lentils, nuts,

chickpeas, etc.) are frequently eaten by vegetarians and vegans, this is less common for meat-consumers. Hoping to appeal to the meat-consumer segment, meat-free products which aim to mimic meat have been hitting the market. Technological innovations have allowed for products to be like meat in terms of taste, texture, appearance, cooking properties, and health and nutrition benefits. And while the future of lab-grown and hybrid meats is highly uncertain as research and development continues, these are looked upon favourably for their role in a more sustainable food system.

REDUCING MEAT CONSUMPTION WITH THE DEFAULT EFFECT

Alongside the growth of alternative protein options and their availability is growing evidence suggesting that consumers can be nudged to choose these foods over conventional meat. Studies conducted primarily in Europe have shown that manipulating restaurant menu design to present the meat substitute as the socially acceptable and recommended option works to promote uptake of the meat-free choice .

My research set out to add to the literature the

the effectiveness of meat-free defaults on online food-ordering menus. Will people order more meat-free food if given an online menu with meat-free defaults? Is the effectiveness of meat-free defaults based on demographics and/or diet preferences?

METHODOLOGY

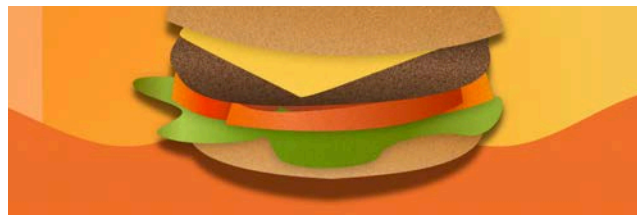
The research approach was a survey-based choice experiment. Through random distribution, undergraduate students in the ENV100 Environmental Science class at the University of Toronto were asked to order a burger from one of two menus. Each menu offered both a beef burger and a bean burger, but one menu framed the bean burger as the default, the automatically selected option, and the other menu framed the beef burger as the default.

RESULTS

Significantly more bean burgers were ordered from the menu that was nudging the bean burger than the menu nudging the beef burger. But not everyone was affected the same by the behavioural nudge. The people who were most influenced by the meat-free default effect were non-Caucasian females who held no objections to bean burgers but some objections to beef burgers and most importantly who were open to reducing their personal meat consumption.

A SUSTAINABLE PROTEIN FUTURE

What this means is that setting the meat-free option as the normal, most salient option on the menu and relegating the meat option to a footnote is effective in getting meat reducers, people who do eat meat but are trying to eat less of it, to choose the meat alternative. And meat reducers make up about one-third of Canada so this menu redesign could help reduce our collective meat consumption¹⁰. Designing menus to nudge more sustainable foods should be part of a global multi-intervention solution to society's meat consumption problem. Maybe the future will have a new normal – one where protein innovations have a better place at the table.



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